

# THE INSTITUTE

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The Indian Institute of Technology, Roorkee is the successor of the University of Roorkee and is the oldest technical institution of the country. Established as the Roorkee college in 1847 and rechristened as the Thomson College of Civil Engineering in 1857, it made tremendous contributions in the development of infrastructural base-roads and highways, canals and Irrigation networks, railways and engineering industries, etc. Recognising its **yeomen** contribution and its potential for growth, the college was elevated to be the first technical University of India on November 25, 1949. Nurtured as the premier institution by the State of Uttar Pradesh, the University was declared an Institute of national importance and converted into the Indian Institute of Technology Roorkee by an Act of Parliament with effect from September 21, 2001.

This oldest seat of learning in technical education in the country has three campuses : i) 365 acres main campus at Roorkee ii) 25 acres Department of Paper Technology at Saharanpur and iii) 10 acres Greater Noida Extension Centre at Greater Noida. There are **11** undergraduate programmes leading to Bachelor's degree in different disciplines of engineering, technology and architecture, **5** Integrated dual degree programmes, **6** Integrated master's programmes in different disciplines of engineering & sciences and **54** postgraduate programmes in specialised areas leading to Master's degree in technology, architecture, sciences and management. In addition, the Institute is engaged in advanced level research and offers doctoral and post doctoral programmes in the areas of cutting edge technologies and sciences.

The Institute has a highly qualified and motivated faculty, about **400** in number, which is not only engaged in teaching and research, but also offers its expertise through consultancy services to private and public sector industries as well as various government agencies. The Institute has at present about **2500** undergraduate students, **1600** postgraduate students and nearly **900** Ph.D. students including foreign students from several developing countries of Asia and Africa.

There are a number of centres carrying out interdisciplinary research and many collaborative programmes exist between the institute and other institutions in India and abroad. The teaching and research work at the Institute is amply supported by central facilities such as the Central Library with more than **3 lakhs** printed volumes of books, journals and periodicals. The Central Library is a member of the Indian National Digital Library in Science and Technology (INDEST) Consortium. The membership provides online access to about 8000 e-journals. Educational Technology Centre, a modern Computer Centre, an Institute Instrumentation Centre with high quality analytical instruments and an Information Superhighway Centre with wide-band internet connectivity.

A large number of distinguished organizations interact with the Institute through research and consultancy services, which bears testimony to the important role being played by the Institute in the national development. The institute also offers, on request, tailor-made short-term continuing education programmes, specifically for personnel from industry and service organizations.

The Institute prepares students to meet the ever-increasing technological and social challenges with its traditions of self-discipline, hard work, all round personality development and a creative approach to problem solving. An extensive infrastructure exists to imbibe and cultivate these attributes amongst the students. To maintain the highest standards, the Institute has recently introduced major changes in its curricular structure, with greater flexibility and interdisciplinary focus.

The Indian Institute of Technology, Roorkee has a unique character and is fully residential for the students and the faculty. The Institute campus hums with diverse creative activities, which constantly serve to bring students and the staff in close contact, thereby fostering an all round intellectual development. On visiting the campus, one is struck by the elegance of the main building of renaissance style, spacious lawns and sports grounds. Few Institutions possess so many recreational and cultural facilities as this Institute does. The Institute campus has an excellent gymnasium, covered badminton and squash courts, lawn tennis courts, an Olympic size swimming pool, the largest number of Billiards Tables in an institution, and numerous recreational and pastime centres like the Student's Clubs, Hobbies Club, Boat Club, Cultural Society and a Institute Cinema Club. The students are housed comfortably in hostels with excellent dining facilities. A fairly equipped Institute Hospital caters to the health needs of the campus community.

Students are encouraged to participate in various sports and cultural activities to help them develop a well balanced personality. Every year, they organize an exhibition of fine arts, sculptures and carvings, Philately, Photography, Scientific models, etc., besides sports activities. Being a rather compact campus, a cheerful and friendly atmosphere prevails and students feel at home very soon after joining the Institute. The green verdant surroundings and the Stately Ganga Canal flowing nearby provide a very stimulating and creative environment.

The Institute has procured a large number of State-of-Art instruments and equipment and various facilities, thus updating and modernizing its laboratories. New Laboratories in different areas have also been established. A new State-of-Art Library has been set-up.

### **Academic Departments, Centres and Units**

There are eighteen academic Departments in the Institute, one academic Centre, six academic support units, three Centres of Excellence and three other units.

#### **Academic Departments**

- Architecture & Planning
- Biotechnology
- Chemical Engineering
- Chemistry
- Civil Engineering
- Earth Sciences
- Earthquake Engineering
- Electrical Engineering
- Electronics & Computer Engineering
- Humanities & Social Sciences
- Hydrology
- Paper Technology
- Management Studies
- Mathematics
- Mechanical and Industrial Engineering
- Metallurgical & Materials Engineering
- Physics
- Water Resources Development and Management

#### **Academic Centre**

- Alternate Hydro-Energy Centre

#### **Academic Service Centres**

- Institute Computer Centre
- Centre for Continuing Education
- Quality Improvement Programme Centre
- Institute Instrumentation Centre
- Information Superhighway Centre
- Central Library

#### **Centres of Excellence**

- Centre for Transportation Systems
- Centre for Disaster Mitigation and Management
- Centre for Nanotechnology

#### **Other Units**

- Education Technology Cell
- Training & Placement Cell
- Intellectual Property Right Cell

The Academic Departments and Centres offer courses to the students of various disciplines. Academic curriculum are so devised that a student of one discipline can take some courses of other disciplines as well. Such flexibility helps a student to develop his core competence together with the interdisciplinary skills in the area of his interest.

#### **Programmes**

The main aim of undergraduate education at IIT Roorkee is to enable students to face the wide-ranging changes taking place in the fields of technology, environment and management with confidence. This includes undertaking design, development, construction, production, managerial and entrepreneurial activities, and higher studies in their chosen or allied interdisciplinary fields of study.

The Institute lays great emphasis on assisting students in the development of character and self confidence with management traits. To achieve these goals, the curriculum lays more stress on learning and less on teaching.

Efforts are made to encourage self-learning, creative thinking, critical evaluation, spirit of inquiry and imbibing the culture of life long learning.

The Institute offers following programmes leading to Bachelor's degree, Integrated Dual Degree (IDD), Integrated M.Tech. and Integrated M.Sc. degrees in different disciplines of Engineering, Technology, Architecture and Science:

S.No.	Programme	Duration (in Years)	Department
<b>Bachelor's Degree</b>			
1.	B.Arch.	4 ½	Architecture
2.	B.Tech. (Biotechnology)	4	Biotechnology
3.	B.Tech. (Chemical Engineering)	4	Chemical Engineering
4.	B.Tech. (Civil Engineering)	4	Civil Engineering
5.	B.Tech. (Computer Science & Engg.)	4	Electronics & Computer Engineering
6.	B.Tech. (Electrical Engineering)	4	Electrical Engineering
7.	B.Tech. (Electronics & Communication Engineering)	4	Electronics & Computer Engineering
8.	B.Tech. (Mechanical Engineering)	4	Mechanical & Industrial Engineering
9.	B.Tech. (Metallurgical & Materials Engineering)	4	Metallurgical & Materials Engineering
10.	B.Tech. (Production & Industrial Engineering)	4	Mechanical & Industrial Engineering
11.	B.Tech. (Pulp & Paper Engineering)	4	Paper Technology
<b>Integrated Dual Degree</b>			
1.	B.Tech. (Chemical Engineering) and M.Tech. (Hydrocarbon Engineering)	5	Chemical Engineering
2.	B.Tech. (Electrical Engineering) and M.Tech. (Power Electronics)*	5	Electrical Engineering
3.	B.Tech. (Computer Science and Engineering) and M.Tech. (Information Technology)	5	Electronics & Computer Engineering
4.	B.Tech. (Electronics & Communication Engineering) and M.Tech. (Wireless Communication)	5	Electronics & Computer Engineering
5.	B.Tech. (Process Engineering) and M.B.A.	5	Paper Technology
<b>Integrated Master of Technology</b>			
1.	M.Tech. (Geophysical Technology)	5	Earth Sciences
2.	M.Tech. (Geological Technology)	5	Earth Sciences
3.	M.Tech. (Polymer Science & Technology)	5	Paper Technology
<b>Integrated Master of Science</b>			
1.	M.Sc. (Applied Mathematics)	5	Mathematics
2.	M.Sc. (Physics)	5	Physics
3.	M.Sc. (Chemistry)	5	Chemistry

## **Structure of Undergraduate/Integrated Dual Degree/Integrated M.Tech. /Integrated M.Sc. Programmes**

The four year B.Tech. programmes and five year B.Arch. programme comprise of courses divided in four distinct areas namely: Institute core, Departmental core, Departmental and Institute Electives, and co-curricular and extra-curricular activities.

The five year Integrated Dual Degree programmes comprise of all the above courses of B.Tech. programme, besides having a number of courses on specialized M.Tech. programme and dissertation.

The five year Integrated. M.Tech. and M.Sc programmes comprise of courses divided in two distinct areas namely: Common courses which include Institute core and Basic Science courses and Specific Programme courses which include Departmental core, Departmental and Institute Electives, Dissertation and co-curricular and extra-curricular activities.

### **Institute Core**

The Institute core courses are common to all programmes and are planned to give the students a firm base. These include courses on Mathematics, Physics, Chemistry, Engineering Sciences and Humanities and Social Sciences.

### **Departmental Core**

The Departmental Core consists of courses considered essential for a chosen engineering/science discipline, including laboratory courses, practical training and major and minor projects

### **Institute Electives**

The Institute Electives are the courses offered by different academic Departments/Centre to the students. The students are free to select a number of courses from a basket of courses offered, depending upon their interests and inclination. However, each student will have to take courses from Basic Sciences, Engineering Sciences and Humanities and Social Sciences.

### **Co-curricular Activities**

Educational tour, group discussion, development of technical communication skills and practical training form an essential part of the curricular structure.

### **Extra-curricular Activities**

The students are also encouraged to participate in a variety of extra-curricular and sports activities with a view to develop their overall personality and groom a student to be an engineer-manager-scientist. These activities are also given weightage in calculating the overall academic grade of a student.

Each course of the above programmes has a number of credits assigned to it depending upon the academic load and weekly hours of lectures, tutorials, practicals and self study. Normally one credit is assigned to each lecture of one hour or each tutorial of one hour or practical of two hours.

Credits assigned to various constituents of the Undergraduate/ IDD/ Integrated M.Tech. and Integrated M.Sc. curricular structure are given in tables {2(a)-2(d)}. Credit and Curricular components for Institute core courses and Institute elective courses are given in the following tables.

**Institute Core Courses for B.Tech. & IDD Programmes**

Curricular Component	Credits	Contact Hours/Week			
		L	T	P	Total
<b>(i) Humanities, Soical Sciences and Management (HSSMC)</b>					
1. Technical Communication	02	1	0	2	03
2. Economics	03	2	1	0	03
3. Behavioral Science	02	2	0	0	02
4. Management Concepts and Practices	03	2	1	0	03
<b>Total</b>	<b>10</b>	<b>07</b>	<b>02</b>	<b>02</b>	<b>11</b>
<b>(ii) Basic Sciences (BSC)</b>					
1. Physics-I	05	3	1	2	6
2. Physics-II	03	3	0	0	3
3. Chemistry	05	3	1	2	6
4. Mathematics-I	04	3	1	0	4
5. Mathematics-II	04	3	1	0	4
<b>Total</b>	<b>21</b>	<b>15</b>	<b>04</b>	<b>04</b>	<b>23</b>
<b>(iii) General Sciences (GSC)</b>					
1. Environmental Studies	02	2	0	0	2
2. Fundamentals of Biotechnology	02	2	0	0	2
3. Introduction to Geo-Science / Energy Resources and Conservation	02	2	0	0	2
<b>Total</b>	<b>06</b>	<b>06</b>	<b>0</b>	<b>0</b>	<b>06</b>
<b>(iv) Engineering Sciences (ESC)</b>					
1. Computer Systems & Programming / Fundamentals of Object Oriented Programming	04	3	0	2	5
2. Computer Aided Graphics	02	1	0	2	3
3. Fundamentals of Electronics	04	3	1	2/2	5
4. Engineering Graphics	04	2	0	4	6
5. Material Science-A or B /Solid Mechanics	04	3	1	0	4
6. Thermodynamics	03	2	1	0	3
7. Electrical Science	04	3	1	2/2	5
8. Manufacturing Techniques	03	2	0	2	4
<b>Total</b>	<b>28</b>	<b>19</b>	<b>04</b>	<b>12</b>	<b>35</b>

**Credits and Curricular Components of Institute Elective for B.Tech., B Arch.,  
IDD (B.Tech. + M.Tech.) and IDD (B.Tech. + M.B.A.) Programmes**

Curricular Component	Credits			
	B.Tech./B.Arch	B.Tech.+M.Tech.	B.Tech.+M.B.A.	Ind M.Tech/M.Sc.
I. Humanities, Social Sciences and Management (HSSMC)	6	3 - 6	9 -12	3 - 6
II. Basic and General Sciences (BGSEC)	6	6 - 9	6 - 9	-
III. Engineering Sciences (ESC)	8 -12	4 - 8	8 -12	4 - 8
<b>Total</b>	<b>20 - 24</b>	<b>17- 23</b>	<b>24 - 30</b>	<b>9 - 12</b>

## Course Coding

A course is identified by a course code designated by a string of alpha-numeric characters and a course title. In a course code, first two letters of the string indicate the Academic Department/Centre offering the course and the last three numbers designate particular course.

The letters symbolizing various Academic Departments / Centres offering courses are:

AH	Alternate Hydro-Energy Center	AR	Architecture & Planning
BM	Management Studies	BT	Biotechnology
CE	Civil Engineering	CH	Chemical Engineering
CY	Chemistry	EC	Electronics & Computer Engineering
EE	Electrical Engineering	EQ	Earthquake Engineering
ES	Earth Sciences	HS	Humanities & Social Sciences
MA	Mathematics	MI	Mechanical & Industrial Engineering
MT	Metallurgical & Materials Engineering	NT	Nanotechnology
PH	Physics	PP	Paper Technology

## Course Number

- The first digit will correspond to the level (year) at which a course is normally offered.
- The last two digits denote the number of the course, which will usually be odd for courses offered in the Autumn Semester and even for courses in the Spring Semester.

## Abbreviations & Notations

**Credits:** Cr

## Teaching Engagements

Every course maintains some teaching schedule for which weekly contact hours are decided for delivering lectures, engaging tutorials and performing practicals to make learning in a course more effective.

L: Lecture      T: Tutorial      P: Practical

In the syllabi, the information regarding number of course credits and contact hours per week is denoted as:

5 (3 - 1 - 2)  
Credits L T P

## Course Categories

All courses of Undergraduate/ IDD/ Integrated M.Tech. and Integrated M.Sc. programmes are categorized according to their nature. The courses are represented by the following notations:

BSC	Basic Science
GSC	General Science
ESC	Engineering Science
HSSMC	Humanities, Social Sciences and Management
DCC	Departmental Core Course
DEC	Departmental Elective Course
MSC	M.Tech. Specialization Course
RP	Research Project
MCC	Management Core course
MEC	Management Elective Course
BGSEC	Basic and General Science Elective Course
HSSMEC	Humanities, Social Sciences and Management Elective Course
ESEC	Engineering Science Elective Course
ECA	Extra Curricular Activity

## Weights for Course Evaluation

Evaluation in every course is based on the weights assigned to various components of the course curriculum. These components are designated as under:

CWS Class Work Sessional PRS Practical Sessional MTE Mid Term Examination  
 ETE End Term Examination PRE Practical Examination

As an example given below, EE-201: Network Theory refers to a course, offered by the Department of Electrical Engineering to the students of second year of the B.Tech. (Electrical) programme and is offered in the Autumn Semester.

Course Code				Credits	Contract Hours/Week		
Department Code	Course Number		Course Title		Lecture (L)	Tutorial(T)	Practical (P)
	Level	Course					
EE	2	01	Network Theory	4	3	1	0

### Proficiencies

Extra Curricular Activities, as listed below, will be offered to the students of B.Tech., B.Arch., I.D.D., Integrated M.Tech. and Integrated M.Sc. Programmes from first year to final year. These activities will run in both the semesters but will be evaluated and tabulated in spring semester only. Proficiency, once opted, can not be changed during the year of the study. In case a particular activity is opted by large number of students and some students can not be accommodated, the Sports Association in consultation with Academic Section will relocate proficiency to such students. One credit has been assigned to proficiency at all levels starting from the second year.

### Sports & Games Activities

- |                       |                                 |                     |               |
|-----------------------|---------------------------------|---------------------|---------------|
| 1. Tennis             | 2. Badminton                    | 3. Squash           | 4. Football   |
| 5. Cricket            | 6. Volleyball                   | 7. Basketball       | 8. Swimming*  |
| 9. Rowing (Boating) * | 10. Table Tennis                | 11. Yogic Exercises | 12. Athletics |
| 13. Hockey            | 14. Gymnastics & Weight Lifting |                     |               |

\*Non-Swimmers are not allowed to take these proficiencies, as swimming test has to be cleared.

### Hobbies Activities

- |                |                              |                |                  |
|----------------|------------------------------|----------------|------------------|
| 1. Electronics | 2. Fine Arts                 | 3. Gardening   | 4. Modeling      |
| 5. Photography | 6. Philately and Numismatics | 7. Star Gazing | 8. Web Designing |

### Cultural Activities

- |          |           |             |          |                              |
|----------|-----------|-------------|----------|------------------------------|
| 1. Drama | 2. Design | 3. Literary | 4. Music | 5. Organization & Management |
|----------|-----------|-------------|----------|------------------------------|

### Himalayan Explorers Club

- |                                |              |           |                   |
|--------------------------------|--------------|-----------|-------------------|
| 1. Mountaineering and Trekking | 2. Rangering | 3. Roving | 4. Unarmed Combat |
|--------------------------------|--------------|-----------|-------------------|

### N.C.C./Rangering/Hindi/N.S.S./N.S.O.

Students of B.Tech., B.Arch., I.D.D., Integrated M.Tech. and Integrated M.Sc. programmes have to take N.C.C. at first year level. Some of the students will be selected for N.S.O. in place of N.C.C. Foreign Students will be offered Hindi in place of N.C.C.. Rangering will be offered to girl students. Two credits have been assigned to these activities. Activities will run in both semesters but will be evaluated and tabulated in Spring Semester only. N.C.C. can also be opted as a proficiency at second year level.

### Discipline

To enforce discipline among students, discipline is also treated as an activity. Two credits in each year have been assigned to this activity for three years. Grades will be awarded by Dean of Students Welfare and will be tabulated in Spring Semester.

### Credit System

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

# **ORDINANCES AND REGULATIONS FOR UNDERGRADUATE, INTEGRATED DUAL DEGREE, INTEGRATED M.Tech. AND INTEGRATED M.Sc. PROGRAMMES**

## **Preamble**

Indian Institute of Technology Roorkee, Roorkee, inherits the legacy of excellence in Undergraduate teaching of the erstwhile University of Roorkee as evident from its illustrious alumni and their engineering feats like Aswan to Bhakra-Nangal dam across the world, standing as testimonies of their capabilities and excellence. The aim of the education at the undergraduate level is to build on the knowledge gained by an undergraduate student through the school curriculum by imparting knowledge with the help of classroom instructions, training and other modes of teaching. After completing the curriculum, the student will acquire adequate knowledge base in the desired branch, which could be easily employed for the solution of real life problems and developed further through higher education, for reaching the frontiers of knowledge in his/her area of specialization. The institute also imparts knowledge to students in the emerging areas of science and technology and has started several five-year Integrated Dual Degree programmes in engineering and five-year Integrated M.Tech and M.Sc. programmes in sciences. The aim of these courses is to catalyze and develop the research potential of the students.

The undergraduate and postgraduate programmes have both academic and extracurricular components designed for the integrated development of professionals possessing individual values of ethics and morality. Many of the students after completing their programmes start working in different organizations where teamwork is the predominant mode of functioning. Ethics and discipline are of paramount importance and without these values teamwork is impossible.

In these days of rapid evolution of knowledge, the academic programmes require provision for continuous updating of the contents of the syllabi to incorporate new developments in a particular area of knowledge. The curriculum is, therefore, broadly defined to make it possible for the teacher to update it continuously by including the latest developments. In addition, the institute undertakes periodic review of the curricular structure to prune the dead wood and incorporate new ingredients, which may become necessary in the changed context of a branch of study. Exchange of knowledge and methodology across the disciplines is important in furthering its frontiers. In keeping with this spirit, the curriculum encourages students to learn across different branches. In different programmes in engineering and sciences, apart from the inputs of social sciences and management, biotechnology and environmental sciences have also been introduced since many novel ideas from these areas are being borrowed in engineering and sciences. The curriculum at the undergraduate and postgraduate level has been so structured that it offers enough flexibility to the students to tailor their learning to individual inclinations and the desired career objectives.

The curriculum in a given branch at the undergraduate level and postgraduate level includes academic programmes involving ingredients of classroom teaching, laboratory practices, training, seminar and project. These ingredients are specified in terms of courses with a given code specifying the subject(s) to be taught under them. Every course has credits depending on the workload it involves. A student is continuously evaluated during the conduct of a course and is awarded a letter grade on the basis of his performance. The academic year is divided into semesters and in each semester the students have to register in a branch of study for a limited number of courses. When a student earns a minimum number of credits specified for a given curriculum, he becomes eligible for the award of the degree.

**ORDINANCES FOR THE UNDERGRADUATE (UG), INTEGRATED DUAL-DEGREE (IDD),  
INTEGRATED M.TECH. AND INTEGRATED M.SC. (IMD) PROGRAMMES**

<b>Short Title &amp; Commencement</b>	1	(i)	These ordinances shall be called the Ordinances for the four year Undergraduate, five year Integrated Master's and the five year Integrated Dual-Degree Programmes of the Indian Institute of Technology Roorkee;
		(ii)	These ordinances shall come into force with effect from such date as the Senate/ Board may appoint in this behalf.
<b>Definitions</b> <i>(Unless the context requires otherwise)</i>	2	(i)	<b>"Applicant"</b> shall mean an individual who applies for admission to any undergraduate (UG) or Integrated dual-degree (IDD) or Integrated Masters degree (IMD) programme of the Institute;
		(ii)	<b>"Board"</b> shall mean the Board of Governors of the Institute;
		(iii)	<b>"BoS"</b> shall mean the Board of Studies of the Institute;
		(iv)	<b>"CAC"</b> shall mean the Centre's Academic Committee;
		(v)	<b>"Casual Student"</b> shall mean a student who is registered for a degree in a recognized Institution/ University in India or abroad and is officially sponsored by his parent institute to avail laboratory and other academic facilities or for attending a formal set of courses;
		(vi)	<b>"CGPA"</b> shall mean the cumulative grade point average of a student;
		(vii)	<b>"Coordination Committee"</b> shall mean the committee of the faculty members involved in a course;
		(viii)	<b>"Council"</b> shall mean the Council of the Indian Institutes of Technology;
		(ix)	<b>"Course"</b> shall mean a curricular component identified by a designated code number and a title;
		(x)	<b>"Course Coordinator"</b> shall mean a faculty member who shall have full responsibility for the course, coordinating the work of other faculty member(s) involved in that course, including examinations and the award of grades;
		(xi)	<b>"CRC"</b> shall mean Centre's Research Committee;
		(xii)	<b>"Degree"</b> shall mean the Bachelor's degree viz. B.Tech., or the Integrated Master's degree viz M.Sc. or M.Tech., or the Integrated dual-degrees viz. B. Tech. and M.Tech./ M.B.A., and such other degrees of the Institute as may be approved by the Board from time to time;
		(xiii)	<b>"Direct Admission Student"</b> shall mean the student who is admitted directly from abroad and, not through JEE, and registered for undergraduate, or Integrated Master's or Integrated dual-degree programmes for full time study;
		(xiv)	<b>"DRC"</b> shall mean the Departmental Research Committee of a Department;
		(xv)	<b>"DAC"</b> shall mean the Departmental Academic Committee of a Department;
		(xvi)	<b>"DAS"</b> shall mean the Dean, Academic Studies;
		(xvii)	<b>"DOSW"</b> shall mean the Dean of Student's Welfare;
		(xviii)	<b>"Faculty Advisor"</b> shall mean a teacher nominated by the Department/Academic Centre to advise a student on the courses to be taken by him and other matters related to the academic programme;
		(xix)	<b>"Grade Moderation Committee"</b> shall mean the committee appointed by the Department/Academic Centre to moderate grades awarded by the Course Coordinators in different courses in a semester at a given level of a curriculum;

		(xx)	“ <b>Institute</b> ” shall mean the Indian Institute of Technology Roorkee;
		(xxi)	“ <b>Integrated Dual-Degree or IDD</b> ” shall mean the five-year Integrated Dual Degrees, namely B.Tech. (parent discipline) and M.Tech. (specialization of the parent discipline)/ MBA of the Institute;
		(xxii)	“ <b>Integrated Master’s Degree or IMD</b> ” shall mean the five-year Integrated Master’s Degree, namely M.Sc. and M.Tech. in different disciplines of the Institute;
		(xxiii)	“ <b>JAB</b> ” shall mean the Joint Admission Board of all the IITs for admission of students to various academic programmes through Joint Entrance Examination (JEE);
		(xxiv)	“ <b>JEE</b> ” shall mean the Joint Entrance Examination for admission to undergraduate (B.Tech./B. Arch.), five-year Integrated Dual Degree (B. Tech. and M.Tech./M.B.A.), Integrated M.Sc. and Integrated M.Tech. programmes of the Indian Institutes of Technology;
		(xxv)	“ <b>OBC</b> ” shall mean the other backward classes as notified by the Government of India from time to time;
		(xxvi)	“ <b>PD</b> ” shall mean the persons with disability as specified by the Government of India from time to time.
		(xxvii)	“ <b>PG</b> ” shall mean Post Graduate;
		(xxviii)	“ <b>Student</b> ” shall mean a student registered for an undergraduate, Integrated Master’s or Integrated Dual-Degree programme for full-time study leading to the Bachelor’s degree or the Master’s degree or the dual Bachelor’s and Master’s degrees, as the case may be;
		(xxix)	“ <b>Scheme of Teaching and Examination</b> ” shall mean the scheme of teaching and examination for a branch of study as approved by the Senate;
		(xxx)	“ <b>SC/ST</b> ” shall mean the scheduled castes and scheduled tribes as notified by the Government of India from time to time;
		(xxxi)	“ <b>SGPA</b> ” shall mean the semester grade point average;
		(xxxii)	“ <b>UG</b> ” shall mean Undergraduate;
		Note: ‘He’ & ‘His’ imply ‘he’/‘she’ and ‘his’/‘her’, respectively	
<b>Ordinances</b>	<b>3</b>	(1)	The Institute shall offer such UG, IMD and IDD programmes and of such minimum duration as the Board may approve on the recommendation of the Senate either on its own or on the initiative of a Department/Academic Centre, and/or on the direction of the Board/Council/ Government of India. Provided that the Board of Studies (BoS) shall recommend all such programmes. Provided further that an interdisciplinary programme may be proposed by a Department/an Academic Centre or by a committee appointed by the Director for the consideration of the BoS, the Senate and the Board;
		(2)	The procedure for starting a new programme, temporarily suspending a programme or phasing out a programme shall be such as may be laid down in the regulations.
		(3)	The minimum entry qualifications and the policy and procedure of admission to UG, IMD and IDD programmes shall be such as may be specified by the JAB/Council/ Government of India and/or laid down in the regulations.
		(4)	A UG or an IMD or an IDD student shall be required to earn a minimum number of credits through various curricular components like teaching/laboratory courses, seminar, project etc. at the Institute or at such other Institutions as have been approved by the Institute. For an IMD or an IDD student, the dissertation, project and other similarly designated academic activities shall have to be undertaken under the guidance of a

	<p>supervisor(s) from the Institute. Provided that an IMD or an IDD student may be permitted by the DAC/CAC to carry out in full or part of his dissertation outside the Institute. In such cases, an additional supervisor from outside Organization/ Institute, if considered necessary, may be appointed by the DAC/CAC on the recommendation of the supervisor from the Institute;</p>
(5)	<p>A Undergraduate or an IMD or an IDD student shall be required to complete all the requirements for the award of the Bachelor's degree or the Integrated Master's Degree, viz M.Sc. or M.Tech. or the Integrated Dual Degrees, viz. B. Tech. in parent discipline and M.Tech in a specialized sub-discipline of the parent discipline or M.B.A., as the case may be, within such period as may be specified in the regulations, including those credits earned at such other institutions as have been recognized by the Institute for this purpose;</p>
(6)	<p>The date of initial registration for the UG or IMD or IDD programmes shall normally be the date on which the student formally registers for the first time. This date shall be construed as the date of joining the programmes for all intents and purposes.</p>
(7)	<p>A student shall be required normally to attend every lecture, tutorial and practical class. However, for late registration, sickness or other such exigencies, absence may be allowed as provided for in the regulations.</p>
(8)	<p>A UG or IMD or IDD student may be granted such scholarship / studentship / assistantship / stipend, etc. and awarded such prizes and medals as may be specified in the regulations in accordance with the directions of the Government of India and/or the decision of the Council/ Board from time to time.</p>
(9)	<p>The procedure for the admission of a student or a direct admission student to a UG or IMD or IDD programme shall be such as may be decided by the Joint Admission Board of the IITs and/or as specified in the regulations; the casual students may be allowed access to academic programmes in the manner as provided for under the regulations.</p>
(10)	<p>In case all the reserved seats for SC/ST category are not filled even with relaxed admission norms, the students in this category who satisfy certain minimum norms specified for this purpose may be offered admission to one year preparatory programme. On successful completion of the preparatory course, these students may be offered direct admission against the unfilled quota of seats as provided for in the regulations.</p>
(11)	<p>The procedure for the withdrawal from a UG or an IMD or an IDD programme, rejoining the programme, the award of grades and the SGPA/CGPA, the examination and all such matters as may be connected with the running of a UG or an IMD or an IDD programme shall be such as may be specified in the regulations.</p>
(12)	<p>The award of the UG degree or the Integrated Master's Degree or the Integrated Dual-Degree to an eligible candidate shall be made in accordance with the procedure laid down in the regulations.</p>
(13)	<p>A student admitted to the UG or the IMD or the IDD programme shall abide by the "Standing Orders for Students" issued by the Institute from time to time. These standing orders shall deal with the discipline of the students in the Bhawans /Hostels, Departments/ Academic Centres, the Institute premises and outside. The Standing Orders may also deal with such other-matters as are considered necessary for the general conduct of the students, and co-curricular and extra-curricular activities. These</p>

		Standing Orders shall be approved by the Director on the recommendation of the Dean of Students Welfare.
	(14)	Notwithstanding anything contained in the above Ordinances, no regulations shall be made in contravention of the decision of the Board/ Council and/or the direction of the Government of India, in regard to the duration of the UG or an IMD or the IDD programmes, the amount and number of scholarship/assistantship and the number of studentships and the procedure of admission and the percentage of students of various categories, viz. reserved (SC/ST; OBC; PD) and unreserved categories. The regulations for the UG or for an IMD or for an IDD programme shall be framed by the BoS, which shall be considered and approved by the Senate.
	(15)	In special circumstances, the Chairman of the Board may, on behalf of the Board, approve amendment, modification, insertion or deletion of an Ordinance(s), which in his opinion is necessary or expedient for the smooth running of a programme: Provided that all such changes shall be reported to the Board in its next meeting for approval.

**REGULATIONS FOR THE UNDERGRADUATE, INTEGRATED MASTER'S DEGREE AND INTEGRATED DUAL DEGREE PROGRAMMES**

<b>Short Title &amp; Commencement</b>	<b>1</b>	(1)	These regulations shall be called the regulations for the UG, IMD and the IDD programmes of the Institute;
		(2)	These regulations shall come into force on such date as the Director may appoint in this behalf.
<b>Undergraduate Programmes</b>	<b>2(a)</b>	(1)	The Institute may offer such Undergraduate programmes leading to Bachelor's Degree in Technology, B.Tech., and Bachelor's Degree in Architecture, B. Arch. as may be approved by the Senate and the Board;
		(2)	The list of currently offered UG programmes and the broad course structure are given in Table-1(a) and -Table-2(a) of Appendix-A respectively. The structure and programme may be amended/modified in accordance with the decisions of the Senate and the Board;
		(3)	The duration of UG programmes leading to degrees of B. Tech. and B. Arch. are normally four and five years, respectively. However, the maximum duration for the UG programme is six years for the degree of B. Tech and seven years for the degree of B. Arch. from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different kinds of leaves permissible to a student, but it shall exclude the period of rustication. The duration for the UG programme may be altered in accordance with the decision of the Board/Council/ Government of India.
<b>Integrated Dual-Degree Programmes</b>	<b>2(b)</b>	(1)	The Institute may offer such five-year IDD programmes leading to Bachelor's degree in Technology, i.e. B. Tech., in a parent discipline and Master's degree in Technology, i.e., M. Tech. in a specialization of the parent discipline or M.B.A., as may be approved by the Senate and the Board;
		(2)	The list of currently offered IDD programmes and the broad course structure are given in Table-1(b) and Table-2(b) of Appendix-A, respectively. The structure and programmes may be amended/modified in accordance with the decisions of the Senate and the Board;
		(3)	The duration of an IDD programme leading to dual-degrees of B. Tech. and M. Tech. /M.B.A. is normally five years and the maximum duration is seven years from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different kinds of leave permissible to a student but it shall exclude the period of rustication. The duration for the IDD programme may be altered in accordance with the decision of the Board/ Council/ Government of India.
<b>Integrated M.Tech. Programmes</b>	<b>2(c)</b>	(1)	The Institute may offer such five-year Integrated M. Tech. programmes in Science/ Technology, as may be approved by the Senate and the Board;
		(2)	The list of currently offered Integrated M. Tech. programmes and the broad course structure are given in Table-1(c) and Table-2(c) of Appendix-A, respectively The structure and programmes may be amended/modified in accordance with the decisions of the Senate and the Board;
		(3)	The duration of an Integrated M. Tech. programme is normally five years and the maximum duration is seven years from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different

			kinds of leave permissible to a student but it shall exclude the period of rustication. The duration for the Integrated M. Tech. programme may be altered in accordance with the decision of the Board /Council/Government of India.
<b>Integrated M.Sc. Programmes</b>	<b>2(d)</b>	(1)	The Institute may offer such five-year Integrated M.Sc. programmes leading to Master's Degree in Science, as may be approved by the Senate and the Board;
		(2)	The list of currently offered Integrated M. Sc. programmes and the broad course structure are given in Table-1(d) and Table-2(d) of Appendix-A, respectively The structure and programmes may be amended/modified in accordance with the decisions of the Senate and the Board;
		(3)	The duration of an Integrated M.Sc. programme leading to Master's degree in Sciences is normally five years and the maximum duration is seven years from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different kinds of leave permissible to a student but it shall exclude the period of rustication. The duration for the Integrated M.Sc. programme may be altered in accordance with the decision of the Board /Council /Government of India.
<b>Board of Studies (BoS)</b>	<b>3</b>		The Board of Studies (BoS) shall be a subcommittee of the Senate, which shall consider all the academic matters recommended by the Departmental/Centre's Academic Committee (DAC/CAC) and coordinate the activities related to UG, IDD and IMD programmes. It shall also consider and recommend to the Senate the broad framework and policies related to the UG, IDD and IMD Programmes offered by the Institute.
<b>Departmental/ Centre's/ Programme Faculty Board (DFB/CFB/PFB)</b>	<b>4</b>		There shall be a Faculty Board consisting of all the faculty members of a Department/ Centre, which may be called the Departmental/Centre's Faculty Board (DFB/CFB). It shall be constituted by every Academic Department / Centre. For an interdisciplinary programme, a Programme Faculty Board (PFB) shall be constituted by the Dean, Academic Studies and it shall look after all academic matters pertaining to that programme. A Programme Coordinator shall be appointed by the Director in consultation with the Dean, Academic Studies and the Heads of the concerned Departments/Centres to look after all the administrative and academic matters related to the interdisciplinary programme. The Programme Coordinator shall exercise the functions of the Head of a Department/Chairman, DAC for such a programme.  The DFB/CFB shall be responsible for considering all the policy issues concerning academic and research programmes of the Department/ Academic Centre. The DFB/CFB shall formulate academic programmes and courses as recommended by the DAC/CAC and DRC/CRC to it and send its recommendation to the Dean, Academic Studies for his consideration and necessary action.
<b>Departmental Academic Committee (DAC)</b>	<b>5</b>		The Departmental Academic Committee (DAC) shall be constituted by the DFB/CFB/PFB to look after all academic matters pertaining to the Undergraduate Programme(s), Integrated Dual-Degree Programme(s) and Integrated Master's Programme(s) offered by the Department/Centre.  Where DAC does not exist, the functions of the DAC and its Chairman shall be performed by the Head of the Department/Centre in consultation with a Committee proposed by him and approved by the Dean, Academic Studies, for this purpose, if necessary.

<b>Phasing Out of a Programme</b>	<b>6</b>		The phasing out of any UG, IDD and IMD programme may be considered by the Senate on the recommendation of a DFB/CFB/PFB and the Boards. Also, a programme may be phased out by the Senate on the recommendation of the BoS if, consecutively for three years, the number of students registering for the programme is less than 40% of the sanctioned intake of the students.
<b>Starting a New Programme</b>	<b>7</b>	(1)	The Board may approve the starting of a new programme or a modified programme in lieu of the old phased-out programme on the recommendation of the DFB/CFB/PFB, the Board of Studies and the Senate.
		(2)	A new programme may be considered and recommended by the Senate to the Board for its consideration and approval. Such a proposal will be initiated by a Department/Academic Centre through its DFB/CFB/PFB and considered and recommended by the BoS.
		(3)	An interdisciplinary programme may be proposed by a Department /Academic Centre in consultation with other participating Department(s)/ Academic Centre(s), or by a group of Department(s) /Academic Centre(s), or by a Committee appointed by the Director for the consideration of the BOS and the Senate for their recommendation to the Board of Governors for obtaining its approval.
<b>Semester System</b>	<b>8</b>	(1)	The academic programmes in the institute shall be based on semester system: Autumn and Spring semesters in a year with winter and summer vacations. A number of courses shall be offered in each semester. In summer vacation, some courses may be offered as provided for in the regulations;
		(2)	Each course shall have a certain number of credits assigned to it depending upon the academic load of the course assessed on the basis of weekly contact hours of lecture, tutorial and laboratory classes, assignments or field study and/or self study;
		(3)	The courses offered in a semester shall be continually assessed and evaluated to judge the performance of a student.
<b>Admissions</b>	<b>9</b>	(1)	Admission to all Under Graduate, Integrated Dual-Degree, Integrated Master's programmes shall be made through the Joint Entrance Examination (JEE). The policy of admissions, the eligibility thereof and other issues pertaining to JEE shall be such as may be approved by JAB and/or directed by the Council/Government of India.
		(2)	Foreign nationals either residing in India or abroad or Indian nationals residing abroad may be admitted to any UG or IDD or IMD programme in accordance with the policy guidelines laid down by the Council.
<b>Refund of Fees</b>	<b>10</b>		The fees and other charges deposited by a candidate seeking admission will be refunded if the student does not join the programme and leaves the Institute by applying for refund on or before the date of registration. The Institute shall decide the amount to be refunded but no refund of fees will be permissible to students who have registered for the programme and leave thereafter. In such cases only caution money will be refunded at the end of the semester.
<b>Allotment of Branch / Programme and its Change</b>	<b>11</b>	(1)	The allotment of branch/programme to a student shall be made at the time of counselling by JEE on the basis of merit according to the preference of the student and the availability of seats.
		(2)	A student enrolled for B. Tech. /IDD /IMD programme and admitted through JEE, shall be eligible for change of branch/programme at the end of first year provided that he/she satisfies the following criteria:

		(i)	CGPA for General and OBC category > 8.0
		(ii)	CGPA for SC/ST category > 7.0
		(iii)	Earned credits at the end of Spring Semester > 48*
		(iv)	Not failed in any course
		(v)	Only top 2% students in the merit of General, OBC, SC and ST categories will be eligible for the change of branch/programme.  *The credits for NCC/NSS/NSO/Rangering, proficiency and discipline shall not be counted for this purpose. However, the CGPA will be calculated on the basis of all academic and extracurricular credits. (Note: The students admitted in B.Arch. programme are not eligible for change of branch)
		(3)	While making the change of branch/programme of a student, the strength of a class should not exceed the sanctioned intake by more than 5%.  Provided that a student of General or OBC category shall not be allowed the change of branch/programme against the vacant seats of SC/ST category.
		(4)	The eligible applicants shall be allowed change of branch/programme strictly on the basis of inter-se-merit as reflected in their CGPA. In case the CGPA of more than one student seeking the change of branch/programme is the same, their inter-se-merit shall be decided on the basis of their ranks in JEE.
<b>Academic Registration</b>	<b>12</b>	(1)	Every student shall register in each semester on the scheduled date as per academic calendar till the completion of the degree.
		(2)	Late registration may be allowed only upto a maximum of 10 days after the scheduled registration date. Registration in absentia may be permitted by the Dean, Academic Studies.
<b>Programme Advisor</b>	<b>13</b>		A Programme Advisor shall be appointed for each programme by the Head of the Department/Centre on the recommendation of DAC/CAC who will be responsible for advising the students for registration.
<b>Course Coordinator</b>	<b>14</b>		Every course offered by a Department/ Academic Center shall be coordinated by a Course Coordinator appointed by the Head of the Department/Centre on the recommendation of DAC/CAC. The Course Coordinator shall have full responsibility for the course. He shall coordinate the work of other faculty member(s) involved in that course in respect of their participation in various activities related to the course including continuous evaluation of the students through tests, quizzes, assignments, mid-term and end-term examinations and the award of the grades.
<b>First Year Class Coordinator</b>	<b>15</b>		The courses in the first year shall be coordinated by a First Year Class Coordinator appointed by the Dean, Academic Studies. The First Year Class Coordinator shall coordinate the time schedules for the first year classes and shall perform such other duties and exercise such other powers of the Head / Chairman, Department Academic Committee, as are necessary for the organization of the courses offered in the first year.
<b>Preparatory Course Coordinator</b>	<b>16</b>		The preparatory courses shall be offered to SC/ST students admitted to these courses through JEE, prior to their joining UG programme. A Coordinator appointed by the Dean, Academic Studies, shall coordinate these courses. The Coordinator shall also be responsible for fixing the time schedule and finalization of the results to be submitted to the Dean, Academic Studies, immediately on completion of the second semester, as per schedule prescribed by the Dean, Academic Studies.

			The attendance and evaluation regulation for the preparatory course students shall be same as those for the other academic programmes. The passing marks in each course shall be 40% of the total marks.
<b>Advisor, SC/ST Students of Preparatory Courses</b>	<b>17</b>		The Coordinator, Preparatory Courses, shall also act as the Advisor, SC/ST students of preparatory course, to advise them and provide them assistance on academic matters.
<b>Subject Registration</b>	<b>18</b>	(1)	Every student shall register for the courses that he/she wants to study for earning credits and his/her name will appear in the roll list of each of these courses. No credit shall be given if a student is allowed to attend a course for which he or she is not registered. The performance of a student in all the courses, for which he/ she has registered, shall be included in his/her grade card.
		(2)	Student should first register for the courses in which he/she has been declared failed in the previous year/semester as back papers and then register for the remaining courses of the semester to make up the total required credits for that semester. However, a student shall not be allowed to register for the courses offered to students of third year, if he/she has not cleared all the courses of first year and a student shall not be allowed to register for the courses offered to students of fourth year, if he/she has not cleared all the courses of second year and a student shall not be allowed to register for the courses offered to students of fifth year, if he/she has not cleared all the courses of third year.
		(3)	Registration of courses to be taken in a particular semester shall be carried out according to specified schedule on payment of necessary fees. In-absentia registration may be allowed only in rare cases such as illness or any other contingencies, at the discretion of the Dean, Academic Studies.
		(4)	The Dean, Academic Studies shall assign the time slots for the next semester and inform the Departments/ Academic Centres, who shall then assign the teachers and decide the time schedule of the courses to be offered in the next semester. These tasks shall be completed at least ten days before the scheduled date of registration and the time schedule shall be made available by the department to the academic section where it will be centrally displayed on the notice board for the students at least one week prior to the date of registration.
		(5)	Those students who are joining the first year of the UG or IDD or IMD programme shall complete the registration procedure on a specified registration date as per academic calendar.
		(6)	Under special circumstances, the students may be allowed late registration by the Dean, Academic studies till a specified date, by paying a late fee of Rs.1000.00, along with other necessary fees.
		(7)	A student may register for a minimum of 15 credits and a maximum of 24 credits. But on the recommendation of the department/centre, Dean, Academic Studies, may allow a student to register for a maximum of 28 credits in not more than two semesters during the entire programme for fulfilling the requirements of minimum earned credits. However, the credits for NCC/ NSS/NSO/Rangering, proficiency and discipline shall not be counted for this purpose.
		(8)	A student shall have the option to add or delete courses from his/her registration during the first ten days of the semester.

		(9)	Before the commencement of classes and at the time of registration, Academic Section shall give each student a registration record which shall be the official record of the courses registered; any change like adding or dropping a course will be marked on this registration record by the student and countersigned by the Chairman, Departmental Academic Committee.
		(10)	At the time of completing the registration form or any subsequent change in the registration, every student shall consult his/her Programme Advisor, who shall be appointed by the Chairman, Departmental Academic Committee of a department/centre. The Programme Advisor shall advise the student in regard to the minimum and the maximum number of total and lecture credits to be registered for in the context of his/her past performance, backlog of courses, SGPA/CGPA and individual interest.
<b>Minimum Students Requirement for an Elective Course</b>	<b>19</b>		An elective course in a Department/ Academic Centre shall run only if a minimum of ten students register for it in a regular semester. However, under special circumstances a course may run with a fewer students too with prior permission of the Chairman, Senate.
<b>Course Codes</b>	<b>20</b>		Each course offered by the institute shall be identified by a course code, normally consisting of a string of six alphanumeric characters followed by a course title. The first two characters in a course code shall be capital letters identifying the responsible Department/ Academic Centre offering /Coordinating the course. The next three characters are numerical digits: the first one normally specifies the year of study and the last two digits specify the course number and the semester in which the course shall be offered. Normally, odd number in the course code will indicate that the course will be offered in the Autumn semester and the even number will indicate that the course will be offered in the Spring semester of the year. For all the UG, IDD, and IMD programmes, 100 series shall be for the courses in first year, 200 for the courses in the second year and so on. The first numerical digit for a preparatory course shall be zero. In case of Institute electives, the code shall begin with 'I' followed by two characters indicating the code of the Department /Academic Centre offering / coordinating the course and two digit code number indicating the elective number offered by the Department/Centre. The sixth character may be used in few cases to differentiate courses of same nature.
<b>Course Credits</b>	<b>21</b>		Each course shall have an integer number of credits, which reflects its weight. The number of credits of a course in a semester shall ordinarily be calculated as under:
		(1)	Lectures/Tutorials: One lecture hour per week shall normally be assigned one credit. One hour of tutorial per week shall be assigned one credit. However, the credits may be adjusted further by taking into consideration the quantum of work required to be put in by a student for learning the course;
		(2)	Practicals: One laboratory hour per week shall normally be assigned half a credit. Not more than three credits may be assigned to a practical course having only laboratory component. The courses having two/three hours of contact every alternate week shall have one credit only;
		(3)	Special courses like project, practical training, group discussion, discipline, proficiency, National Cadet Corps (NCC)/ National Service Scheme (NSS)/ National Sports Organization (NSO) in the UG, IDD and IMD programme shall be treated as any other course and shall be assigned such number of credits as may be approved by the Senate.

<b>Course Evaluation</b>	<b>22</b>	(1)	A student shall be evaluated for his/her academic performance in a course through tutorials, practicals, home work assignments, term papers, field work, seminars, quizzes as Class Work Sessionals (CWS) and Practical Sessionals (PRS), Mid Term Examinations (MTE), End-Term Examination (ETE), and Practical Examinations (PRE) as applicable according to the guidelines formulated by BoS for this purpose.
		(2)	The distribution of weights for each component shall be decided and announced by the Course Coordinator at the beginning of the course, subject to such stipulations as are given in the Scheme of Teaching and Examination for a given programme.
		(3)	The criteria for evaluation of any subject be declared in the very first week of commencement of the classes.
		(4)	Answer books of the tests and examination cannot be written in Pencil.
		(5)	Evaluation of marks should not be in pencil.
		(6)	A student can go through his/her answer script of mid-term examination and the end-term examination and point out any discrepancy in its evaluation on a day fixed by the Course Coordinator/ Chairman, Grade Moderation Committee. Objections will be entertained right then, and not even on the next day.
		(7)	The duly evaluated answer books be returned (Mid Term Examination -I & Mid Term Examination -II), within a week from the date of the test.
		(8)	HODs to ensure that End Term Examination answer books are shown to the students before the day of moderation, on a date to be specified and prominently displayed by the respective teachers. Further, the answer books be preserved by the concerned teacher for six months, before handing over to departmental stock for disposal.
		(9)	The answer script of the End-Term Examination shall not be shown to a student after finalization of the grades by the Grade Moderation Committee.
		(10)	The practical/field training shall normally be evaluated through the quality of work carried out, the report submission and presentation(s) but the project shall be evaluated normally by mid-term seminar (s), quality of work carried out, project report submission and the viva-voce examinations.
		(11)	The evaluation of performance in the Summer Term will follow the standards followed previously when the course was offered last during a regular semester. The record copy of that evaluation including the statistical parameters will be provided to the Course Coordinator by the Chairman, Department Academic Committee or the First Year Class Coordinator as the case may be.
<b>Grading System</b>	<b>23</b>	(1)	The academic performance of a student shall be graded on a ten-point scale following guidelines given in Appendix-B. The letter grades and their equivalent grade points are listed in Table-3.
		(2)	The letter Grades awarded to a student in all the courses (except audit courses) shall be converted into a semester and cumulative performance index called the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), to be calculated by the procedures given in Appendix-B of these regulations.
<b>Courses of Special Nature</b>	<b>24</b>		The UG, IDD and IMD programmes may contain the following courses of special nature in different curricula some of which are already indicated in section 21(c) of these regulations;

<b>NCC/NSS/NSO/Rangering</b>	
(1)	Every student shall register for the specified number of credits in the first year, for participation in the NCC / NSS / NSO / Rangering for the overall development of his/her personality. Students shall be admitted to NCC/ NSS/ NSO/ Rangering on the basis of their preference and by virtue of their aptitude and abilities as decided by a committee constituted by DOSW. The student shall be continually evaluated for his/her participation and awarded grade following the procedures specified. There shall be at least 80 hours of engagement in an academic year and the attendance regulations for the courses shall apply. This requirement shall be completed in the first year. If, however, a student is not able to complete this requirement in the first year, he/she shall complete it by the end of second year failing which he/she will not be allowed to register in the fifth semester;
<b>Proficiency/NSO</b>	
(2)	Every student shall be admitted to proficiency and various games and sports in NSO from the second year onwards on the basis of their preference and by virtue of their aptitude and abilities as decided by a committee constituted by DOSW. In case of proficiency / NSO, minimum engagement shall be at least 5 hours per week and it will be evaluated continuously as specified for the courses. A special course on 'Hindi' may be offered to foreign / non-Hindi speaking students under proficiency;
<b>Minor-project/Practical Work/Case Studies</b>	
(3)	A UG curriculum may contain a 2-credit course on minor project/ practical work/ case studies as a departmental core course, which may be offered in any semester during the third and fourth years of the programmes to carry out a design and/or fabrication type of project or laboratory course.
<b>Practical/Field Training</b>	
(4)	Both UG and IDD curricula shall contain a 2-credit component of departmental core course on Industrial/Field Training for 8-weeks, generally carried out during the summer vacation following the spring semester of third year. It would be desirable for the students to undergo training outside the Institute. Every effort should be made by the students and the concerned department for arranging a summer internship outside IIT Roorkee. Under special circumstances, a student can undergo training in an Academic Department/Center within the Institute. The evaluation of this course will be carried out in the autumn semester of fourth year. The procedure for evaluation of practical/field training is given in Appendix-E1.
<b>Communication Skills</b>	
(5)	Both UG and IDD curricula shall contain a 2-credit component of departmental core course on Communication Skills generally offered in the third year of the programme. The courses shall be conducted in the form of Group Discussion and Presentation on contemporary issues of technological importance,
<b>Group Discussion and Viva Voce</b>	
(6)	All UG, IDD and IMD curricula shall contain a 2-credit course of Department core course in this category. The procedure for the conduct and evaluation of this course is given in Appendix-E2.

		<p><b>Self Study Course</b></p> <p>(7) One self study course may be offered under special circumstances from the list of regular courses of study, to a student in his/her final semester or thereafter. This course shall be offered only if approved by the Dean, Academic Studies on the recommendation of the Chairman, DAC/CAC with the provision that the course evaluation process will not be diluted. The guidelines for the allocation and evaluation of self-study course are given in Appendix-E3.</p> <p><b>Audit Course</b></p> <p>(8) A student of a UG/IDD/IMD programme may register to audit some courses within prescribed limits as advised by the Programme Advisor. The guidelines for the grant of audit course and award of grades are given in Appendix-E4.</p> <p><b>Major Project</b></p> <p>(9) Each UG programme shall contain a 8 credit major project as a component of the departmental core course, generally offered in the fourth year of the programme. The procedure for the conduct and evaluation of major project is given in Appendix-E5.</p> <p><b>Research Project</b></p> <p>(10) Each IDD programme shall contain a research project of 4 credits as a component of the Departmental / Centre's core course.</p> <p><b>Dissertation</b></p> <p>(11) Every student of five year IDD (B.Tech. &amp; M.Tech) and Integrated M.Tech. and Integrated M.Sc. programmes shall have to work on a Dissertation. The Dissertation topic shall be allotted to a student at the end of the Spring Semester examination of fourth year. The Dissertation work involves in-depth study and critical review of the topic and the creation of new knowledge in the area-either through development of new techniques, instruments, experimental facility and new experimental findings and/or theoretical and fundamental insight or by reinterpretation of the existing facts to propound a new theory. The procedure for the evaluation of Dissertation is given in Appendix-E6.</p> <p>(12) A student may be permitted to take upto 8 additional credits subject to a maximum of two courses in the 9th semester alongwith the dissertation, project and seminar.</p> <p><b>Discipline</b></p> <p>(13) Every student shall have to undertake 2 credits of discipline in each of the first 3 years of the programme, totaling to 6 credits, for the requirements of the B. Tech., B.Arch. Degree, IDD and IMD. The student shall be continuously evaluated for discipline during his/her entire period of enrolment. The grades earned by a student in discipline shall be accounted for as earned.</p>
<b>Grade Moderation Committee</b>	<b>25</b>	<p>(1) The DAC shall appoint a Grade Moderation Committee for all the Academic Courses under its purview. This committee shall be responsible for adherence to the guidelines for the award of grades and shall include all the concerned Course Coordinators. The Chairman, Grade Moderation Committee shall be responsible for the display of grades in the department and for forwarding the final grades to the Academic Section. The Chairman, Grade Moderation Committee shall also retain the record copies of the marks and the grades along with the statistical parameters for all the courses moderated and hand over a copy of the same to the Chairman, DAC. The general guidelines for the moderation of grades are given in Appendix-F.</p>



		<p>(3) For Project, Class Work Submissions, Mid-Term Examination etc., the Course Coordination Committee may report the matter to the concerned DAC (or CAC) as the case may be. The DAC (or CAC) may, after considering the matter reported to it and after giving an opportunity to the concerned student(s) to explain his/her conduct, impose appropriate penalty, including the award of Grade in the concerned course(s) on the concerned student(s).</p> <p>(4) Any case pertaining to purported to resorting to unfair means / plagiarism before and after the examination / class work submission / quizzes / submission of seminar reports / Dissertation / Practicals / Laboratory classes/ Projects, etc shall be dealt with by the appropriate committees/ persons of the concerned Department. In cases of serious nature / grave offence in the opinion of the appropriate departmental committees, viz. course coordination committees, DAC or CAC, the matter shall be referred to the Institute Standing Committee for dealing with the offence/case.</p> <p>The penalty in such cases of unfair means / plagiarism which have been found to be true and</p> <p>(i) which have occurred before or after the examination, or partly before and during or during and after the examination;</p> <p>(ii) which have been detected after the examination/declaration of the result/award of the degree;</p> <p>(iii) which has been reported or detected after a research paper report/note/communication has been published in a Research Journal widely circulated magazine/ Proceedings of conferences/ seminar or a monograph or a book, and or any electronic device shall be recommended by the appropriate committees of the department/institute Standing Committee, as the case may be. The imposition of any such penalty shall be at the discretion of the Director, who, after considering the full facts and the report on the matter (i) may impose the same penalty, (ii) may reduce the penalty, or (iii) may enhance the penalty as recommended by the committee.</p>
<p><b>Attendance, Absence, Leave and Withdrawals</b></p>	<p><b>28</b></p>	<p>(1) All the students of UG, IDD and IMD programme are expected to be present in every lecture, tutorial, practical or drawing class scheduled for them.</p> <p>(2) The students of UG/ IDD/ IMD must have a minimum attendance of 75% of the total number of classes including lectures, tutorials and practicals, held in a subject in order to be eligible to appear at the End-Term Examination for that subject.</p> <p>(3) A student should meet the above attendance requirement irrespective of the number of days, he/she is on medical and/or other leave for any reason whatsoever.</p> <p>(4) Attendance of the students shall be monitored and displayed during a semester as per the guidelines approved by the Academic Board. The guidelines for monitoring the attendance of the students are given in Appendix-H</p> <p>(5) The names of the students who have remained absent with or without leave, for more than 25% of the actual classes held in a course as specified in section 25(2) will be intimated by the Course Coordinator on the last teaching day, to the Chairman, Department Academic Committee/First Year Class Coordinator, who will consolidate the list for all such students for all the courses of a given yearly level of a programme and display it on the notice board of the Department/ Academic Section/ Centre. The list of such students shall also be forwarded to the Dean, Academic Studies.</p>

			These students shall not be allowed to appear in the end-term examination of that course and shall be awarded the grade 'F' irrespective of their performance in Class Work (CWS)/ Mid Term Examination (MTE) etc.
		(6)	If more than 50% students of a class are absent, it will be considered Mass Abstention and suitable disciplinary action will be taken against them. The guidelines for deduction of marks for Mass Abstention are given in Appendix-I.
<b>Second Examination on Medical/Extra Ordinary Grounds</b>	<b>29</b>	(1)	If a student is absent during End Term Examination of a course due to medical reasons or other special circumstances, he/she may apply for the award of 'I' grade to the Chairman DAC/CAC of the concerned department/ academic centre offering the course, through the Course Coordinator and Programme Advisor, provided that he/she has attended 75% of the classes held. The Chairman DAC/CAC may grant this request under intimation to the Academic Section. A second examination shall be held normally within one month of the last day of End Term Examination to convert 'I' grade to proper letter grade not exceeding B+.
		(2)	The application for second examination on medical grounds should be supported by a Medical Certificate of the Institute Medical Superintendent or in his/her absence by the Medical Officer of the Institute. If, however, a student is outside the campus at the time of illness or a mishap/accident, his/her application should be supported by a Medical Certificate issued by a Medical Officer of the rank of the Deputy Chief Medical Officer or above, of the concerned District. The Institute reserves the right to accept or reject such an application and the decision of the Dean, Academic Studies shall be final in this respect;
		(3)	In special cases and on the specific recommendation of the Institute Medical Superintendent, a student may be permitted to appear in his/her regular examination in the Institute Hospital;
		(4)	A student who fails to appear in the Mid-Term Examination due to sudden illness or mishap/accident and is supported by Medical Certificate as per subsection 26(2) above, may be allowed to take another examination with the permission of the concerned Chairman, DAC/CAC, as the case may be.
<b>Withdrawal from Course</b>	<b>30a</b>		A student who wants to withdraw from a course shall apply through the Chairman, DAC/CAC, to the Dean, Academic Studies, on a prescribed form within one week from the end of the first Mid Term Examination under the advice of his/her programme Advisor. If his/her request for withdrawal is granted, it will be recorded in the registration record of the student and the concerned Course Coordinator will be informed about it. The student will be awarded a withdrawal grade at the end of the semester.
<b>Semester Withdrawal</b>	<b>30b</b>		In case a student is unable to attend classes for more than four weeks in a semester, he/she may apply to the Dean, Academic Studies through Chairman DAC/DAC, for withdrawal from the semester, which shall mean withdrawal from all the registered courses in the semester. However, such application shall be made under the advice of the Programme Advisor, as early as possible and latest before the start of the End Term Examination. Partial withdrawal from the semester shall not be allowed.
<b>Semester Withdrawal on Medical Grounds</b>	<b>30c</b>	(i)	In case the period of absence on medical grounds is more than twenty working days during the semester, a student may apply for withdrawal from the semester, if he/she so desires. But, as per provisions of section 30(b) above such an application must be made to the Dean, Academic Studies through chairman DAC/DAC, under the advice of the Programme advisor, as early as possible and latest before the

			beginning of End Term Examination.
		(ii)	Any application on medical grounds shall be accompanied with a medical certificate from Institute Medical Officer. A certificate from a registered medical practitioner containing the registration number may also be accepted in those cases where a student is normally residing off-campus or becomes ill while away from the institute.
<b>Rustication/ Suspension, Withdrawal from a semester/ Year</b>	<b>30d</b>		A student rusticated from the Institute or suspended or debarred from attending the classes due to any reason whatsoever or having withdrawn from a semester/year on medical grounds, shall have to meet the requirement of 75% attendance in each course in a semester and shall have to complete the programme within its maximum time limit of six year for Four Year UG programmes and seven years for Five Year UG, IDD and IMD Programmes as specified in Regulations.
<b>Summer Term</b>	<b>31</b>	(1)	The student of first and second year UG, IDD and IMD Programmes who have registered but failed to clear Institute core courses in the previous semesters may be allowed to register themselves for such courses in the Summer term during summer vacation following first year and second year of the programme on payment of necessary fees on a specified date. The Summer Term is a compressed semester where all the regulation for the normal semester shall apply but the registration shall be limited to three courses having total credits not exceeding 14.
		(2)	The concerned department shall offer the required summer courses, as intimated by the Academic Section before the beginning of the summer term. A course will be offered in the summer semester provided a minimum of five students register for it. The schedule of lecture classes, tutorials, mid-term examinations, end-term examinations, etc. shall be notified by the Chairman, DAC before the commencement of the Summer Term.
<b>Academic Performance Monitoring</b>	<b>32</b>	(1)	<p>A student shall be put on academic probation by the Dean, Academic Studies, at the end of each semester for monitoring his/her academic progress under one or more of the following conditions:</p> <p>(a) His/her CGPA becomes 4.0 or less</p> <p>(b) His/her SGPA is below that of the last semester by two points or more</p> <p>(c) The earned credits in a semester are less than 15 or</p> <p>(d) The cumulative earned credits are less than 17 times the number of semester a student has registered except in the first semester.</p> <p>The Summer Term be not considered for counting the number of semesters for which a student has registered. The earned credits in the Summer Term will also be considered towards cumulative earned credits,</p> <p>The credits for NCC/NSS/NSO, proficiency and discipline shall not be counted for the purpose of (c) and (d) above.</p>
		(2)	The academic progress of all such students, who are put on academic probation, shall be monitored by a committee appointed for this purpose by the Chairman, DAC/CAC, of the concerned department/ academic centre.
<b>Termination of Enrolment</b>	<b>33</b>	(1)	<b>Due to Absence:</b> If a student registered in the first year of the programme is continuously absent from the classes for more than four weeks without informing the Course Coordinators, the Coordinator shall immediately bring it to the notice of First Year Class Coordinator / the Head of the concerned Department/ Centre as the case may be, for informing the Academic Section. The names of such students shall be

			removed from the institute rolls and such absence during first year will render the student ineligible for readmission.
		(2)	<b>On Academic Grounds</b>
		(a)	The enrolment of a student in a curriculum may be terminated if he/she fails to earn minimum number of credits specified at different yearly levels in the programme as given in Table-4 given in Appendix-J, notwithstanding the fact that the student has or has not been put under academic probation. Semester withdrawal will be excluded to determine the yearly level of a student for this purpose. This condition will also not be applicable if a student is not allowed to register for the courses of current year in accordance with 18(2). The communication regarding termination of enrolment shall be issued by the Academic Section within fifteen days from the date of declaration of results.
		(b)	The enrolment of a student may be terminated on disciplinary grounds, in accordance with the Standing Orders for the students.
		(c)	A student whose enrolment has been terminated may appeal to the Director for reconsideration within fifteen days from the date of issuance of the communication of termination and the appeal will be disposed off within fifteen days. If the appeal is allowed, his/her registration and enrolment shall be restored.
		(d)	A Student who does not complete the subject registration within the stipulated period be issued a show cause notice immediately after the last date for subject registration is over as to why his name be not struck off the rolls of the Institute and the name struck off within a period of one week if the reply is not found satisfactory.
<b>Earned Minimum Credits and Minimum CGPA for the Degree</b>	<b>34</b>	(1)	The credits for the courses in which a student has obtained 'D' (minimum passing grade for a course) grade or higher shall be counted as Credit earned by him/her. A student who has a minimum CGPA of 5.0 and earned a minimum number of credits as specified in the UG/IDD/Integrated Master's Degree curriculum he/she is registered for, is eligible for the award of the respective degree.
		(2)	A student, who has earned the minimum credits required for a degree but fails to obtain the minimum specified CGPA for this purpose, shall take additional courses till the minimum CGPA is attained within the maximum time limit for different programmes.
<b>Transfer of Credits from any other Institute for award of degree</b>	<b>35</b>	(1)	Transfer of credits earned by the students from reputed institutions known for high academic standards in India and abroad, which have an MOU with the Institute concerning this aspect, be permitted.
		(2)	The students of IIT Roorkee, who have been nominated/recommended by the Chairman, DAC, and approved by Dean, Academic Studies for pursuing study in such other institutions, will only be eligible for such transfer of credits.
		(3)	The subject wise study programme for each student and equivalence for transfer of credits based on the syllabi of the course of the host Institution to the Institute will be recommended by the Chairman, DAC on case to case basis, and be approved by the Dean, Academic Studies.
		(4)	The credits earned in other institute will be transferred for award of degree.
		(5)	The maximum permissible limit for transfer of credits will be 24.
		(6)	The subjects and grades earned will be indicated in the consolidate grade sheet/

			transcripts with the remark that the grades have been awarded by the host institution.
		(7)	Credits earned and grades will not be considered towards calculation of SGPA/CGPA.
		(8)	Grades earned in host institutions will not be considered for any award/prize at the Institute.
<b>Scholarships, Prizes and Certificates</b>	<b>36</b>	(1)	The institute shall award the merit-cum-means (MCM) scholarships, Institute free studentship, SC/ST category institute scholarship and other scholarships, stipends, awards and prizes to the students of UG, IDD and IMD programmes as may be approved by the Senate. Other scholarships may be instituted by grant from individuals, trusts, organizations and the Governments with a view to provide financial assistance to needy students under the terms and conditions specified by the Institute. Announcements on these scholarships, stipends, etc. stating eligibility and the value of scholarships, stipends, etc. shall be made by the Institute while inviting applications from time to time.
		(2)	A student registered for the fifth year of the IDD programme and who has cleared all the coursework requirements upto fourth year of the programme and (i) has a CGPA not less than 8.0, or (ii) has qualified GATE, may be offered MHRD scholarship/ assistantship on the basis of his/her attendance in the courses registered in a semester and his/her fulfilling the requirement of weekly work hours assigned to him/her. Sixty percent (60%) of the amount of scholarship/assistantship shall be paid on the basis of monthly attendance of a student and the rest forty percent (40%) on the basis of weekly work hours assigned to a student. The deduction from the scholarship/ assistantship due to absence in class or non-fulfillment of the weekly work-hours assignment shall be made on pro-rata basis. If the marks obtained in the portion of the dissertation carried out by a student in the Autumn Semester of fifth year of the programme are less than 35%, the student shall cease to get scholarship/ assistantship in the next semester. Announcements on these scholarships/ assistantship stating eligibility and the number and value of scholarships/ assistantship etc. shall be made while inviting applications from time to time;
		(3)	A student may draw scholarships or stipends from outside sources only if permitted by the Dean, Academic Studies.
		(4)	Those students, who have been punished for unfairmeans, plagiarism during Mid-term Examination (MTE) or End-Term Examination (ETE) or in Seminars/Project/ Dissertation, etc. or for serious act of indiscipline shall not, be not awarded Merit-cum-Means Scholarship, Fellowship / Assistantship / and other trust scholarship for Medals, Prizes and awards for that academic session only. Grade 'C' or below in discipline will be treated a serious act of indiscipline.
		(5)	The criteria for award of MCM scholarships, medals and awards are given in Appendix-K.
<b>Leave for Assistantship Holders Under IDD Programme</b>	<b>37</b>	(1)	Subject to his/her fulfilling the attendance requirements as detailed in Regulation 30 above, a student of IDD programme who is a recipient of the Institute assistantship will be entitled for 30 days leave (including leave on medical grounds) during fifth year of the programme. He/She will not be entitled to mid-semester breaks, and summer and winter vacations;
		(2)	The leave will be subject to approval of the concerned Head of the Department/ Academic Centre/Programme Coordinator;
		(3)	The Department/Academic Centre /Programme Coordinator concerned shall maintain a proper leave account of each student;

<b>Casual Student</b>	<b>38</b>	<p>A student registered for degree in a recognized Institute/University in India or abroad may be allowed to attend classes and laboratories as a Casual Student, if sponsored officially by the institute/ University where he/she is studying. However, the maximum period for which a casual student will be allowed to avail the facility, shall not exceed six months. The guidelines for Casual Students are defined in Appendix-L.</p> <p>International students are also allowed to be admitted for short duration in a course. The guidelines for admission of such International students are given in Appendix-M.</p>
<b>Training of Outside Students</b>	<b>39</b>	<p>Outside students (students from other engineering colleges) can take Summer Training at the institute. The guidelines for training of outside students are given in Appendix-N.</p>
<b>Interpretation of Regulations</b>	<b>40</b>	<p>In case of any dispute, difference of opinion in interpretation of these regulations or any other matter not covered in these regulations, the decision of the Chairman, Senate shall be final and binding.</p>
<b>Emergent Cases</b>	<b>41</b>	<p>Notwithstanding anything contained in the above regulations, the Chairman of the Senate may, in emergent situations, take such action including insertion, suspension or modification of any regulation(s) on behalf of the Senate as he deems appropriate and report it to the next meeting of the Senate for its approval.</p>

**Table - 1 (a): UG PROGRAMMES LEADING TO BACHELOR'S DEGREE**

Sl.No.	Branch	Degree
1.	Architecture	B. Arch.
2.	Bio Technology	B.Tech. (Bio Technology)
3.	Chemical Engineering	B. Tech. (Chemical Engineering)
4.	Civil Engineering	B. Tech. (Civil Engineering)
5.	Computer Science & Engineering	B. Tech. (Computer Science & Engineering)
6.	Electrical Engineering	B. Tech. (Electrical Engineering)
7.	Electronics & Communication Engg.	B. Tech.(Electronics & Communication Engg.)
8.	Mechanical Engineering	B. Tech.(Mechanical Engineering)
9.	Metallurgical & Materials Engg.	B. Tech. (Metallurgical & Materials Engg.)
10.	Production & Industrial Engineering	B. Tech. (Production & Industrial Engg)
11.	Pulp & Paper Technology	B. Tech. (Pulp & Paper Technology)

**Table - 1 (b): FIVE YEAR INTEGRATED DUAL-DEGREE  
(B. TECH. AND M. TECH./M.B.A.) PROGRAMMES**

S.No.	Department	B. Tech. (Parent Discipline)	M.Tech. (Specialization of the Parent Discipline)
1.	Chemical Engg.	Chemical Engg.	Hydrocarbon Engineering
2.	Electronics & Computer Engg.	Computer Science & Engg.	Information Technology
3.	Electronics & Computer Engg.	Electronics & Communication Engg.	Wireless Communication
4.	Electrical Engg.	Electrical Engineering	Power Electronics
5.	Pulp and Paper Technology	Process Engineering	M.B.A.

**Table - 1 (c): FIVE YEAR INTEGRATED M.TECH. PROGRAMMES**

Sl.No.	Department	Integrated M. Tech. Programmes
1.	Earth Science	Integrated M.Tech (Geophysical Technology)
2.	Earth Science	Integrated M.Tech (Geological Technology)
3.	Pulp and Paper Technology	Integrated M.Tech (Polymer Science & Technology)

**Table - 1 (d): FIVE YEAR INTEGRATED M.Sc. PROGRAMMES**

Sl.No.	Department	Integrated M.Sc. Programmes
1.	Physics	Integrated M.Sc. (Physics)
2.	Chemistry	Integrated M.Sc. (Chemistry)
3.	Mathematics	Integrated M.Sc. (Applied Mathematics)

**Table - 2 (a): STRUCTURE OF UNDERGRADUATE PROGRAMMES**

<b>CURRICULAR COMPONENTS</b>	<b>Credits (B.Tech.)</b>
<b>(a) Institute Core (IC) Courses</b>	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	21
III. General Sciences (GSC)	06
IV. Engineering Sciences (ESC)	28
<b>Total</b>	<b>65</b>
<b>(b) Departmental Core Courses (DCC)</b>	
I. Class Contact Core courses	62-65
II. Communication skills	02
III. Major Project	08
IV. Minor Project/ Practical Work/ Case Studies	02
V. Practical/Field Training	02
<b>Total</b>	<b>76-79</b>
<b>(d) Departmental Elective Courses (DEC)</b>	15-18
<b>(e) Institute Elective Courses (IEC)</b>	20-24
<b>(f) Extra-Curricular Activities (ECA)</b>	
I. Discipline (2 Credits/year for 3 years)	06
II. NCC/NSS/NSO (First Year)	02
III. NSO/Proficiency (Second year to Fourth year)	03
<b>Total</b>	<b>11</b>
<b>Grand Total</b>	<b>187-193</b>

**Table - 2 (b) : STRUCTURE OF FIVE YEAR INTEGRATED DUAL DEGREE (IDD)  
(B.TECH. & M. TECH.) PROGRAMMES**

<b>CURRICULAR COMPONENTS</b>	<b>Credits</b>
<b>(a) Institute Core (IC) Courses</b>	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	21
III. General Sciences (GSC)	06
IV. Engineering Sciences (ESC)	28
<b>Total</b>	<b>65</b>
<b>(b) Departmental Core Courses (DCC)</b>	
I. Class Contact Core Courses including Modeling and Simulation	62-65
II. Communication skills	02
III. Practical/Field Training	02
<b>Total</b>	<b>66-69</b>
<b>(c) Departmental Elective Courses (DEC)</b>	12
<b>(d) Institute Elective Courses (IEC)</b>	17-23
<b>(e) M.Tech. Specialization Courses (MSC)</b>	18-21
<b>(f) Research Project (RP)</b>	04
<b>(g) Seminar (SEM)</b>	02
<b>(h) Dissertation (DIS)</b>	20-24
<b>(f) Extra-Curricular Activities (ECA)</b>	
I. Discipline (2 Credits/year for 3 years)	06
II. NCC/NSS/NSO (First Year)	02
III. NSO/Proficiency (Second year to Fourth year)	03
<b>Total</b>	<b>11</b>
<b>Grand Total</b>	<b>213-219</b>

**Table - 2 (c) : STRUCTURE OF FIVE YEAR INTEGRATED DUAL DEGREE (IDD)  
(B.TECH. & M. B.A.) PROGRAMMES**

<b>CURRICULAR COMPONENTS</b>	<b>Credits</b>
<b>(a) Institute Core (IC) Courses</b>	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	21
III. General Sciences (GSC)	06
IV. Engineering Sciences (ESC)	28
<b>Total</b>	<b>65</b>
<b>(b) Departmental Core Courses (DCC)</b>	
I. Class Contact Core Courses	60-63
II. Modeling, Simulation and Computer Application	03
III. Communication skills	02
IV. Major Project	04
V. Practical/Field Training	02
<b>Total</b>	<b>73-76</b>
<b>(c) Departmental Elective Courses (DEC)</b>	<b>6-9</b>
<b>(d) Management Core Courses (MCC) (including projects and presentation)</b>	<b>26-29</b>
<b>(e) Management Elective Courses (MEC) in specialization groups</b>	<b>12-15</b>
<b>(f) Institute Elective Courses (IEC)</b>	<b>24-30</b>
<b>(g) Extra-Curricular Activities (ECA)</b>	
I. Discipline (2 Credits/year for 3 years)	06
II. NCC/NSS/NSO (First Year)	02
III. NSO/Proficiency (Second year to Fourth year)	03
<b>Total</b>	<b>11</b>
<b>Grand Total</b>	<b>215-225</b>

**Table - 2 (d) : STRUCTURE OF FIVE YEAR INTEGRATED M.TECH. & M.SC. PROGRAMMES**

<b>CURRICULAR COMPONENTS</b>	<b>Credits</b>
<b>(a) Institute Core (IC) Courses</b>	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	50-51
III. General Sciences (GSC)	06
IV. Engineering Sciences (ESC)	24
<b>Total</b>	<b>90-91</b>
<b>(b) Departmental Core Courses (DCC) (including Group Discussion &amp; Viva)</b>	<b>62-65</b>
<b>(c) Departmental Elective Courses (DEC)</b>	<b>20-22</b>
<b>(d) Institute Elective Courses (IEC)</b>	<b>9-12</b>
<b>(e) Seminar (SEM)</b>	<b>04</b>
<b>(f) Project (RP)</b>	<b>04-06</b>
<b>(g) Dissertation (DIS)</b>	<b>12-16</b>
<b>Total</b>	<b>66-69</b>
<b>(h) Extra-Curricular Activities (ECA)</b>	
I. Discipline (2 Credits/year for 3 years)	06
II. NCC/NSS/NSO (First Year)	02
III. NSO/Proficiency (Second year to Fifth year)	04
<b>Total</b>	<b>12</b>
<b>Grand Total</b>	<b>215-228</b>

\*Each Engineering, Science and Humanities and Social Sciences Department shall offer at least one institute elective in each semester under ESEC, BGSEC and HSSMEC respectively, and the departments shall specify as to whether the students of a given branch have done an equivalent course and therefore, are not allowed to register for that institute elective.

**Table - 3: STRUCTURE OF GRADING OF ACADEMIC PERFORMANCE**

Academic Performance	Grades	Grade Points
Outstanding	A+	10
Excellent	A	9
Very Good	B+	8
Good	B	7
Average	C+	6
Below Average	C	5
Marginal	D	4
Poor	F	0
Pass in Audit Courses	AP	-
Fail in Audit Courses	AF	-
Incomplete	I	-
Continued Project	X	-
Satisfactory	S	-
Unsatisfactory	U	-

**Explanation :****'F' Grade**

The 'F' grades denote poor performance, i.e. failing a course. 'F' grade is also awarded in case of poor attendance (see Attendance Rules).

For the other (elective) courses in which 'F' grade has been awarded, the student may take the same course or any other course from the same category. Further, 'F' grade secured in any course stays permanently on the grade card. The weight, of 'F' grade is not counted in the calculation of the CGPA, however, it is counted in the calculation of the SGPA.

In case a student is awarded a failing grade in the major project, he/she shall have to repeat the course in the form of a new project. Such a student will have to work full time on the project for a minimum period of three months and maximum 'B' grade can be awarded to the student.

**AP/AF Grades**

These grades are awarded to an audit course as specified in section 30 above. These grades are not counted in the computation of SGPA/CGPA.

**'I' Grade**

This refers to an 'incomplete' grade, which is required to be converted into a regular letter grade as provided in section 29(1) of Regulations for the UG, IDD, and IMD programmes. The guidelines for the award of 'I' grade are given in Appendix-B3.

**'X' Grade**

This grade is awarded for incomplete Project/ Dissertation work as per guidelines given in Appendix - B4 and will be converted to a regular grade on the completion of the Project work and its evaluation.

**Calculation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)**

$$(i) \quad S.G.P.A. = \frac{\sum_{i=1}^n C_i \times p_i}{\sum_{i=1}^n C_i}$$

where,

$C_i$  = Number of credits of the  $i^{th}$  course of a semester for which SGPA is to be calculated

$P_i$  = Grade point obtained in  $i^{th}$  course.

$i$  = 1,..... n, represent the number of courses in which a student is registered in the concerned semester.

$$(ii) \quad C.G.P.A. = \frac{\sum_{i=1}^m C_i \times p_i}{\sum_{i=1}^m C_i}$$

where,

$C_i$  = Number of credits of the  $i^{th}$  course, upto the semester for which CGPA is to be calculated

$P_i$  = Grade point earned in  $i^{th}$  course. A grade lower than 'D' (i.e. grade point < 4) in a course shall not be taken into account.

i = 1,..... m; represent the number of courses in which a student was registered and obtained a grade not lower than 'D' upto the semester for which CGPA is to be calculated.

### General Guidelines for the Award of Grades

The following are the general guidelines for the award of grades:

- (i) All evaluations of different components of a course shall be done in marks for each student.
- (ii) The marks of various components shall be reduced to approved weights (as decided by the DFB/CFB) and / or indicated in the scheme of Teaching and Examination and added to get total marks secured on a 100-points scale. The rounding off shall be done only once and on the higher side.
- (iii) For less than 30 students in a course, the grades shall be awarded on the basis of natural cut-off in the absolute marks (Appendix B1).
- (iv) For 30 or more than 30 students in a course, the statistical method shall be used for the award of grades with or without marginal adjustment for natural cut-off. The salient features of statistical method are given in Appendix-B2.
- (v) The overall distribution of different grades shall be as indicated in the statistical distribution to the extent possible. (Appendix B2)
- (vi) A+ (A Plus) grade shall not be awarded for percentage of marks less than 80 under any circumstance. There will not be more than 10% (rounded off to near integer value) A+ grade.
- (vii) D grade shall not be awarded for percentage of marks less than 35 in any case. Still further, no student having 35% or more marks would be awarded failing grade F.
- (viii) The overall distribution of different grades shall be as indicated in the statistical distribution to the extent possible. (Appendix-B1).
- (ix) The provisional grades shall be awarded by the Coordination Committee of the course consisting of all the teachers involved in that course. The Course Coordinator shall have full responsibility for this purpose.
- (x) The grades so awarded shall be moderated by a Grade Moderation Committee of a Department/ Academic Centre. This committee will finalize the grades and display a copy of the grades awarded on the Notice Board of the Department/ Centre. The grades should be finalized and displayed as per the academic calendar. All the final grades shall be communicated to the Academic Section within seven days from the last date of the End Term Examination. The Chairman, Grade Moderation Committee shall retain the records of all the marks and grades and shall send one copy of all records to the Chairman, DAC.
- (xi) For a student to get passing grade, he/she will have to appear in End-Term Examination.
- (xii) The procedures for evaluation and award of grades for project, training, seminar, group discussion, and comprehensive viva-voce shall be as given in the Appendix E1-E5 of Regulations for the UG, IDD, and IMD programmes.
- (xiv) For Dissertation, each student will be evaluated individually and the grades shall be awarded on the basis of absolute marks (Appendix B-1). The Dissertation shall be presented before a Examination Board for evaluation, as per procedure given in Appendix -E6

### APPENDIX - B1

#### Award of Grades Based on Absolute Marks System

The award of grades based on absolute marks out of 100 shall be made as follows:

Marks		Grades		Marks
91	<	A+	<	100
82	<	A	<	90
73	<	B+	<	81
64	<	B	<	72
55	<	C+	<	63
46	<	C	<	54
35	<	D	<	45

**Note:**

- (1) The grade boundaries as indicated above may be marginally adjusted.
- (2) The upper and lower limits are subject to limitations of percentage of marks.

### Statistical Method for the Award of Grades

For the award of grades in a course, all component-wise evaluation shall be done in marks. The marks of different components viz., Mid-Term Examinations (MTE), End-Term Examination (ETE), Course Work Sessionals (CWS), and Practical Sessionals (PRS) would be reduced to relative weights of each component as approved by the Senate and added. Marks so obtained shall be out of 100 and the same would be converted to, grades following the guidelines given below:

For 30 or more number of students in a course, the statistical method shall invariably be used, with marginal adjustment for natural cut-off. The mean ( $\bar{X}$ ) and the standard deviation of marks obtained of all the students in a course shall be calculated and the grades shall be awarded to a student depending upon the marks and the mean and the standard deviation as per Table given below.

**Awards of Grades Using Statistical Method**

Lower Range of Marks	Grade	Upper Range of Marks
	<b>A+</b>	$> \bar{X} + 1.5 \sigma$
$\bar{X} + 1.0 \sigma <$	<b>A</b>	$\leq \bar{X} + 1.5 \sigma$
$\bar{X} + 0.5 \sigma <$	<b>B+</b>	$\leq \bar{X} + 1.0 \sigma$
$\bar{X} <$	<b>B</b>	$\leq \bar{X} + 0.5 \sigma$
$\bar{X} - 0.5 \sigma <$	<b>C+</b>	$\leq \bar{X}$
$\bar{X} - 1.0 \sigma <$	<b>C</b>	$\leq \bar{X} - 0.5 \sigma$
$\bar{X} - 1.5 \sigma <$	<b>D</b>	$\leq \bar{X} - 1.0 \sigma$
	<b>F</b>	$\leq \bar{X} - 1.5 \sigma$

### Award of 'I' Grade

- If a student is absent during End-Term Examination/ Mid-Term Examination of a course due to medical reasons or other special circumstances, he/she may apply for the award of 'I' grade to the Chairman, DAC through the Course Coordinator and the Program Coordinator, provided that he/she has attended 75% of the classes held. The concerned Course Coordinator shall have to be convinced about the extraordinary circumstances and shall have to certify the attendance record before this rarely used option to award 'I' grade is recommended. The Chairman DAC may award 'I' grade.
- The 'I' grade so awarded shall be notified by the Department/Centre to which the student belongs and a copy of the notification will be endorsed to the Academic Section and to the concerned Course Coordinator (e.g., the notification for 'I' grade of a Chemical Engineering student will be, notified by the Department of Chemical Engineering on the recommendation of the concerned Course Coordinator, even if the course pertains to another Department/Academic Centre).
- The 'I' grade shall be converted into a proper letter grade not exceeding 'B' and shall be sent to the Academic Section within one month from the date on which the End-Term Examination is over and the requirements of the course are completed by the student.
- In extraordinary circumstances, the period of conversion of 'I' grade may be extended to the next semester, with the approval of the Dean, Academic Studies on his own or on the recommendation of the Course Coordinator and the Head of the Department /Centre to which the student belongs.
- In extra-ordinary circumstances, on the recommendation of the Dean, Academic Studies, the Director may order the award of 'I' grade to a student/class or a batch of students taking a particular course. The conversion of 'I' grade into a regular grade or any other action shall be as per the directive of the Director.

### Award of 'X' Grade

A student who is unable to complete his/her Project/Dissertation before the last date of submission may be awarded an 'X' grade on the recommendation of an Evaluation Committee consisting of (i) The nominee of the Head of the Department/Academic Centre for each specialization, who shall be the Chairman (ii) Nominee of the DAC; and (iii) The Supervisor(s) of the Project/Dissertation. The student concerned shall have to present his/her work to the Evaluation Committee for the Project/Dissertation, before the date of registration to the next semester.

A student who has been awarded an 'X' grade shall be required to formally register for the next Semester and pay the requisite fees. A student may be awarded 'X' grade only once.

'X' grade will be awarded in exceptional circumstances beyond student's/supervisor's control. Normally, the following grounds may be considered for the award of 'X' grade:

- (a) Medical grounds to the satisfaction of the Institute Medical Officer and the approval of the Dean, Academic Studies.
- (b) Technical reasons/grounds such as the Supervisor/ equipment not being available.

## **APPENDIX – E1**

### **Procedure for Evaluation of Practical/Field Training**

- (a) Every student will submit a written report to the Department/Centre on the work carried out during the training period along with a certificate from the organization where training was done.
- (b) A time slot of 2 hour/week/batch will be assigned in the student time table and the students will be asked to present their work in the form of a seminar of about 30-minute duration, before a committee appointed by the DFB and other students of that batch.
- (c) The performance of the students will be evaluated by the committee in marks on the basis of (i) the training report, (ii) presentation, (iii) viva-voce.
- (d) Although normal attendance will not apply to this course component, 10-20% marks will be awarded on the basis of attendance in seminars to encourage participation of the entire class.
- (e) The grades will be computed on the basis of the established procedure as for other courses.
- (f) The grade moderation committee for the course will be the same as that for the other courses of the class.
- (g) If a student is awarded a failing grade in this course, he shall have to repeat the course by undergoing 8-week training either at the Institute or at an organization outside the Institute during the summer vacation following the eighth semester.

## **APPENDIX – E2**

### **Procedure for Conduct and Evaluation of Group Discussion and Viva-voce**

- (a) The entire class will be divided into batches of 30-40 students each and a two-member committee will be appointed for each batch by the DFB. One of the members of the committee(s) will be appointed as the Course Coordinator.
- (b) A time slot of 2 hours/week/batch will be allotted for this course in the time table.
- (c) The committee will form groups of 5-6 students each and give topics of contemporary technological and social relevance for discussion. The duration of one such session may be 20-30 minutes for a group, including interaction of the group with the audience. In this way about 3 to 4 groups can be accommodated in each time slot of 2 hours.
- (d) Sometimes the topics can be given on the spot and sometimes these can be given one week in advance.
- (e) The performance of each student will be judged based upon (i) content, (ii) fluency of presentation, (iii) leadership qualities, and (iv) summarizing ability.
- (f) The committee will award marks to various students for each discussion.
- (g) Though normal attendance regulations will not apply, 10-20% marks will be awarded on the basis of attendance to encourage participation by the students.
- (h) The grades will be computed in accordance with the established procedure.
- (i) If a student is awarded a failing grade, he shall have to repeat the course when it is offered by the Department /Centre the next time.

## **APPENDIX – E3**

### **Guidelines for Allocation and Evaluation of Self-Study Course**

- (a) A student cannot claim to take a course as a self-study course as a matter of right.
- (b) The course can only be offered to a student in his/ her final semester when he/she is likely to fall short by a maximum of 6 earned credits to become eligible for the award of degree.

- (c) Only a course from the list of regular courses of study for the programme, which the student has not cleared and which is not being offered in that semester as a regular course, can be given as a self-study course. However, Group Discussion and viva voce cannot be taken as a self study course.
- (d) The duration of the course will be a full semester.
- (e) The student will apply to Dean, Academic Studies through his programme advisor and the concerned Chairman DAC well before the date of registration. The course will be offered only if Dean, Academic Studies approves it.
- (f) If the course is approved by Dean, Academic Studies, the Head of the concerned department will appoint a course coordinator in consultation with Chairman, DAC. A teaching load of 1 hour/week will be counted in the time-table of the coordinator.
- (g) No formal lectures will be held in the course but laboratory, design, and tutorial exercises will be conducted if they form an integral part of the course. The course coordinator will assign tutorial problems / laboratory exercises to the student and monitor his/her progress weekly.
- (h) The mid-term and end-term examinations for the course will be scheduled by the department like in other courses and the course coordinator will be responsible for the conduct of these examinations.
- (i) For the award of marks, various components, e.g., lecture, tutorial, and practical, will be given the same weight as specified in the curricular structure.
- (j) The final grade will be awarded on the basis of Absolute Grading System and will not exceed 'B' in any case.
- (k) The grade moderation committee for the course will be the same as for other courses of the class.
- (l) Normal attendance regulations will not apply to this course.
- (m) A fee of Rs.1500.00 per credit shall be charged from a student who registers for a self study course in summer term.

## APPENDIX – E4

### Guidelines for the Grant and Award of Audit Course

- a) A student can register to audit a maximum of 8 credits from amongst the Institute or /and Departmental electives, out of the minimum requirement of earned credits specified for a given academic curriculum, on the advice of the Programme Advisor. However, the student cannot register to audit the Institute core courses or the Departmental Core courses pertaining to his programme.
- b) All such requests will be made at the time of registration and shall be so noted in the registration card.
- c) The normal registration in course may also be converted to audit registration and vice versa, provided that the request is made by the student to Chairman DAC/CAC within one week from the end of the first mid-term examination. The Chairman DAC/CAC may grant the approval and inform the Assistant Register (Academic) who will record it in the registration record of the student.
- d) A student may also register to audit additional courses, over and above the minimum earned credits specified for a programme, from amongst the courses of any UG/IDD/IMD academic curriculum of the institute. Such a request will be granted from the fifth semester onwards, provided that (i) the student has a CGPA > 7.0 and (ii) the total number of registered credits, including the audit registration, are within the credit limits prescribed in clause 17(7) of UG regulations.
- e) The evaluation of a student, who has registered for the audit course, will be carried out in the same way as for other students registered in the course and his grade will be computed along with other students in the class. However, his/her grade will be recorded in the grade sheet as an 'AP' (Audit Pass) grade if he/she obtains a 'D' or higher grade and 'AF' (Audit Fail) grade if he obtains 'E' or 'F' grade.
- f) Normal attendance regulations, as Prescribed by the Institute from time to time, will apply to audit courses. If the attendance of a student, who has registered for audit course is less than the Prescribed limit, *he/she* will not be eligible to appear in the end-term examination and will be awarded an 'AF' grade.
- g) In case a student has registered for a audit course out of the minimum earned credits prescribed for the degree and is awarded an 'AF' grade, he can either repeat the course when it is offered the next time or choose to register in another institute or Departmental Elective, as the case may be.

## APPENDIX – E5

### Procedure for Conduct and Evaluation of Major Project

- (a) This course will be offered in the final year of the B. Tech. / B.Arch. programme and its total duration will be two semesters.

- (b) Head of the Department shall appoint an O.C. Project on the advice of DFB from amongst the members of the DAC/CAC, who will act as the course coordinator.
- (c) The major project can be carried out by the students either individually or in a group. However, the number of students in a group will not exceed four.
- (d) The O.C. Project will invite proposals from the faculty members and students and finalize the project problems allotted to various groups by August 31, in the 7<sup>th</sup> semester.
- (e) An L-T-P loading of 0-0-3 and 0-0-8 will be shown in the time table of students in the seventh and eighth semesters respectively, and the students would be required to work on their projects during these periods. However, no teacher will be assigned for these periods and the progress of students will be monitored by their respective supervisors.
- (f) The evaluation will be based upon mid-term examinations and a final examination. A weight of 40% will be assigned to mid-term examination and 60% to final examination.
- (g) At least one mid-term examination will be held in each of the VII and VIII semesters. The mid-term examinations will involve report submission, presentation and oral viva-voce. For this purpose, suitable committees will be appointed by the Head of the Department in consultation with O.C. Project. The various examination committees will award marks to individual students and forward them to the O.C. Project, who will maintain a record.
- (h) The final project examination will be held in the 8<sup>th</sup> semester, within 10 days from the last theory paper. For this purpose, suitable examination committees will be appointed by the Head of the Department, in consultation with O.C. Project, with at least one external examiner. In case an examiner from outside the Institute is not available, a faculty member of the Institute from outside the Department/Centre may be appointed as an external examiner after taking his/her consents.
- (i) The students will be required to submit a final project report to O.C. Project, at least 3 days before the date of final project examination.
- (j) The final examination may be in the form of demonstration in the laboratory and viva-voce or only viva-voce, depending upon the nature of the project.
- (k) The examination committee will award marks to individual students and forward them to O.C. Project, who will compute grades in accordance with the prescribed procedures.
- (l) The Grade Moderation Committee for the course will be the same as that for other courses of the class.
- (m) In case a student is awarded a failing grade in the major project, he shall have to repeat the course in the form of a new project. Such a student will have to work full time on the project for a minimum period of 4 months.
- (n) In special circumstances, a student may be awarded 'X' grade, the conditions for which are given in Appendix-B4.
- (o) Normal attendance regulations will not apply to this course.

## APPENDIX - E6

### Procedure for the evaluation of M.Tech. Dissertation

- (a) The mid term as well as final evaluation of dissertation will be done by an examination board consisting of all the members of the concerned academic area/group. The external examiner may be invited, if available. In case such academic groups do not exist in the department, a board of 3 to 4 members belonging to the broad academic area may be constituted, including the supervisor for each student. This examination board will carry out mid-term and final evaluation of each student. Chairman of these boards should be common for at least 5 students so that uniformity in evaluation is possible.
- (b) The student will be evaluated for mid term evaluation in the month of December before the closing of autumn semester and this part of evaluation will carry 25% weight. Student will be assessed on the basis of work done.
- (c) The student would submit his/her dissertation in spiral bound form on April 30 and viva-voce examination will be held before mid May and this part of evaluation will have a weight 50%. The student will note the observations of the examination board and will submit the final dissertation report incorporating all suggestions by June 30 in hard bound form.
- (d) During the period between viva-voce examination and June 30, the student will also write a research paper and communicate the same for publication if not done earlier. In some cases, it may be possible to get the review report on the research paper. A certificate to this effect will be submitted by the student while submitting the final copy of dissertation .
- (e) The examination board will award remaining marks (25% weightage) to all the students of the same academic group and thereafter the grades will be awarded. This work will be done after the final submission of dissertation, i.e. June 30, and will be completed by July 10.

**GUIDELINES FOR MODERATION OF GRADES**

- (a) The date of moderation should be made a part of Academic Calendar.
- (b) Two tier moderation be done, both for the subject and for the Semester (SGPA,CGPA). Minor adjustment should be possible during moderation, particularly in the marginal cases . Chairman, DAC/CAC should invariably retain a copy of the grades sent to Academic Section so that CGPAs may be calculated without having to make a reference to the Academic Section for this purpose.
- (c) All concerned faculty members should invariably be present for the moderation committee meeting. In case any body is going out on institute duty, he / she will hand over his / her inputs for moderation with a colleague, who should present it, in the meeting.

**INSTRUCTION FOR PENALTY FOR USE OF UNFAIR MEANS**

1. The main instructions for the conduct of a student in the examination hall shall be printed on the cover page of the answer book. Any contravention of these instructions and the use of any unfair means will render the student liable for punishment.
2. As soon as a student is suspected by the invigilator or any other authorized person of having resorted to unfair means, his/her answer-book shall be seized. The paper etc. duly signed by the invigilator found in possession of the student shall be attached with the answer-book in his/her presence. The student shall then be asked to complete part II of the prescribed form and sign it. This form shall then be endorsed by the Invigilator.
3. After completing all the above formalities, a fresh answer - book shall be given to the student for completing the examination.
4. After a particular examination is over, these answer-books (duly marked I, II) shall be sent or delivered, separately to the Registrar / Assistant Registrar (Academic) together with the report form duly completed in all respects.
5. A committee appointed by the Director shall enquire into cases of attempt at unfair means in the examination. It shall submit its recommendations after laying down clearly the nature of the offence listed below at 7. to the Director for consideration and necessary orders.
6. A student whose guilt is established shall be dealt with under the provisions of the disciplinary regulations.
7. The following action may be taken for different categories of offences under these regulations:

**(A) NATURE OF OFFENCE**

- (a) A student found talking to another student during the examination hours.
- (b) If during the examination hours i.e. after receipt of the question paper and before handing over the answer-book, a student is found to be talking to a person outside the examination-hall while going to the urinal etc.
- (c) Changing seat in the examination- hall without permission.

**ACTION TO BE TAKEN:** The first answer-book to be withdrawn and cancelled and the second answer-book to be provided and evaluated.

**(B) NATURE OF OFFENCE**

- (a) Attempt to influence the examiner by an appeal in the answer-book.
- (b) Writing either the questions set in the paper or solutions there of on paper/electronic gadgets etc. during the examination.
- (c) Possession of cell phone or any other item of such type of communication in examination hall.

**ACTION TO BE TAKEN :** The examination of the concerned paper to be cancelled and 'F' grade to be awarded.

**(C) NATURE OF OFFENCE:**

To be found in possession of any written or cyclostyled notes or any printed materials or notes written on any part of the body/clothing or instruments such as set square, electronic gadgets etc. or having notes written on chair, table, desk or drawing board during the examination.

**ACTION TO BE TAKEN:** All the examinations for that semester to be cancelled and 'F' grade to be awarded.

**(D) NATURE OF OFFENCE**

If during the examination hours i.e. after receipt of the question paper and before handling - over the answer-book a student is found:

- a) To be copying or to have copied from any paper, book or notes written on any part of his/her clothing or body or table or desk or instruments like calculators, scales, etc.
- b) To be consulting notes or books while being outside the examination hall during examination hours.

- c) Passing on a copy of question(s) set in paper or solution thereof to any one.
- d) To have received help from or given help to another candidate through some written material/electronic device pertaining to the questions set in the paper concerned.
- e) To have allowed any other candidate to copy from his/her answer-book.
- f) Communicating or attempting to communicate directly or through someone else with the examiner or anybody connected with the Institute examination for influencing them in the award of marks.
- g) To be guilty of swallowing or destroying any note or paper found with him/her  
**ACTION TO BE TAKEN:** All the examinations for that semester to be cancelled and the student to be debarred from appearing at all Institute examinations during the next semester.

**(E) NATURE OF OFFENCE**

- a) Found in possession of a solution of a question set in the paper through the help of any student, supervisory or ministerial staff or some other agency.
- b) Found guilty of having made previous arrangement to obtain help in connection with the question paper in cases not covered by the above provision.  
**ACTION TO BE TAKEN:** All examinations to be cancelled for that semester and the student to be debarred from appearing at any Institute examination for the next two semesters.

**(F) NATURE OF OFFENCE**

Found guilty of:

- a) Smuggling in an answer-book, taking out or arranging to send out an answer-book.
- b) Writing deliberately another students' roll number in his/her answer-book or found in possession of an answer-book not his/her own or impersonating another candidate in any examinations.
- c) Guilty of serious misconduct in the examination hall or non-compliance with the instructions of the superintendent or any of the invigilators in the examination hall.  
**ACTION TO BE TAKEN:** All examinations of that semester to be cancelled and to be further debarred from appearing in any Institute Examination for a period of three to four semesters or expulsion from the Institute depending on the gravity of the offence.

**(G) NATURE OF OFFENCE**

- a) Any person who is not a candidate for any examination found committing or abetting in committal of any of the offences mentioned above.  
**ACTION TO BE TAKEN:** To be dealt with by the Director in an appropriate manner.

**(H) CASES NOT COVERED BY THESE REGULATIONS.**

**ACTION TO BE TAKEN:** To be decided by the Director.

- Note:
- a) In these regulations the year means the academic year.
  - b) A candidate found using unfair means leading to the cancellation of one paper or the whole examination in the First Year shall not be allowed to rejoin the Institute.
  - c) In case of extenuating circumstances, the above punishment may be reduced by the Director depending upon the merits of the case.

**FORM FOR REPORTING CASES OF USE OF OR ATTEMPT TO  
USE UNFAIR MEANS AT THE INSTITUTE EXAMINATIONS**

Note: One sheet should be used for one candidate only. If printed forms run short, the form should be photocopied and used.

- (1) Name of Examination .....
- (2) Candidate's Enrolment No.....
- (3) Name of Candidate..... (with full postal address)
- (4) Room No ..... Bhawan.....
- (5) Subject in which the candidate is reported to have used or intended to use unfair means .....
- (6) Day.....Date.....Time.....

I. Particulars of books, papers, electronic gadgets etc. found in possession of the student and submitted along with the scripts and this report (All these materials should be signed by the Invigilator of examination and the candidate).

- (1) Name of book (if any) (a) .....  
(b) .....  
(c) .....
- (2) Number of leaves of books .....
- (3) Number of (a) manuscript slips:..... (b) sheets: .....
- (4) Any other articles such as electronic gadget etc  
(a) .....  
(b) .....  
(c) .....

II. Statement of the candidate to be obtained at once in his/her own handwriting.

- (1) Were the above articles recovered from your possession ? .....
- (2) Why did you keep them with you inspite of clear instructions ? .....
- (3) Did you make any use of them ? .....
- (4) Have you any thing else to state ? .....

Date..... Time.....

(Signature of Candidate)

Certified that this statement was made in my presence.

Certified that the candidate declined to give any statement. (Certificate not applicable should be crossed by the invigilator)

Date.....

Time.....

(Signature of Invigilator)

(N.B. The report of the invigilator should be definite and unambiguous).

**GUIDE LINES FOR ATTENDANCE RECORDS AND PREPARATION OF LIST OF STUDENTS NOT ELIGIBLE TO APPEAR IN THE END TERM EXAMINATIONS**

Step	Action	Performa to be filled	Target Dates
<b>First</b>	Communication from Chairman, DAC/ Coordinator, First year B. Tech. to Course Coordinator requesting to submit the list of students having short attendance on specified format upto prescribed date.	ATT. 1/7	X + 48
<b>Second</b>	Consolidation of the list of such students by Chairman, DAC/ Coordinator, First year B. Tech & Notice from chairman, DAC/ Coordinator, First year B. Tech for Short Attendance	ATT. 2/7	X + 56
<b>Third</b>	Communication from AR (Acad) to parent/ guardian of student having short attendance.	ATT. 3/7	X + 63
<b>Fourth</b>	Communication from Chairman, DAC/ Coordinator, First year B.Tech to Course Coordinator requesting to submit the final list of students having short attendance on specified format upto prescribed date.	ATT. 4/7	Y-7
<b>Fifth</b>	Preparation on list of detained students by DAC/ FYCC and recommendation to this effect.	ATT. 5/7	Y + 1
<b>Sixth</b>	Notices from Chairman DAC/ Coordinator, FYCC or to Students Notice Board	ATT. 6/7	Y + 2 or Z-3
<b>Seventh</b>	Action by AR (Acad) to ascertain that the detained students do not appear in exam.	ATT. 7/7	Z -1

**Target dates:**

X = first day of teaching starts in a semester:

Y = Last day of teaching in a semester.

Z = first day of start end term examination.

ATT. 1/7

**From Chairman, DAC /Coordinator First Year to Course Coordinators**

DEPARTMENT OF.....

**LIST OF STUDENTS HAVING SHORT ATTENDANCE (<75%)**

Academic Year.....

Class.....

Semester.....Autumn/Spring

Course Title.....Course Code.....

**All Course Coordinators**

Please inform the names of UG Students having less than 75% attendance (L+T+P) upto ..... (as per academic calendar) in the course of which you are the Coordinator in Autumn /Spring Semester ..... The Information may please be sent to undersigned **latest by** .....in the proforma given below alongwith a photocopy of attendance record of entire class. If there is no short attendance case in your course , please write NIL in the proforma. **(Chairman, DAC / Coordinator First Year)**

S.No.	Student Enroll No.	Name of Student	Branch	Attendance Record (L+T+P)		
				Classes Held	Classes Attended	Percentage Attendance

Name of the Course Coordinator.....

**Signature**

## From Chairman, DAC /Coordinator First Year to Notice Boards

DEPARTMENT OF.....

## NOTICE

## LIST OF STUDENTS HAVING SHORT ATTENDANCE (&lt;75%)

Academic Year..... Class..... Semester.....Autumn/Spring

As per attendance regulations in force, a student is required to have attended at least 75% of the total classes held in a subject, in order to be eligible to appear in the end-term examination of that subject. Upto ..... ( as per academic calendar), the following students are having short-attendance in the courses indicated against their names. These students are advised to be extra careful and make up for the short attendance, otherwise they may be debarred from appearing in the end-term examination.

S.No.	Student Enroll No.	Name of Student	Branch	Course		Percentage Attendance
				Title	Code	

(Chairman, DAC / Coordinator First Year)

Copy to :

1. Head of the Department
2. Asstt. Registrar (Acd) to inform student's parent / guardian
3. Students Notice Boards
4. All Bhawan & Mess Notice Boards
5. Respective Programme Advisors with the request to call the students and counsel them.

ATT. 3/7

## NOTICE

## UNDER CERTIFICATE OF POSTING

From Assistant Registrar (Academic) to student's parent / guardian

## LIST OF STUDENTS HAVING SHORT ATTENDANCE (&lt;75%)

No:EX/

Dated .....

Dear Guardian / Parent,

Your ward is studying B.Arch./B.Tech (..... Year) degree course at this institute.

I have to inform you that as per regulations of the institute governing the attendance of the students, a student is required to have at least 75% attendance in a course in a semester to be eligible to appear in the End Term Examination of that course . But your ward is not attending the classes regularly and his/her attendance has fallen below the required level in following course (s).

Sl.No.	Course		Sl.No.	Course	
	Code	Title		Code	Title
1			4		
2			5		
3			6		

This is for your kind information. You may also kindly advise your ward to be regular in attending the classes and bring his/her attendance to the required level failing which he/she will not be allowed to appear in the examinations.

Yours truly,

Assistant Registrar (Acd)

## From Chairman, DAC /Coordinator First Year to Course Coordinators

DEPARTMENT OF.....

## LIST OF STUDENTS HAVING SHORT ATTENDANCE (&lt; 75%)

Academic Year..... Class..... Semester.....Autumn/Spring

Course Title.....

Course code.....

## All Course Coordinators

Please inform the names of UG Students having less than 75% attendance (L+T+P) upto (as per academic calendar) .....in the course of which you are the Coordinator in Autumn / Spring Semester..... The information may please be sent to undersigned **latest by**..... in the proforma given below alongwith a photocopy of attendance record of entire class. If there is no short attendance case in your course, please write NIL in the proforma.

(Chairman,DAC / Coordinator First Year)

S.No.	Student Enroll No.	Name of Student	Branch	Attendance Record (L+T+P)		
				Classes Held	Classes Attended	Percentage Attendance

Name of the Course Coordinator.....

Signature

## From Chairman, DAC/Coordinator First Year B. Tech.

DEPARTMENT OF.....

## LIST OF STUDENTS NOT ELIGIBLE TO APPEAR IN END TERM EXAMINATION AS PER REGULATION.....

Academic Year..... Class..... Semester.....Autumn/Spring

Course Title.....

Course Code.....

Sl.No.	Enrolment No.	Name of student	Percentage attendance

- (a) Dates on which the names of the students were placed on the Notice Boards of the Department.....  
(b) If the names of the students were not placed on the Notice Boards, specify the reasons for the same.
- As per the information given by all teachers of this subject, there are no other cases of shortage of attendance in this subject.
- The students as listed above are detained from appearing in the examination in the subject noted above as per the attendance record given above.

## Signatures of Chairman DAC / First Year Coordination Committee (FYCC) members and Chairman

Members.....

(CHAIRMAN)

Copy to: 1. Head of the Department

## From Chairman, DAC /Coordinator First Year to Notice Boards

DEPARTMENT OF.....

## NOTICE

## LIST OF STUDENTS HAVING SHORT ATTENDANCE (&lt; 75%)

Academic Year..... Class..... Semester.....Autumn/Spring

On the recommendation of department academic committee meeting held on .....following students are hereby detained from appearing in the end term examination in subjects listed against their names.

S.No.	Student Enroll No.	Name of Student	Branch	Course		Percentage Attendance
				Title	Code	

Date:

(Chairman, DAC/Coordinator First Year)

Copy to:

1. Head of the Department
2. Assistant Registrar(Academic)
3. Students Notice Boards
4. All Bhawan & Mess Notice Boards
5. Respective Programme Advisors with the request to call the students and counsel them.

ATT. 7/7

## List of students having Short of Attendance (&lt;75%)

Academic Year.....

Class.....

Semester.....Autumn/Spring

As per attendance regulations..... and recommendation made by competent authority, following students are not found eligible to appear in End Term Examination of Autumn/Spring Semester in the courses mentioned before their name. Invigilators are requested not to allow these students to appear in the concerned examinations.

S.No.	Student Enroll No.	Name of Student	Branch	Course		Percentage Attendance
				Title	Code	

Date.....

Asst. Registrar (Academic)

## APPENDIX – I

## Guidelines for Deduction of Marks for Mass Abstention from Classes

A fine of 5 marks for undergraduate students out of the discipline group, will be imposed on each of the student by the Head of the Department on the recommendation of Course Coordinators and Chairman DAC/CAC, for mass abstention from a class. The maximum fine for a day would be limited to 15 marks. For B.Tech./ IDD/ Integrated Master's Degree I year students, such fine shall be imposed by the First year Class Coordinators. All such fines shall be communicated to Dean of Students Welfare for record. The marks so fined will not be converted into monetary fine.

If the disciplinary marks are exhausted for a student, additional fine of marks would be converted to monetary fine. For the purpose of calculating equivalent monetary fine from marks or vice-versa, one mark shall be treated as **Rs. 50/-** or the amount approved by the Director from time to time on the recommendation of Dean of Students Welfare.

**Table-4: MINIMUM REQUIREMENT OF EARNED CREDITS FOR CONTINUATION OF REGISTRATION**

S.No.	Year	B. Tech.	B. Arch.	Int. Dual Degree (IDD)	Int. M. Tech. (IMT)	Int. M. Sc. (IMS)
1.	I Yr*	24	24	24	24	24
2.	II Yr**	50	50	50	50	50
3.	III Yr	78	78	78	78	78
4.	IV Yr	108	108	108	108	108
5.	V Yr	140	140	140	140	140
6.	VI Yr	176***	176	176	176	176
7.	VII Yr	-	198***	202***	202***	202***

\* Excluding Proficiency / NCC Discipline credits.

\*\* Including credits, if any, earned during summer term

\*\*\* The figure should not be less than the minimum prescribed.

### SCHOLARSHIPS, PRIZES, MEDALS, AWARDS

#### A. INSTITUTE MERIT-CUM-MEANS (MCM) SCHOLARSHIPS

The institute offers merit-cum-means scholarships to undergraduate students in engineering and technology. These are permissible to about 25% of students. The present value of merit-cum-means scholarship is Rs.1000/- per month for general category students and the, recipient is exempted from paying tuition fee.

The 4-year B.Tech, 5-year Dual Degree and 5-year Integrated M.Tech students will be eligible to receive Merit-cum-Means scholarship at the time of joining the Institute. The criterion of merit for first year is All India Rank in the JEE. The scholarships are renewed on a yearly basis until he/she clears all academic requirements of the programme, provided that he/she continues to satisfy the eligibility criteria (given below).

Continuation of MCM scholarship for general category students of the 4-year B. Tech., 5-year Dual-degree and 5-year Integrated M.Tech programmes, the requirements of merit for continuation of Institute Merit-cum-Means Scholarship are: .

- (i) CGPA must be 6.0 or more; and,
- (ii) Earned credits should not be less than 22 times the number of semesters registered for; and
- (iii) SGPA in the previous semester must be 6.0 or more
- (iv) Should not be penalised due to unfairmeans/discipline

For continuation of MCM, performance of the students will be reviewed at the end of each semester. The first such review will be held at the end of the second semester.

On the criterion of means, only those students are presently eligible whose parents have gross yearly income upto **Rs. 4.5 lacs per annum** for all categories of students including SC/ST students. The terms and conditions of the award of scholarship are laid down in the rules and regulations thereof in force and are subject to change from time to time.

#### B. MEDALS & AWARDS

The following medals/prizes will be awarded to students for their academic/overall excellence.

##### B.1 PRESIDENT's Gold Medal

To be awarded to the student who obtains the highest marks/CGPA among all students obtaining a B. Tech. degree in that year from the 4/5-year B. Tech./B. Arch., 5-year Integrated M.Tech and 5-year Dual-Degree programmes. For the purpose of this award, the marks/ CGPA for the 4-year programme students will be computed without including the Major Project grades, while those for the dual-degree students will be based on the UG credits. In case there is a tie, the medal will be awarded to the student with the largest earned credits.

##### B.2 DIRECTOR's Gold Medal

To be awarded to a student who is adjudged as the best all-rounder from amongst the graduating students of the 4/5year B.Tech./B.Arch , 5-year Integrated M.Tech. and 5-year Dual-Degree programmes.

##### B.3 INSTITUTE Gold Medal

To be awarded to a student securing a CGPA of 10, other than the one who has been awarded the President's old Medal.

##### B.4 INSTITUTE Silver Medal (One for each UG/dual degree programme)

To be awarded to a student (one in each programme) who obtains the highest marks/CGPA amongst the graduating class of undergraduate students of the Institute, in his/her programme. A separate (additional) Institute Silver Medal, will be awarded for each Dual Degree programme to a student who obtains the highest marks/CGPA amongst the

graduating students of that programme. For the purpose of this award, the marks/CGPA will be calculated on the basis of the cumulative performance in both B.Tech./ B.Arch. and M.Tech. credits. In case there is a tie, the medal is awarded to the student with the largest earned credits. No Silver Medal will be awarded in the discipline from which a student gets the President's Gold Medal or Institute Gold Medal. A minimum marks/CGPA of 8.5 or its equivalent is required for award of the Institute Silver Medal; in case no graduating student satisfies this criterion, the student with the highest marks/ CGPA will be given a certificate.

## **APPENDIX - L**

### **Guidelines for Casual Students**

The students from other institutions can be admitted as Casual students for both UG and PG courses as per following guidelines:

- (a) The entry of such students be made more stringent by evolving appropriate selection criterion through DAC/ CAC so that IIT brand is not misused or diluted.
- (b) The registration of the students be approved by the Dean, Academic Studies.
- (c) Casual students should only be admitted for course work. Thesis or project work be excluded for casual students, with the exception of these students who join under some MOUs with provisions enabling it.
- (d) The casual students should not be admitted in the Institute for Summer Training.
- (e) A maximum of 10% of the total regular students in B.Tech./IDD/Integrated Master's programme and 20% in M.Tech. can be admitted as casual students in a course.
- (f) The quality of casual students be checked by the concerned department.
- (g) Full fee for the semester be charged irrespective of number of courses taken.

## **APPENDIX – M**

### **Guidelines for Admission of International Students for Short Duration**

International students be allowed to join the Institute for a short term duration for course work / training / project in all Undergraduate /Postgraduate of the Institute, subject to following conditions:

- (a) The duration of course / training / project will not be more than one year,
- (b) The bench fee will be as follows:
  - i) US\$50 per credit with a minimum of US\$ 500 (Five Hundred) per semester for students from SAARC countries;
  - ii) US\$100 per credits with a minimum of US\$ 1000 (One Thousand) per semester for students from other countries;
- (c) The fee charged will cover the hostel rent also. The students will have to pay mess charges as being charged from other hostel inmates;
- (d) In each semester, the maximum number of students allowed to join a Department / Centre will be 02 (two);
- (e) The applications of the candidates, duly forwarded by their parent Institution, will be received by the department / centre of the candidate's specialization which will forward the suitable applications to Dean, Academic Studies for final approval. International projects and the exchange covered under MoUs, is beyond these provisions.
- (f) Foreign students will be admitted as per the MHRD guidelines issued from time to time.

## **APPENDIX – N**

### **Guidelines for Training of Outside Students**

- (a) Students only from IITs, Govt. Engineering Colleges which will include a University Deptt./Institute be accepted provided the Supervisor and the concerned HOD agree to provide the training and facilities in the Department.
- (b) The maximum limit per department may be 3 candidates at a time in place of 10 to 15 students in the Institute at any one time. The number of IIT students can be 3 in each department over and above.
- (c) A bench fee of Rs. 5000/- P.M. per student be charged by the Institute from the students/ sponsoring institute(s).
- (d) The sponsoring institution will not advertise in any of their publications that the practical training will be arranged at IIT Roorkee.
- (e) The training certificate will be given by the faculty supervisor only, after satisfactory completion of the training.
- (f) The selection of trainees be decided by the concerned department. However, the decision should be referred to the Dean Academic Studies.
- (g) The children of Institute employees studying in other Institutes can be admitted for practical training as per following guidelines:
  - i) 100% bench waiver to the children of Group 'D' employees.
  - ii) 50% bench fee waiver to the children of Group 'B' & 'C' employees.
  - iii) The fee waivers be confined to the UG students studying in Government Engineering Colleges only.
  - iv) Applications be routed to the Dean, Academic Studies, through the Head of the concerned Department, alongwith all the relevant documents.
  - v) These trainees will be over and above the strength of trainees, which the Institute can accept in a year.

# **B.ARCH., B.TECH., I.D.D. and 5 Year Integrated Master's PROGRAMMES**

## **BACHELOR'S DEGREE**

1. B. Arch.
2. B.Tech. (Biotechnology)
3. B.Tech. (Chemical Engineering)
4. B.Tech. (Civil Engineering)
5. B.Tech. (Computer Science & Engineering)
6. B.Tech. (Electrical Engineering)
7. B.Tech. (Electronics & Communication Engineering)
8. B.Tech. (Mechanical Engineering)
9. B.Tech. (Metallurgical & Materials Engineering)
10. B.Tech. (Production & Industrial Engineering)
11. B.Tech. (Pulp & Paper Engineering)

## **INTEGRATED DUAL DEGREE**

1. B.Tech. (Chemical Engineering) and M.Tech. (Hydrocarbon Engineering)
2. B.Tech. (Electrical Engineering) and M.Tech. (Power Electronics)
3. B.Tech. (Computer Science and Engineering) and M.Tech. (Information Technology)
4. B.Tech. (Electronics & Communication Engineering) and M.Tech. (Wireless Communication)
5. B.Tech. (Process Engineering) and M.B.A.

## **INTEGRATED MASTER OF TECHNOLOGY**

1. M.Tech. (Geophysical Technology)
2. M.Tech. (Geological Technology)
3. M.Tech. (Polymer Science & Technology)

## **INTEGRATED MASTER OF SCIENCE**

1. M.Sc. (Applied Mathematics)
2. M.Sc. (Physics)
3. M.Sc. (Chemistry)

**Institute Core Courses for B.Tech., I.D.D., I.M.Tech. & I.M.Sc.  
First Year**

**Structure A**

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)				
S.No.	Subject Code	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>AUTUMN SEMESTER (1st Semester)</b>														
1	MA-101	Mathematics-I	BSC	4	3	1	0	3	-	25	-	25	50	-
2	PH-101	Physics-I	BSC	5	3	1	2	3	2	15	15	15	40	15
3	EE-101	Electrical Science	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4.	EC-101A	Computer Systems & Programming	ESC	4	3	0	2	3	-	15	15	30	40	-
	EC-101B	Fundamentals of Object Oriented Programming												
5.	MI-102	Manufacturing Techniques	ESC	3	2	0	2	2	-	15	15	30	40	-
6.	BT-101	Fundamentals of Biotechnology	GSC	2	2	0	0	2	-	15	-	35	50	-
7.	HS-101	Technical Communication	HSSMC	2	1	0	2	2	-	25	-	25	50	-
Total				24	17	3	9							
<b>SPRING SEMESTER (2nd Semester)</b>														
1.	MA-102	Mathematics-II	BSC	4	3	1	0	3	-	25	-	25	50	-
2.	CY-101	Chemistry	BSC	5	3	1	2	3	2	15	15	15	40	15
3.	EC-102	Fundamentals of Electronics	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4.	CE-101	Engineering Graphics	ESC	4	2	0	4	3	-	-	25	25	50	-
5.	MI-101	Thermodynamics	ESC	3	2	1	0	2	-	25	-	25	50	-
6.	CE-102	Environmental Studies	GSC	2	2	0	0	2	-	15	-	35	50	-
7.	HS-102	Behavioral Science	HSSMC	2	2	0	0	2	-	15	-	35	50	-
Total				24	17	4	7							
<b>Structure B</b>														
<b>AUTUMN SEMESTER (1st Semester)</b>														
1.	MA-101	Mathematics-I	BSC	4	3	1	0	3	-	25	-	25	50	-
2.	CY-101	Chemistry	BSC	5	3	1	2	3	2	15	15	15	40	15
3.	EC-102	Fundamentals of Electronics	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4.	CE-101	Engineering Graphics	ESC	4	2	0	4	3	-	-	25	25	50	-
5.	MI-101	Thermodynamics	ESC	3	2	1	0	2	-	25	-	25	50	-
6.	CE-102	Environmental Studies	GSC	2	2	0	0	2	-	15	-	35	50	-
7.	HS-102	Behavioral Science	HSSMC	2	2	0	0	2	-	15	-	35	50	-
Total				24	17	4	7							
<b>SPRING SEMESTER (2nd Semester)</b>														
1.	MA-102	Mathematics-II	BSC	4	3	1	0	3	-	25	-	25	50	-
2.	PH-101	Physics-I	BSC	5	3	1	2	3	2	15	15	15	40	15
3.	EE-101	Electrical Science	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4.	EC-101A	Computer Systems & Programming	ESC	4	3	0	2	3	-	15	15	30	40	-
	EC-101B	Fundamentals of Object Oriented Programming												
5.	MI-102	Manufacturing Techniques	ESC	3	2	0	2	2	-	15	15	30	40	-
6.	BT-101	Fundamentals of Biotechnology	GSC	2	2	0	0	2	-	15	-	35	50	-
7.	HS-101	Technical Communication	HSSMC	2	1	0	2	2	-	25	-	25	50	-
Total				24	17	3	9							

**Institute Core Courses for B.Tech., I.D.D.**  
**Second Year**

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)				
S.No.	Subject Code	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>AUTUMN SEMESTER (3rd Semester)</b>														
1.	PH-201	Physics-II	BSC	3	3	0	0	3	-	15	-	35	50	-
2.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4.	MT-201A	Material Science-A	ESC	4	3	1	0	3	-	25	-	25	50	-
5.	MI-201	Solid Mechanics	ESC	4	3	1	0	3	-	25	-	25	50	-
6.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
7.	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	-	15	-	35	50	-
<b>SPRING SEMESTER (4th Semester)</b>														
1.	PH-201	Physics-II	BSC	3	3	0	0	3	-	15	-	35	50	-
2.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4.	MT-201B	Material Science-B	ESC	4	3	1	0	3	-	25	-	25	50	-
5.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
6.	ES-201	Introduction to Geo-Science	GSC	2	2	0	0	2	-	15	-	35	50	-
7.	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	-	15	-	35	50	-

**Note:** The courses at 2nd year level will be held in both the semesters except MT-201A , MT-201B, MI-201 and ES-201.

# Institute Core Courses for I.M.Tech. & I.M.Sc.

## Second Year

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)				
S.No.	Subject Code	COURSE TITLE	Subject Area	Credits	L	T	P/D	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>AUTUMN SEMESTER (3rd Semester)</b>														
1.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
2.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
3.	PH-201M	Optics	BSC	5	3	1	2	3	-	15	-	35	50	-
4.	CY-201M	Physical Chemistry-I	BSC	3	2	1	0	2	-	25	-	25	50	-
5.	CY-202M	Basic Inorganic Chemistry	BSC	3	2	1	0	2	-	25	-	25	50	-
6.	MA-201M	Complex Analysis and Partial Differential Equations	BSC	4	3	1	0	3	-	25	-	25	50	-
7.	MA-203M	Mechanics-I	BSC	4	3	1	0	3	-	25	-	25	50	-
<b>SPRING SEMESTER (4th Semester)</b>														
1.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2.	ES-201	Introduction to Geo-Science	GSC	2	2	0	0	2	-	15	-	35	50	-
3.	CY-203M	Organic Chemistry-I	BSC	3	2	1	0	2	-	25	-	25	50	-
4.	PH-202M	Electricity and Magnetism	BSC	5	3	1	2	2	-	25	-	25	50	-
5.	MA-202M	Numerical Analysis	BSC	4	3	1	0	3	-	25	-	25	50	-
6.	MA-204M	Linear Algebra	BSC	4	3	1	0	3	-	25	-	25	50	-

## Teaching Scheme for B.ARCH. I Year

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)					
S.No.	Subject Code	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE	
<b>AUTUMN SEMESTER (1st Semester)</b>															
1	MA-101	Mathematics-I	BSC	4	3	1	0	3	0	25	-	25	50	-	
2	EC-101A	Computer Systems & Programming	ESC	4	3	0	2	3	0	15	15	30	40	-	
	EC-101B	Fundamentals of Object Oriented Programming													
3.	MI-102	Manufacturing Techniques	ESC	3	2	0	2	2	0	15	15	30	40	-	
4	BT-101	Fundamentals of Biotechnology	GSC	2	2	0	0	2	0	15	-	35	50	-	
5.	HS-101	Technical Communication	HSSMC	2	1	0	2	2	0	25	-	25	50	-	
6.	AR-101	Basic Design and Model Making	DCC	4	1	0	6	0	3	-	50	20	-	30	
7	AR-103	Architectural Graphics-I	DCC	4	1	0	6	0	3	-	50	20	30	-	
Total				23	13	1	18								
<b>SPRING SEMESTER (2nd Semester)</b>															
1.	MA-102	Mathematics-II	BSC	4	3	1	0	3	0	25	-	25	50	-	
2.	CE-102	Environmental Studies	GSC	2	2	0	0	2	0	15	-	35	50	-	
3.	HS-102	Behavioral Science	HSSMC	2	2	0	0	2	0	15	-	35	50	-	
4.	AR-102	Architectural Design-I	DCC	4	1	0	6	0	7	-	60	20	-	20	
5.	AR-104	Architectural Graphics-II	DCC	4	1	0	6	0	3	-	50	20	-	30	
6.	AR-106	Introduction to Building Materials and Construction	DCC	3	1	0	4	4	0	50	-	20	30	-	
7.	AR-108	Principles of Architecture	DCC	3	2	1	0	2	0	25	-	25	50	-	
8.	AR-110	Colour Fundamentals and Its Application	DCC	2	1	0	2	0	2	-	50	20	-	30	
Total				24	13	2	18								

## Teaching Scheme for B.ARCH. II Year

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)					
S.No.	Subject Code	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE	
<b>AUTUMN SEMESTER (3rd Semester)</b>															
1.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	0	-	25	25	50	-	
2.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	0	25	-	25	50	-	
3.	AR-201	Architectural Design-II	DCC	5	1	2/2	6	0	7	-	60	20	-	20	
4.	AR-203	Building Construction-II	DCC	3	1	0	4	0	4	-	50	20	-	30	
5.	AR-205	Climatology in Architecture	DCC	3	2	1	0	2	0	25	-	25	50	-	
6.	AR-207	Measured Drawing Camp	DCC	2	0	0	2	0	0	-	100	-	-	-	
7.	CE-291	Introduction to Geomatics Techniques	DCC	4	3	0	3	3	3	15	15	15	40	15	
8.	AR-IE1	Institute Elective-I	BGSEC	3	2	1	0	2	2	25	-	25	50	-	
Total				25	12	6	15								
<b>SPRING SEMESTER (4th Semester)</b>															
1.	HS-201	Economics	HSSMC	3	2	1	0	2	0	25	-	25	50	-	
2.	MT-201B	Material Science-B	ESC	4	3	1	0	3	0	25	-	25	50	-	
3.	AR-202	Architectural Design-III	DCC	5	1	2/2	6	0	7	-	60	20	-	20	
4.	AR-204	Building Construction-III	DCC	3	1	0	4	0	4	-	50	20	-	30	
5.	AR-206	History of Architecture-I	DCC	3	2	1	0	2	0	25	-	25	50	-	
6.	CE-292	Theory of Structures-I	DCC	4	3	1	0	3	0	25	-	25	50	-	
7.	AR-IE2	Institute Elective-II	BGSEC	3	2	1	0	2	0	25	-	25	50	-	
Total				25	14	6	10								

# Institute Core Courses

**BT-101 Fundamentals of Biotechnology**  
Pre-requisite: NIL Sem. Both

Cr:2(2-0-0)  
TH:2 PR:0

5.Chandra A. M. and Chandra S., "Engineering Graphics", Narosa Publishing House.

**Basic Component:** Introduction, structural and chemical components of cell;**Molecular mechanism and engineering:** DNA replication, RNA and protein synthesis, mutation and genetic recombination, Protoplast and cell fusion technology, Genetic engineering and PCR; **Microbes & fermentation:** Bacteria, fungi, viruses, microbial growth and bioprocess technology, Enzyme kinetics and bioconversion, Immobilization of enzymes, cell and application; **Plant and animal biotechnology and safety issues:** Biodiversity, transgenic plants and animals, Biosafety and bioethics; **Applications:** Biofuels, Bioremediation, bio-medical applications

## References:

- 1.Smith J. E., "Biotechnology", 3<sup>rd</sup> Ed, Cambridge University Press.
- 2.Walker J. M. and Gingold E. B., "Molecular Biology and Biotechnology", The Royal Society of Chemistry, UK/Panama Publishing Corporation.
- 3.Auderisk G. and Auderisk T., "Biology life on Earth", Macmillan Publishing Company.

**CE-101 Engineering Graphics**  
Pre-requisite: NIL Sem. Both

Cr:4(2-0-4)  
TH:3 PR:0

Types of Projection, Reference Planes and Quadrants. Projection of point keeping it in different quadrants; Auxiliary planes, projection of points on auxiliary planes; Projection of lines; Oblique planes – determination of VTH when inclination are given and vice versa, conversion; Projection of plane figures; Plane figure in OP and one edge inclined to HP or VP; Types of solids and their projections in their initial positions; Section of solid and development; **General:** Sheet Layout, Line Symbols, Line Groups, Preferred Scales, Theory of Orthographic Projection, Technical Sketching; **Shape Description (External):** Multiplaner Representation Systems of Projection, Sketching of Orthographic Views from Pictorial Views, Conventional Practices, Precedence of Views, Precedence of Lines; **Uniplaner Representation:** Sketching of Pictorial Views (Isometric and Oblique) from Multiplaner Orthographic Views; **Shape Description (Internal):** Sectioning as an Aid to understand internal features, Principles of Sectioning, Types of Sections, Section Lines, Cutting Plane Lines and Conventional Practices; **Size Description:** Dimensioning, Tools of Dimensioning, Size and position Dimensions, Unidirectional and Aligned Systems, Principle and Practices, of Dimensioning, Tolerance Dimensioning; **Conventional Representation:** Representation and Identification of Common Machine Elements and Features  
**Practicals:** Projection of Points; Projection of lines; Oblique planes; Projection of Plane Figures; Projection of Solids; Section and Development; Sketching of Orthographic ; Views from Pictorial Views; Sketching of Pictorial Views (isometric and Oblique) from Multiplaner Orthographic Views; Missing Lines Exercise; Missing View Exercise; Sectioning Exercise; Dimensioning Exercise; Identification Exercise.

## References:

- 1.Giesecke, Mitchell, Spencer, Hill, Dygdon and Novak, "Technical Drawing", Macmillan Publishing Company
- 2.French T. E., Vierck C. J. and Foster R. J., "Engineering Drawing and Graphics Technology", McGraw-Hill Inc
- 3.Luzadder W. J., Warren J. and Duff J. M., "Fundamentals of Engineering Drawing", Prentice Hall international Editions
- 4.Sp 46:1988 Engineering Drawing Practice for Schools and Colleges, Bureau of Indian Standards

**CE-102 Environmental Studies**  
Pre-requisite: NIL Sem. Both

Cr:2(2-0-0)  
TH:2 PR:0

Introduction and scope; Earth's natural environment, human population and Ecosystems; Environmental Pollution Air pollution-sources, effects and control, Distribution of pollutants in atmosphere, Air quality standards Water pollution-sources, effects and control, Distribution of pollutants in water, Water quality standards; Land pollution – sources, effects and control; Thermal and noise pollution; Basic principles of waste management, including industrial wastes; Hazardous wastes and risk management; Environmental impact assessment; Life cycle assessment; Sustainable development; Conservation of natural resources; Trade, environment and development; Environmental management systems and ISO certification; Control policies, legislations and acts

## References:

- 1.Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering," 3rd Ed., McGraw Hill.
- 2.Masters G. M., "Introduction to Environmental Engineering and Science", 2nd Ed., Prentice Hall of India.
- 3.Peavy H. S., Rowe D. R. and Tchobanoglous G., "Environmental Engineering", McGraw Hill

**CY-101 Chemistry**  
Pre-requisite: NIL Sem. Both

Cr:5(3-1-2)  
TH:3 PR:2

**Quantum Mechanics:** Postulates, Schrödinger wave equation, Interpretation of wave function, particle in a box, implication of the concepts, H atom, radial and angular wave functions, and shapes of orbital; **Thermodynamics:** Statistical concept of entropy, free energy, and chemical equilibria, chemical potential; **Kinetics and Catalysis:** Theories of chemical reactions, homogeneous and heterogeneous catalysis; **Electrochemical Cells:** Electrochemical corrosion and fuel cells; **Stereoisomerism:** Overview of concepts, configuration, Fischer and Newman projections. Optical isomerism of simple cyclic systems and of compounds without asymmetric carbon atom (allenes, spiro compounds, etc.); chirality involving atoms other than carbon; **Reaction Mechanism and Stereochemistry in Organic Synthesis:** (a) Addition of  $\text{KMnO}_4$ ,  $\text{OsO}_4$ , and per acid on cis-, and trans alkenes (b) Diels-Alder reaction: (4+2) cycloaddition MO treatment (c) Aromatic nucleophilic substitution mechanism (S<sub>N</sub>Ar, S<sub>N</sub>1, Arynes) reactivity and reactions; **Novel Polymers:** Stereo chemical control of synthesis, Ziegler-Natta catalyst, Polyurethanes, conducting polymers; **Spectroscopic Techniques:** Introductory ideas of molecular spectroscopy and applications of UV-visible and IR to simple compounds/coordination complexes; **Coordination Compounds:** Crystal field theory of octahedral and tetrahedral complexes, colour and magnetic properties, Jahn-Teller distortion with specific reference to d<sup>9</sup> case; **Organometallics:** (i) Metal carbonyls: synthesis, structure and bonding (ii) Metal alkene complexes: bonding in metal alkene complexes, role of metal alkene complexes in hydrogenation and hydroformylation; **Metal ions in Biological Systems:** Role of trace metals in biological systems with special reference to transition metals (Cu, Fe, Zn), toxic effects of Cd and Hg.

## Experiments:

- 1.Determination of iron in iron ore using potassium dichromate (Internal indicator method);
- 2.Determination of sodium carbonate in baking/ washing soda;
- 3.Determination of hardness of water by

EDTA- complexometry titrations; 4.Heat of neutralization of a strong base by a strong acid; 5.Equivalent weight of an acid; 6.Viscosity of mixtures of liquids; 7.Surface excess of 1-butanol in aqueous solution; 8.Order of reaction; 9.Percentage of ammonia in an ammonium salt; 10.Identification of functional groups in organic compounds; 11.Blue Printing12.pH metry/ potentiometry titrations; a)Strong acid – strong base; b) Strong acid – weak base; c) Weak acid – strong base; d) Redox titration: Fe<sup>2+</sup> or Mn<sup>2+</sup>; 13.Spectrophotometry: Determination of Fe (III) by colorimetry; 14.Determination of water of crystallisation by microwave irradiation; 15.Preparation of acetanilide or aspirin and determination of melting point, and matching with known sample; 16. Determination of chloride of As or Cr in Water.

#### References:

- 1.Lee J. D., "Concise Inorganic Chemistry", 5th Ed., Chapman & Hall.
- 2.Malik T. and Madan, "Selected Topics in Inorganic Chemistry", 5<sup>th</sup> Ed., S. Chand & Company.
- 3.Peter S., "A guide book to Mechanism in Organic Chemistry, 6<sup>th</sup> Ed., Orient Longman.
- 4.Morrison R. T. and Boyd R. N., "Organic Chemistry", Sixth Ed., Printice Hall of India.
- 5.Mahan B. H., "University Chemistry", 3<sup>rd</sup> Ed., Narosa Publishing House, New Delhi.
- 6.Atkins P. W., "Physical Chemistry", Vth Ed. ELBS, Oxford Univ. Press, Oxford.

**EC-101A Computer Systems & Programming Cr:4(3-0-2)**  
**Pre-requisite: NIL Sem. Both TH:3 PR: 0**

**Basic Computer Fundamentals:** Introduction to computer systems ; number system integer,m signed integer, fixed and floating point representations; IEEE standards integer and floating point arithmetic; CPU organization ALU, registers, memory, the idea of program execution at micro level: concept of flow chart and algorithm, algorithms to programs Concept of strain, normal and shear strain, two dimensional state of principal strains, Poisson's ratio, volumetric strain, strain circle.

**Basic Programming elements in C++: Input/Output:** Constants, variables expressions and operations: Naming conventions and styles: Conditions and selection statements; Looping and control structures; File I/O header files, string processing; Pre-processor directives such as include, #define, #ifdef, #ifndef, Compiling and linking; **Programming through functional decomposition:** Functions (void and value returning) parameters, scope and lifetime of variables, passing by value, passing by reference passing by constant reference : Design of functions and their interfaces (concept of functional decomposition), recursive functions, function overloading and default arguments; Library functions; **Aggregate data-types: Arrays and pointers: Structures :** Dynamic data and pointers, dynamics arrays ; Introduction to data structures, use of pointers in linked structures; **Object Oriented Programming Concepts:** Data hiding, abstract data types, classes, access control : Class implementation – default constructor, constructors, copy constructor, destructor, operator overloading, friend functions ; Object oriented design, inheritance and composition : Dynamic binding and virtual functions ; Polymorphism ; Dynamic data in classes.

#### References:

- 1.Dietel H. M. and Dietel P. J., "C ++ How to Program" Prentice Hall Publications.
- 2.Nell D., Chip W. and Mark H., "Programming and Problem Solving with C++", CBS Publishers and Distribution.
- 3.Cohoon J. P. & Davidson J. W., "C++ Program Design" Tata McGraw Hill.

**EC-101B Fundamentals of Object Oriented Programming Cr:4(3-0-2)**  
**Pre-requisite: NIL Sem. Both TH:3 PR:0**

**Basic Computer Fundamentals:** Introduction to computer systems, computer as a programmed machine: CPU organization, ALU, registers, memory: machine language, assembly language, idea of program execution at micro level, high – level languages: concept of flow chart and algorithm algorithms to programs, efficiency of algorithms, big-O notation; object oriented programming concept difference in approach from procedural programming; **Introduction to linux and Java programming environment, Java compiler and virtual machine:** structure of a Java program, stand-alone programs and applets: concepts of portability; **Basic Programming elements in Java :** data types, variables and array's operators, assignment and selection statements iterative structures, nested loops; **Classes in Java:** general form of a class, creating objects, access control in classes. Constructors, methods, finalization, parameters, method overloading, recursive methods, returning objects, static members final, qualifier, nested and inner classes, string handling in Java, I/O mechanism, command line arguments.

**Inheritance:** basics super classes and subclasses, multilevel hierarchy, method overriding: run time polymorphism, abstract classes, final in inheritance, and the object class; **Packages and Interfaces :** defining package, access protection, importing classes and packages, defining and implementing interfaces, nested interfaces, use of interfaces, variables in interfaces, the keyword extends; **Exception handling :** fundamentals , types of exceptions catching exceptions, multiple catching nested try statements, uncaught exceptions, throw and throws, finally mechanism, built-in exceptions, creating exception subclasses, using exceptions; **Applets :** applet fundamentals, native methods, static import, the applet class, applet display method, requesting repainting, a banner applet, passing parameters to applets, uses of applets.

#### References:

- 1.Dietel and Associates, "Java How to Program", 7<sup>th</sup> Ed., Prentice-Hall.
- 2.David F., "Java in a Nutshell, 5<sup>th</sup> Ed., O'Reilly Media, Inc.,
- 3.David Gries, "The Science of Programming"
- 4.Dijkstra E. W. "A Short Introduction to the Art of Programming"
- 5.Dromey, "How to solve it by Computer"
- 6.Bruce E., "Thinking in Java", Prentice Hall
- 7.Gosling J., Joy B., Steele G. and Bracha G., "The Java Language Specification", 2<sup>nd</sup> Ed.

**EC-102 Fundamentals of Electronics Cr:4(3-1-2/2)**  
**Pre-requisite: NIL Sem. Both TH:3 PR:0**

**Review of conductors, semiconductors, and insulators; Drift and diffusion currents ;** p-n junction ; junction under forward and reverse bias ; circuit models ; diode applications : rectifier, clipper, clamper ; Zener diode regulator ; simple power supply with capacitor filter and zener regulator.**Bipolar Junction Transistor :** structure and operation, various configurations, input and output characteristics, BJT as amplifier, DC analysis of various biasing circuits, biasing stability. **Field Effect Transistors :** JFET, depletion-mode and enhancement-mode MOSFETs, FET biasing, FET as an amplifier. **Small-signal analysis of BJTs and FETs:** h-parameter model of BJT, small-signal analysis of BJT amplifier circuits, frequency response of RC-coupled BJT and FET amplifiers. **Amplifiers :** cascade connection, current mirror, differential amplifier, operational amplifier, op-amp applications, power amplifiers, feedback in amplifiers.**Oscillators :** Barkhausen criterion, damped oscillations in LC circuits, audio and rf oscillators.**Digital Electronics :** Combinational Circuits – adder, de-

coder, encoder, multiplexer, demultiplexer ; Sequential Circuits – flip-flops, counters, and shift registers ; ADC and DAC.

#### References:

1. Boylestad R. L. and Nashelsky L., "Electronic Devices and Circuit Theory", 9<sup>th</sup> Ed., Pearson Education.
2. Millman J. and Halkias C. C., "Electronic Devices and Circuit" –Mc Graw-Hill.
3. Millman J. and Halkias C. C., "Integrated Electronics", Tata McGraw-Hill.
4. Nagrath I. J. "Electronics – Analog and Digital", Prentice Hall of India.
5. Santiram K., "Basic Electronics", Prentice Hall of India.

#### EE-101 Electrical Science

Pre-requisite: NIL

Sem. Both

Cr:4(3-1-2/2)

TH:3 PR:0

**Network Fundamentals:** Types of Sources and Elements, Kirchoff's Laws, Mesh and Node Analysis of D.C. Networks.

**Transient Analysis :** RL & RC circuits. **Network Theorems:** Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Theorem, Star-Delta Transformation. **A.C. Fundamentals :** Concept of Phasor, Impedance and Admittance, Mesh and Node analysis of Single Phase AC Networks, Network Theorems in AC Networks, Active and Reactive Power in AC Circuits, Resonance in Series AC Circuits. **Introduction to 3-phase A.C. Circuits:** Analysis of 3-phase balanced star-delta circuits, Power in 3-phase Circuits. **Magnetic Circuit Concepts :** Analogy with Electrical Circuits, Calculation for series, parallel and series parallel magnetic circuits, Eddy current and Hysteresis losses. **Single Phase Transformer:** Basic constructional features, Operating principle, Phasor diagram, Equivalent Circuit, Voltage regulation, Efficiency, Open circuit and Short Circuit tests. **D.C. Machines :** Principle of operation, Basic constructional features, Emf and torque equation, Armature reaction, Types of Excitation and Generator characteristics, Types of D.C. motors, Starting and speed control of D.C. motors. **Machines :** Three phase Induction Motor : Operating principle, Constructional features, Equivalent circuits, Torque-speed characteristics, Starting and speed control. Synchronous Generator : Basic principle of operation, Emf equation, Constructional features. **Measurement of Electrical Quantities:** Measurement of Voltage, Current, Power and Energy, Moving Iron Instruments, Measurement of 3 phase power, Accuracy class of meters.

#### References:

1. Mukhopadhyaya P., Pant A. K., Kumar V. and Chittore D. S., "Elements of Electrical Science", M/s Nem Chand & Brothers.
2. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall of India.
3. Kothari D. P., Nagrath I. J., "Theory and Problems of Basic Electrical Engineering", Prentice Hall of India.
4. Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", Tata McGraw-Hill Publishing Company Limited.
5. Chapman S. J., "Electric Machinery Fundamentals", MCGraw Hill Book Company.
6. Hughes E., "Electrical & Electronic Technology", 8<sup>th</sup> Ed., Pearson Publishing.

#### HS-101 Technical communication

Pre-requisite: NIL

Sem. Both

Cr:2(1-0-2)

TH:2 PR:0

**Communication Basics :** scope, process, barriers, Non-verbal Communication, tools for Effective Communication

**A. Writing Skills : Technical Reports :** Definition ; Types ; Planning and Preparation ; Structure ; Writing of Technical Reports – Technical Style B. Writing Skills : Writing Resume / Job Application Letter /CVs

**Oral Skills :** Pre-placement Group Discussion ; Interview Techniques ; Effective Strategies for Oral Presentations. Listening Variations of English Language in the Global Scenario.

#### References:

1. Guffey, Mary E., "Essentials of Business Communication", 5 Ed., South-Western College Publishing
2. Bovee, Courland L. and John T., "Business Communication Today", 8<sup>th</sup> Ed., Pearson Education.
3. Stevenson, Susan and Whitmore S., "Strategies for Engineering Communication", John Willey and Sons.
4. Sharma R. C. and Mohan K., "Business Correspondence and Report Writing", 3<sup>rd</sup> Ed., Tata McGraw Hill.
5. Raman, Minakshi and Sharma S., "Technical Communication : Principles and Practice", OUP

#### HS-102 Behavioral Science

Pre-requisite: NIL

Sem. Both

Cr:2(2-0-0)

TH:2 PR:0

**Introduction to behavioral Science:** The core disciplines contributing to behavioral Science and its importance; **Society and Culture:** Social structures (micro and macro level), attitudes, values, traditions, stereotypes and prejudices and their influence in behaviour. Ethnocentrism and culture relativism; **Personality and Socialization:** Role of biological and cultural factors in its development. Agents of socialization: family, school media and peers. Socialization and identify. Rikson's Eight Stages of Man; **Social groups and leadership :** Group structure, Boundaries : In-group and out-group, Group size, dyads and triads, primary and secondary groups, reference groups and leadership; **Motivation:** Theories of Motivation. Two-Factor Theory, ERG Theory, and McClelland's Theory of Needs; **Perception and individual decision making:** Perception and its relevance in behaviour, factors influencing perception, Person-perception: making judgements about others. Attribution theory, fundamental attribution errors. Cultural differences in it.

#### References:

1. Donald L. Jr. and Suzzane E. K., "Sociology", 2<sup>nd</sup> Ed., McGraw-Hill.
2. Fred L., "Organizational Behavior", 10<sup>th</sup> Ed., McGraw-Hill Companies.
3. Joseph C. Jr., "Introductory Sociology", McGraw-Hill, Inc.
4. Morgan, King, Weisz, and Schopfer, "Introduction to Psychology", 7<sup>th</sup> Ed., Tata McGraw-Hill.
5. Denisoff R. S. and Ralph W. A. "An Introduction to Sociology", 3<sup>rd</sup> Ed., Macmillan Publishing Co. Inc.
6. Robert A. B. and Donn B., "Social Psychology", 10<sup>th</sup> Ed., Pearson Education, Inc.
7. Stephen P. R. "Organizational Behaviour", 9<sup>th</sup> Ed., Prentice Hall of India Pvt. Ltd.

#### MA-101 Mathematics-I

Pre-requisite: NIL

Sem. Both

Cr:4(3-1-0)

TH:3 PR:0

**Functions of Several Variables:** Limit, continuity and differentiability of functions of two variables. Euler's Theorem, tangent plane and normal, change of variables, chain rule. Jacobians, Taylor's Theorem for two variables. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers; **Ordinary Differential Equations:** Solution of linear differential equations with constant coefficients, Euler-Cauchy Equations, Solution of second order differential equations by change of dependent and independent variables. Method of variation of parameters for second order differential equations. Numerical solution of ODE by Picard's method, Taylor's series, Euler method & Modified Euler method; **Infinite Series:** Convergence of infinite series, Comparison test, Ratio test, Root test, Raabe's test, Logarithmic test, Demorgan's

test, Cauchy Integral test; **Solution in Series:** Solution in series of second order linear differential equations with polynomial coefficients. Bessel and Legendre equations and their series solutions. Properties of Bessel functions and Legendre polynomials; **Matrix Algebra:** Rank of a matrix, inverse of a matrix by elementary operations, Solution of linear simultaneous equations and their numerical solutions by Gauss Elimination and Gauss Seidel methods, eigen values and eigen vectors, Cayley-Hamilton theorem, diagonalization of matrices. Orthogonal, Hermitian, Skew-Hermitian, Normal and Unitary matrices and their elementary properties, quadratic forms.

**References:**

1. Thomas G. and Finney R. L. "Calculus and Analytical Geometry", 9<sup>th</sup> Ed., Addison Wesley.
2. Kreyszig E., "Advanced Engineering Mathematics", 9<sup>th</sup>, Wiley Eastern.
3. Grewal B. S., "Engineering Mathematics", Khanna Publishers
4. Piaggio H. T. H., "An Elementary Treatise on Differential Equations and their Applications", G. Bells & Sons Ltd.
5. Simmons G. F., "Differential Equations", TMH Edition
6. Prasad C., "Mathematics For Engineers", 19<sup>th</sup> Ed. Prasad Mudralaya.
7. Gerald C. F. and Wheatley P. O., "Applied Numerical Analysis", 6<sup>th</sup> Ed., Wesley.
8. Krishnamurthy E. V. and Sen S. K., "Applied Numerical Analysis, East West Publication.

**MA-102 Mathematics-II**

**Cr:4(3-1-0)**

**Pre-requisite: NIL**

**Sem. Both**

**TH:3 PR:0**

**Integral Calculus:** Double and triple integrals, change of order of integration, change of variables. Gamma, Beta functions, Dirichlet's integral. Applications (Evaluation of surface area, volume, center of gravity, moment of inertia).

**Vector Calculus:** Differentiation of vectors, gradient, divergence, curl and their physical meaning. Differential operators and their identities. Line and surface integrals. Green's Theorem in a plane. Gauss Divergence and Stokes's theorems and their applications;

**Laplace Transform:** Definition, shifting theorems, transform of derivatives. Differentiation and Integration of Transforms, Heaviside unit step and Dirac delta functions. Solution of ordinary differential equations in mechanics, electric circuits and bending of beams using Laplace Transform; **Z-Transform:** Definition, Z-transform of elementary functions, shifting theorems, convolution theorem, initial and final value theorems. Inverse of Z- transform. Application to solution of difference equations; **Fourier Series:** Trigonometric Fourier Series, half range series, harmonic analysis; **Fourier Transform:** Definition, Fourier Sine and Cosine transforms, Fourier Integral Formula and Applications.

**References:**

1. Kreyszig J., "Advanced Engineering Mathematics", Wiley & Sons
2. Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 2<sup>th</sup> Ed., Narosa Publishing House.
3. Hilderbrandt, "Advanced Calculus For Applications", Prentice Hall, India
4. Prasad C., "Advanced Mathematics For Engineers", 13<sup>th</sup> Ed. Prasad Mudralaya.

**MI-101 Thermodynamics**

**Cr:3(2-1-0)**

**Pre-requisite: NIL**

**Sem. Both**

**TH:2 PR:0**

**Introduction :** Introduction to thermodynamic system, surrounding, state, process, properties, equilibrium, heat and work, Zeroth Law of Thermodynamics; **Properties of Pure Simple Compressible Substance:** PvT surface, Pv, Tv, TP diagrams. Equation of state for ideal and real gases. Virial equation of state, Van-der waal, Redlich-

Kwong, Peng Robinson equation of state etc. use of steam tables and Mollier diagram; **First Law of Thermodynamics:** First law application to non-flow processes such as isochoric, isobaric, isothermal, adiabatic and polytropic processes. Steady flow energy equation, flow work. Application to various practical systems viz nozzles, diffuser, turbines, heat exchangers etc. Application of energy equation to transient flow problems; **Second Law of Thermodynamics:** Second law, reversible and irreversible processes, Clausius and Kelvin Planck statements, Carnot cycle, corollaries of second law: thermodynamic temperature scale, Clausius inequality, entropy as a property, principle of increase of entropy. Calculation of entropy change; **Thermodynamic Cycles:** Otto, Diesel, Rankine cycles and their applications. Vapour compression refrigeration cycle.

**References:**

1. Van W. and Sonntag, "Fundamentals of Thermodynamics", John Wiley.
2. Roger G. F. C. and Mayhew, "Engineering Thermodynamics Work and Heat Transfer", Longman.
3. Smith J. M., Van Ness H. C. and Abbott, "Introduction to Chemical Engineering Thermodynamics", M.M. Tata McGraw Hill.
4. Version S. I., Moran M. J. and Shapiro H. M., "Fundamentals of Engineering Thermodynamics", John Wiley.

**MI-102 Manufacturing Techniques**

**Cr:3(2-0-2)**

**Pre-requisite: NIL**

**Sem. Both**

**TH:2 PR:0**

**Introduction :** Engineering materials, their manufacturability and applications; **Casting :** Pattern materials, pattern types, allowances, molding sand, composition and properties, cores, casting defects and their remedies, plastic parts molding; **Machining:** Lathe, drilling, milling and grinding machines and their operations, cutting tools used; **Joining :** Welding fundamentals, types of welded joints, types of welding processes, gas welding process, manual metal arc welding, welding defects and remedies, Soldering and brazing, their applications in electronics industry; **Forming:** Forging, rolling, extrusion, wire drawing and tube drawing, sheet metal operations, forging defects and remedies; **Advance Manufacturing Process:** Introduction to advanced manufacturing technique and their application.

**References:**

1. De Garmo P. E., Black J.T., Kohser R. A., "Materials and Processes in Manufacturing": Prentice Hall of India Pvt. Limited.
2. Kalpakjian S., Schmid S. R., "Manufacturing Engineering and Technology": Pearson Education.
3. Groover M. P., "Fundamentals of Modern Manufacturing": John Wiley and Sons Inc.
4. Lindberg R. A., "Processes and Materials of Manufacture": Prentice Hall India Limited.

**PH-101 Physics-I**

**Cr:5(3-1-2)**

**Pre-requisite: NIL**

**Sem. Both**

**TH:3 PR:0**

**Vector Fields :** Vector transformation, Vector calculus, Divergence and curl in curvilinear coordinates. Divergence and curl of electrostatic fields, Electric potential, Laplace's and Poisson's equation, Divergence and curl of magnetic field, Magnetic vector potential; **Electromagnetic Waves :** Maxwell's equations. Conservation of charge and energy, Electromagnetic waves in vacuum and in matter, Polarized and unpolarized electromagnetic waves. Absorption and dispersion; **Special Relativity:** Postulates of special relativity, Lorentz transformation, Introduction to four-vectors, Time dilation, Doppler effect, Length contraction, Twin paradox, Relativistic momentum, Mass and energy, energy and

momentum, Relativity as bridge between electricity and magnetism, Magnetism as relative phenomenon (Qualitative discussion); **Wave Particle Duality and Quantization**: Blackbody radiation, photoelectric effect, Compton effect, DeBroglie waves, Electron Diffraction, Davisson –Germer experiment, Uncertainty principle. Bohr atom model and Sommerfeld corrections. Franck-Hertz experiment.

**Practicals:**

Measurement of magnetic susceptibility by Quinck's method; Determination of Planck's constant by photoelectric effect; Franck-Hertz Experiment; Single-slit, double slits and multiple slits diffraction by Laser; Determination of Planck's constant by radiation method; Stefan's constant; Magnetic field of paired coils in Helmholtz arrangement; Davisson – Germer Experiment

**References:**

1. David J. G., "Introduction to Electrodynamics", 3<sup>rd</sup> Ed., Prentice Hall of India
2. Arthur B., "Concepts of Modern Physics", 6<sup>th</sup> Ed., Tata McGraw-Hill.
3. Mathew N. O. S., "Elements of Electromagnetic", 3<sup>rd</sup> Ed., Oxford University Press
4. Feynman R. P., Leighton R.B. and Sands M., "The Feynman Lectures on Physics", Volume 1 & II, Narosa Publishing House.

**BM-201 Management Concepts & Practices** **Cr:3(2-1-0)**

**Pre-requisite:** NIL **Sem. Both** **TH:2 PR:0**

**Introduction to Management :** Evolution of Management Thought; Management Processes and Functions, Roles and Skills ; Understanding Organizational design and structure

**Marketing :** The concept of Marketing Mix of Product Policy and design, Pricing and Promotion; **Finance :** Finance function, Concept, Scope and its relationship with other Disciplines; Financial Statements, Financial Analysis, Management of Working Capital; **Human Resource Management :** Introduction ; Recruitment & Selection, Performance appraisal, Career Development; Operations, Manufacturing, Operations Planning and Control, Management of Supply Chain, Introduction to Materials Management, Systems and procedures for inventory Management; **Strategy :** Firm and its environment : Strategies for growth and diversification process of strategic planning Current and Emerging Trends.

**References:**

1. Kotler P., "Principles of Marketing," , Pearson Education.
2. Robbins S. P., "Organizational Behaviour : Concept Controversies and Applications", PHI.
3. Thomas S., Bateman and Scott A. S., "Management : Competing in the new era., Tata McGraw Hill.
4. Bhattacharyya A. K., "Financial Accounting for business managers Prentice Hall India", Prentice Hall of India.
5. "How to read a Balance Sheet, An ILO Programme Book I", Oxford & IBH Publishing Co. Pvt. Ltd.

**CE-201 Computer Aided Graphics** **Cr:2(1-0-2)**

**Pre-requisite:** NIL **Sem. Both** **TH:2 PR:0**

**Computer Aided Graphics :** Introduction and Applications Graphic Data file formats; Point and Line Generation Algorithms; Two Dimensional Coordinate Systems, Coordinate transformations; Two dimensional windowing and clipping; **Graphics Software :** Auto CAD, Microstation, MS Excel Spread Sheet Digitisation, Scanning and Animation

**Practical exercises on generation of simple 2 dimensional drawings:** plans, sections etc. charts and other figures. Digitisation

and scanning exercises. Editing and cleaning of drawings. Presentation of drawings.

**References:**

1. Foley, James, Andries van Dam, Steven F.r, Hughes J., "Computer Graphics: Principles and Practice", 2<sup>nd</sup> Ed., Addition – Wesley.
2. Hearn D. and Baker M. P, "Computer Graphics", 2<sup>nd</sup> Ed., Prentice Hall of India.
3. Daniel B. O. and Daniel B., "Computer Graphics for Design From Algorithms to Autocad", Prentice Hall of India.
4. Xiang Z. and Roy P., "Computer Graphics", Schaum's Outline Series, McGraw Hill Book Co.
5. User Manual, AutoCAD
6. User Manual, MS Excel

**CH-201 Energy Resources & Conservation** **Cr:2(2-0-0)**

**Pre-requisite:** NIL **Sem. Both** **TH:2 PR:0**

**Introduction:** Energy resources spectrum, Renewable and non Renewable energy Sources, consumption pattern in various sectors, Efficiency of energy resources, load demand, and economics; **Coal:** Classification, properties, combustion, carbonization, liquefaction and gasification, Electricity generation; **Liquid fuels:** various type of fuels, properties and handling; **Gaseous fuel:** CNG, LNG, and LPG; **Nuclear Energy:** Potential, Fusion and fission processes and nuclear reactor; **Wind:** potential and utilisation; **Solar Energy:** Solar radiation measurements, **Solar Thermal:** Flat plate and focusing collectors, solar space heating and cooling, solar pond, **Solar Photovoltaic:** Solar cells and storage; **Hydropower:** Types, components of hydropower generation systems; **Biomass:** Types, characterization, conversion routes, bio diesel; **New Energy:** Hydrogen, Fuel Cells, and other energy sources.

**References:**

1. "World Energy Outlook 2006", International Energy Agency, France
2. Electricity in India International Energy Agency, France
3. Twidel J. and Tonyweir, "Renewable Energy Resources", Second Edition, Taylor & Francis.
4. Manwell J. F., "Wind Energy Explained – Theory, Design & Application", Wiley.
5. Sukhatme S. P., "Solar Energy: Principles of Thermal Collection and Storage", 2<sup>nd</sup> Ed., Tata McGraw-Hill Publishing Company Ltd.
6. Takahashi, Peytrick and Trenka A., "Ocean Thermal Energy Conservation", Wiley.
7. Teddy, DIRECTORY, TERI, New Delhi.

**ES-201 Introduction to Geo-Science** **Cr:2(2-0-0)**

**Pre-requisite:** NIL **Sem. Spring** **TH:2 PR:0**

Earth, its place in Solar System, physical features of its surface, other basic features (mass, shape, size, density, etc.) and Earth's interior; Rocks and Minerals, gems and gemstones; Volcanoes, earthquakes and tsunamis, glaciers, landslides, mudflows and avalanches; Evolution of the Earth through ages; Remote Sensing, GIS and GPS; Mineral Exploration and Geophysical Exploration; Groundwater, Hydrocarbons and coal; Rock Deformation, Mining and Tunnelling; Geological Divisions of India, Plate Tectonics and the Himalayas.

**References:**

1. Press F. and Siever R., "Understanding the Earth", W.H. Freeman & Co.
2. Gass I. G., Smith P.J. and Wilson R. C. L., "Understanding the Earth", ELBS
3. Moore J. S. and Wicander R., " Physical Geology", Brooks/Cole Pacific Grove ,CA
4. William L., " Fundamentals of Geophysics", Cambridge University Press

**HS-201 Economics****Pre-requisite: NIL****Sem. Both****Cr:3(2-1-0)****TH:2 PR:0**

**Basic Concepts :** micro and macro economics, static and dynamic economics, equilibrium, utility, stock and flow, national income concepts, Indian Union Budget; **Consumer Behaviour :** demand, law of demand, elasticity of demand, consumer's equilibrium; **Production and Cost Analysis:** production functions, laws of returns and returns to scale, Isoquants – producer's equilibrium ; cost theory and functions, break-even analysis; **Pricing of Final Products : Pricing of Final Products :** marginal analysis approach – price and output determination under perfect and imperfect market conditions; Money and Capital markets; Inflation and Stabilization Policies; Balance of Payments and Foreign Exchange Market; WTO and Intellectual Property Rights.

under perfect and imperfect market conditions; Money and Capital markets; Inflation and Stabilization Policies; Balance of Payments and Foreign Exchange Market; WTO and Intellectual Property Rights.

**References:**

- 1.Koutsoyiannis A., "Modern Microeconomics" Macmillan Publishers.
- 2.Ahuja H. L., "Principles of Microeconomics", S. Chand Publishers.
- 3.Brian A., "Applied Economics (Ed.)", Macmillan Publishers
- 4.Evans J. D., "Managerial Economics : Theory, Practice and Problems", Prentice Hall.
- 5.Dutt R. and Sundharam K. P. M., "Indian Economy", S. Chand.
- 6.Mukerjee S., "Modern Economic Theory", New Age International Publishers.
- 7.Vasudeva P. K., "World Trade Organization : Implications for Indian Economy", Pearson Education.

**MI-201 Solid Mechanics****Pre-requisite: NIL****Sem. Autumn****Cr:4(3-1-0)****TH:3 PR:0**

**Concept of Stress and Strain:** Concept of stress ; normal stress and shear stress : nine Cartesian components of stress at a point, sign convention and notation, equality of shear stresses on mutually perpendicular planes and their planes of action, stress circle. Concept of strain, normal and shear strain, two dimensional state of principal strains, Poisson's ratio, volumetric strain, strain circle; **Stress-Strain Relationship:** Hooke's law and its application to isotropic materials, elastic constant and their relationships, plane stress and conditions; **Mechanical Properties:** Uniaxial tension test to determine yield and ultimate strength of materials, uniaxial stress-strain diagram, proof stress, ductile and brittle materials, hardness and impact strength Conditions affecting mechanical behaviour of engineering materials; **Members in Uniaxial State of Stress:** Uniform cross section and tapered bars subjected to uniaxial tension and compression, composite bars and statically indeterminate bars, thermal stresses, introduction to plasticity concepts; **Members Subjected to Axi-Symmetric Loads:** Stresses and strains in the cylindrical shells and spheres under internal pressure stresses in thin rotating rings; **Materials Subjected to Torsional Loads:** Torsion of solid and hollow circular shafts, stepped and composite shafts, close-coiled helical springs subjected to axial loads; **Members Subjected to Flexural Loads:** Statically determinate beams, support reactions, relationship between load, shear forces and bending moment, shear force and bending moment diagrams. Theory of flexure for initially straight beams, distribution of bending, normal and shearing stresses across the beam cross-section ; principal stresses in beams stress in composite and built-up beams. Equation of elastic curve for the loaded beam, relationship between bending moment, slope and deflection. Calculation of deflection by integration moment area, and unit-load methods.

**References:**

- 1.Timoshenko and Gere, "Mechanics of Materials", Van Nostrand Reinhold.
- 2.Crandall, Dahi and Lardner, "A Introduction to the Mechanics of Solids", McGraw Hill Kogakusha Ltd.
- 3.Hearn E. J., "Mechanics of Materials" , Pergamon.
- 4.Ohlden, Stiles, Weese and Riley, "Mechanics of Materials", Higdon, John Wiley
- 5.Nagarajan P. and Lu, "Mechanics of Materials", Prentice-Hall of India.

**MT-201A Material Science-A****Pre-requisite: NIL****Sem. Autumn****Cr:4(3-1-2/2)****TH:3 PR:0**

**Crystal and Crystalline Defects:** Point line and planet defects, surfaces and properties, stoichiometry, non-stoichiometry and defects structur; **Solid Solutions and Two-phase Solids:** Isomorphous alloys, phase diagrams and binary eutectic phase diagram of Pb-Sn alloys; **Electrical and Thermal Conduction in Solids:** Drude model, temperature dependence of resistivity of metals, Mathiessen's rule, resistivity of two-phase ag-Ni alloy and electrical contacts, electrical conductivity of semi-conductors, ionic crystals and glasses; **Semi-conductors:** Energy band and intrinsic semi-conductors, electrons and holes, extrinsic semi-conductors, temperature dependence of conductivity, recombination and minority carrier injection, diffusion and conduction equations, continuity equation, optical absorption, luminescence, Schottky junctions, Ohmic contacts and thermo-electric coolers; **Dielectric Materials and Insulation:** Matter polarization and relative permittivity, electronic polarization, polarization mechanisms, dielectric constant and dielectric loss, dielectric strength and insulation breakdown, capacitor dielectric materials, piezoelectricity, ferroelectricity and pyroelectricity; **Magnetic Materials:** Magnetization of matter and classification of magnetic materials, origin of ferromagnetism and exchange interaction, saturation magnetization and curie temperature, magnetic domains in ferromagnetic materials, soft and hard magnetic materials.

**Referneces:**

- 1.Askeland D. R., "The Science and Engineering of Materials", 3<sup>rd</sup> Ed., PWS Publishing Co.
- 3.Callister W. D., "Materials Science and Engineering and Introduction", 5<sup>th</sup> Ed., Jr. John Wiley & Sons, Inc.
- 4.Kasap S. O., "Principles of Electronic Materials and Devices", 2<sup>nd</sup> Ed., Tata McGraw Hill.

**MT-201B Material Science-B****Pre-requisite: NIL****Sem. Spring****Cr:4(3-1-0)****TH:3 PR:0**

**Introduction to Crystallography:** Crystal defects, Point defects line defects, dislocations surface defects and volume defects; **Principles of Alloy Formation :** Primary and intermediate phases, their formation, solid solutions, Hume Rothery rules; **Binary Equilibria:** Binary phase diagrams involving isomorphous, eutectic, peritectic and eutectoid reactions. Phase rule, lever rule, effect of non-equilibrium cooling on structure and distribution of phases. Some common binary phase diagrams viz : Cu-Ni, Al-Si, P-Sn, Cu-Zn, Cu-Sn and Fe-C and important alloys belonging to these systems; **Mechanical Properties :** Hardness, Tensile Properties, Fracture-ductile and brittle, ductile-brittle transition; Introduction to fatigue and creep properties, creep resistant materials, super alloys, nimonics, inconel; **Heat Treatments:** Basic principles of steel, TTT and CCT diagrams, common heat treatments like annealing, normalizing, quenching (hardening) and tempering, Matempering and austempering; Heat treatment of non-ferrous alloys: precipitation hardening; Surface hardening: Flame hardening, Induction hardening and chemical hardening; **Engineering Materials :** Ferrous

materials, classification of steels and their applications, non-ferrous materials: Al, Cu, Mg and Ti based alloys; **Advanced materials:** Composite Materials: Introduction, types of composite materials, factors affecting properties of composite materials, polymeric materials: Introduction to polymeric materials, processing of plastic materials; Types of plastic and their applications; Ceramic materials: Introduction, structure and properties of ceramics, application and processing of ceramics, advanced ceramics.

#### References:

1. Raghavan V., "Materials Science and Engineering- A first Course", 4<sup>th</sup> Ed., Prentice Hall of India.
2. Askeland D. R., "The Science and Engineering of Materials", 3<sup>rd</sup> Ed., PWS Publishing Co.
3. Callister W. D., "Materials Science and Engineering and Introduction", 5th Ed., Jr. John Wiley & Sons, Inc.
4. Sidney H. A., "Introduction to Physical Metallurgy", McGraw Hill Book Company.
5. Azaroff L. V. and Brophy J. J., "Electronic Processes in Materials", McGraw Hill Book Company.
6. Raghavan V., "Physical Metallurgy: Principles and Practice", Prentice Hall of India.

#### PH-201 Physics-II

Pre-requisite: NIL

Sem. Both

Cr:3(3-0-0)

TH:2 PR:0

**Elements of Quantum Mechanics:** Basic postulates of quantum mechanics and meaning of measurement, Schrodinger wave equation, idea of wave function, expectation values, stationary states, particle in a box, finite potential well, potential barrier and tunneling one dimensional harmonic oscillator; **Atomic Structure:** Hydrogen atom (qualitative), angular momentum quantization, space quantization, electron spin, Stern –Gerlach experiment, vector atom model, fine structure of H $\alpha$  line; **Photonics:** Distribution function of classical and quantum particles, Elements of classical and quantum statistics, Basic ideas of laser and its properties, Einstein's A and B coefficients, ruby laser, He-Ne laser, basic idea of holography, optical fiber for telecommunication; **Solid State physics:** Crystal structure, Free electron theory of metals, electron in a periodic potential, Kronig-Penny Model, effective mass, origin of the energy gap, band theory of solids, classification solids into metal, semiconductor and insulators, magnetic properties of solids. Concepts of electrons confinement in low dimensions, quantum wells and superlattices leading to nanodevices. Essential properties of superconductors, zero resistivity, Meissner effect, isotope effect, heat capacity, Energy gap, Type-I & II superconductors, Levitation; **Nuclear Structure:** Binding energy and stability of nuclei, Liquid drop model and shell model, applications in nuclear energy.

#### References:

1. Beiser A., "Concepts of Modern Physics", Tata McGraw-Hill.
2. Laud B.B., "Lasers and Nonlinear Optics" Wiley Eastern.
3. Kittel C., "Introduction to Solid State Physics", John Wiley.
4. Lilley, "Nuclear Physics – Principles and Applications", John Wiley
5. Mani and Mehta, "Introduction to Modern Physics" Affiliated East West Press
6. Feynman R. P., Leighton R. B. and Sands M., "The Feynman Lectures on Physics Volume III", Narosa Publishing House.
7. Thornton S. T. and Rex M. A. "Physics for Scientists & Engineers", 2<sup>nd</sup> Ed., Sanders College Pub.

#### CY-201M Physical Chemistry-I

Pre-requisite:CY-101

Sem. Autumn

Cr:3(2-1-0)

TH:2 PR:0

**Colloidal State:** Introduction, coagulation, kinetics of coagulation, sensitization, protection, stability of sols, electrophoresis, electro osmosis, origin of charge, determination of charge and zeta potential, emulsions, gels, Liesegang ring phenomenon, sol-gel transformation, thixotropy; **Chemical Kinetics:** Introduction to its concepts, differential and integrated rate expressions for various reactions, methods for studying the kinetics of reactions, theories of reaction rates, complex reactions; **Phase Rule:** Concepts and derivation of phase rule, phase diagrams of 1,2 and 3 component systems, Lever rule; **Electrochemistry:** Introduction, anomaly of strong electrolytes, interionic attraction theory, Debye – Hückel – Onsager equation, Wein effect, Debye – Falkenhagen effect, types of electrodes, galvanic cells, liquid junction potential, concentration cells with and without transference, polarization, decomposition voltage, over voltage; **Phase Rule:** Concepts and derivation of phase rule, phase diagrams of 1, 2 and 3 component systems, Lever rule; **Electro - chemistry:** Introduction, anomaly of strong electrolytes, interionic attraction theory, Debye – Hückel – Onsager equation, Wein effect, Debye – Falkenhagen effect, types of electrodes, galvanic cells, liquid junction potential, concentration cells with and without transference, polarization, decomposition voltage, over voltage.

#### References:

1. Levine I. N., "Physical Chemistry", 5<sup>th</sup> Ed., Tata McGraw-Hill Publishing Company Ltd.
2. Silbey R. J. and alberty R. A., "Physical Chemistry", 3<sup>rd</sup> Ed., John Wiley and Sons, Inc.
3. Atkins P. W., "Physical Chemistry" 6<sup>th</sup> Ed., Oxford University Press.

#### CY-202M Basic Inorganic Chemistry

Pre-requisite:CY-101

Sem. Autumn

Cr:3(2-1-0)

TH:2 PR:0

Periodic trends and its relation to chemical bonding and reactivity; **Introduction to Molecules and their Chemical Bonding:** Simple molecules, macromolecules and supramolecules. **Ionic Bonding:** Energetics of ionic bond, and lattice energy. **Covalent Bonding:** Energetics of covalent bond in hydrogen molecule –valence bond theory, VSEPR concept and hybridization (involving s, p, d orbitals) and shapes of molecules of higher (5, 6 and 7) co-ordination numbers, elementary ideas of molecular symmetry; Molecular orbital theory of both homo- and hetero-nuclear diatomic molecules, resonance and delocalized molecular orbitals; H-bonding, inter- and intramolecular and their effects; Weak intermolecular forces; **Metallic Bonding:** band model, soft X-ray spectra and N(E) curves, binding energy in metals, conductors, semiconductors and insulators, effect of temperature and impurity on conductivity; **Representative Chemistry of Main group Elements:** solvated electron in alkali metals, multicentre bonds; structures, bonding and applications – boron halides, diborane, tetraborane, borazines, boronitrides, crown ethers, carbides, fullerenes, fluorocarbons, silicon halides, silicates, siloxanes, silicon polymers, phosphonitric halides, synthesis, structures and reactivity of compounds of xenon, bonding in xenon fluorides; **Principles and Applications of Transition Metal Chemistry:** Variable valency, colour, spectral, magnetic and catalytic properties, ability to form complexes, stability constant of coordination compounds, importance of transition metals in biological systems and in medicine; **Lanthanides and Actinides:** Separation and isolation of lanthanides, separation of Np, Pu and Am from U, comparison of lanthanides and actinides, and their applications in technology; **Introduction of Metal Ions in Medicine and Materials:** Preliminary ideas on bio-inorganic chemistry, oxygen

transport and storage, metalloenzymes.

**References:**

- 1.Greenwood N. N. and Earnshaw A., "Chemistry of the Elements", 2<sup>nd</sup> Ed., Butterworth Heinemann, Oxford.
- 2.Cotton F. A., Wilkinson G. and Gaus P. L., "Basic Inorganic Chemistry", 3<sup>rd</sup> Ed., John Wiley & Sons.
- 3.Shriver D. F. and Atkins P. W., "Inorganic Chemistry", 3<sup>rd</sup> Ed., Oxford University Press
- 4.Huheey J. E., Keiter E. A. and Keiter R. L., "Inorganic Chemistry, Principles of Structure and Reactivity", 4<sup>th</sup> Ed., Pearson Education Asia.
- 5.Cotton F. A., Wilkinson G. Murillo C. A. and Bochmann M., "Advanced Inorganic Chemistry", 6<sup>th</sup> Ed., John Wiley & Sons.

**CY-203M Organic Chemistry-I** **Cr:3(2-1-0)**  
**Pre-requisite:CY-101** **Sem. Spring** **TH:2 PR:0**

**Nature of Bonding in Organic Molecules:** Delocalised chemical bond, hyperconjugation, tautomerism, hydrogen bonding, aromaticity of benzenoid and nonbenzenoid compounds, Hückel rule, energy levels of pi-molecular orbitals in simple systems. Brief discussion on the strength of organic acids and bases; **Stereochemistry:** Configuration and chirality, optical isomerism of compounds containing chiral centres optical isomerism of compounds without chiral centres (allenes, spiro compounds, diphenyl derivatives, and compounds containing exocyclic double bonds), R, S- convention. Prochirality, enantiotopic and diastereotopic groups, methods of resolution. Geometrical isomerism in acyclic, cyclic, condensed and bridged systems and oximes (Beckmann rearrangement) E, Z- convention; **Reactive Intermediates:** General methods of generation, their reactivity and stability; **Aliphatic Substitution:** SN<sub>1</sub>, SN<sub>2</sub> and SNi mechanisms, stereochemistry, relative reactivity in substitutions, effect of substrate structure, attacking nucleophile, leaving group and reaction medium, neighbouring group participation, competitive reactions. Introduction to SE<sub>1</sub>, SE<sub>2</sub> and SEi reactions; **Elimination Reactions:** Introduction, discussion of E<sub>1</sub>, E<sub>2</sub>, E<sub>1</sub>CB and E<sub>2</sub>C mechanisms, stereochemistry, relative reactivity in elimination, effect of substrate structure, attacking nucleophile, leaving group and reaction medium, competitive reactions, orientations/orientation of the double bond, Saytzeff and Hoffman rules, beta-eliminations (Fritsch-Buttenberg-Wiechell rearrangements).

**References:**

- 1.Sykes P., "Guide book to Mechanism in Organic Chemistry", Orient Longman.
- 2.Morrison R. T. and Boyd R. N., "Organic Chemistry", 6<sup>th</sup> Ed., Prentice Hall of India.
- 3.March J., "Advanced Organic Chemistry", John Wiley & Sons.
- 4.Eliel E. L., "Stereochemistry of Carbon Compounds", Tata McGraw Hill.

**MA-201M Complex Analysis and Partial Differential Equations.** **Cr:4(3-1-0)**  
**Pre-requisite:MA-101** **Sem. Autumn** **TH:3 PR:0**

**Functions of a Complex Variable:** Limits, continuity and differentiability of functions of a complex variable: Analytic functions. Conjugate harmonic functions, Applications to the problems of potential flow; **Conformal Transformations:** Conformal mapping, mapping by elementary functions, Bilinear transformations, Schwarz-Christoffel transformation and their applications; **Infinite Series of Complex Numbers and Functions:** Convergence and uniform convergence of series of complex numbers and functions. Properties of power series, radius of convergence; **Complex Integration:** Line integrals of complex valued functions, Cauchy integral theorem

and integral formulae. Liouville's theorem, fundamental theorem of algebra, maximum modulus principle. Taylor's and Laurent's expansions. Zeros and singularities. Cauchy residue theorem. Contour integration and its application; **Partial Differential Equations:** Solution of first order quasi linear partial differential equations, four standard forms of PDE, solution of first order non-linear PDE using Charpit's method, solution of linear equations with constant coefficients, classification of second order PDE, solution of one dimensional wave and diffusion equation, Laplace equation in 2 and 3 dimensions.

**References:**

- 1.Brown J. A. and Churchill R. V., "Complex variables and Applications", 6<sup>th</sup> edition, Mc Graw Hill.
- 2.Kreyszig E., "Advanced Engineering Mathematics", John Wiley and Sons.
- 3.Grawal B. S., "Higher Engineering Mathematics", Khanna Publishers.
- 4.Sneddon I. N., "Elements of Partial Differential Equations", McGraw Hill.

**MA-202M Numerical Analysis** **Cr:4(3-1-0)**  
**Pre-requisite:MA-101** **Sem. Spring** **TH:3 PR:0**

**Error Analysis:** Types of errors, propagation of errors, correct and significant digits; **Roots of Non-linear Equations:** Bisection method, Regula-falsi method, modified regula-falsi method, Atkin's, Newton-Raphson method, direct iterative method with convergence criteria. Extension of Newton-Raphson method to the solution of non-linear equations in two or more variables; **System of Linear Equations:** Gauss elimination method without and with partial pivoting. Crout's and Doo Little methods, Jacobi, Gauss-Seidel and Successive Over Relaxation Iterative methods with their convergence; **Eigen Values and Eigen Vectors:** Dominant and smallest eigen values and eigen vectors by power method. Solution of homogeneous equations; **Interpolation:** Finite difference operators, difference tables and interpolation formulae- Newton's forward and backward, Stirling and Bessel formulae. Newton's divided difference, Lagrange's interpolation formulae. Errors in various formulae (without proof), Cubic spline interpolation, Inverse interpolation- successive approximation and Lagrange's method; **Numerical Differentiation:** Various formulae for first and second order derivatives; **Numerical Integration:** Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration and Gaussian quadrature formulae, errors in various integration rules; **Solution of First and Second Order Ordinary Differential equations:** Second and fourth order Runge-Kutta methods, Milne's, Adams-Bashforth methods, Predictor-Corrector method with errors. Solution of two-point boundary value problems by shooting and finite difference methods.

**References:**

- 1.Gerald C. F. and Wheatley P. O., "Applied Numerical Analysis", 6<sup>th</sup> Ed., Wesley.
- 2.Jain M. K., Iyengar S. R. K. and Jain R. K., "Numerical Methods for Scientific and Engineering Computation", New Age Pvt. Pub,
- 3.Conte S. D. and De Boor C., "Elementary Numerical Analysis", Koga Kusha.
- 4.Krishnamurthy E. V. and Sen S. K., "Applied Numerical Analysis", East West Publication

**MA-203M Mechanics-I** **Cr:4(3-1-0)**  
**Pre-requisite:Nil** **Sem. Autumn** **TH:2 PR:0**

**Moment of Inertia :** Moment of Inertia of particles and solids of standard shapes. Centre of gravity; **Thin Beams and Flexible**

**Cables:** Tension, Shearing force and Bending moment, general formulae for flexible cables hanging freely, common catenary, frames; **Virtual Work:** Infinitesimal displacement of rigid body parallel to fixed plane; Principle of virtual work, work and potential energy; **Stable and Unstable Equilibrium:** Potential energy, minimum energy principle for stable equilibrium, simple problems of stable equilibrium; **Kinematics of Particle and system:** Rectangular; Radial; transversed; tangential and normal velocities and accelerations, angular velocity and acceleration, principle of energy and angular momentum for a particle and a system; **Rectilinear Motion:** Motion with variable accelerations, harmonic oscillators, damped and forced oscillations; **Constrained Motion:** Motion of a particle in a vertical circle (inside and outside), in a cycloid, along a smooth plane curve; **Central Orbit:** Differential equation of a central orbit, law of force, velocity and periodicity for a given central orbit and the equation of orbit for a given law. Stability of a circular orbit. Planetary orbits, Keplers laws

#### References:

1. Shames I. H., "Engineering Mechanics: Statics and Dynamics", Prentice Hall of India.
2. Synge J. L. and Griffith, "Principle of Mechanics", Mc Graw Hill
3. Beer F. P. and Johnston E. R., "Vector Mechanics for Engineers", Tata Mc Graw Hill.

#### MA-204M Linear Algebra

Pre-requisite: Nil

Sem. Spring

Cr:4(3-1-0)

TH:3 PR:0

**System of Linear algebraic Equations:** Elementary row operations, row-reduced echelon form, Invertible matrices and their applications; **Vector Spaces:** Definition of vector space, subspace, sum of subspaces, linear independence and dependence, basis and dimensions, infinite dimensional spaces, coordinates; **Linear Transformations:** Definition, rank-nullity theorem, matrix representation, algebra of linear transformation, change of basis, solution of linear system  $AX=b$ . Applications to differential equations; **Canonical Forms:** Characteristic equation, eigen values, eigen vectors, properties, diagonalization, minimal polynomial, Cayley-Hamilton theorem, generalized eigen vector, Jordan form, computation of matrix exponent; **Inner Product Spaces:** Cauchy-Schwartz inequality, triangular inequality, ortho-normal basis, Gram-Schmidt process; **Special Matrices/Operators:** Hermitian, normal, unitary and projection operators, bi-linear, quadratic and Hermitian forms.

#### References:

1. Hoffmann and Kunze R., "Linear Algebra", Prentice Hall of India
2. Charles W., "Linear Algebra", Sprunge Verlag
3. Halmos P. R., "Finite Dimensional Vector Spaces", Springer Verlag.
4. Peter J., Olver and Shakivban C., "Applied Linear Algebra", Prentice Hall.
5. Dutta K. B., "Matrix and Linear Algebra", Prentice Hall of India.

#### PH-201M Optics

Pre-requisite: PH-101

Sem. Autumn

Cr:5(3-1-2)

TH:3 PR:0

**Waves and Oscillations:** Simple harmonic motion, damped oscillations, forced vibrations, origin of refractive index, wave packet, group velocity of a wave packet, pulse dispersion, wave propagation, energy transport in wave motion, 1-D wave equation and its general solution, stationary light waves, Ives and Wiener's experiments; **Geometrical optics:** Fermat's principle, the ray equation and its solutions, matrix method in paraxial optics, unit planes, nodal planes, system of thin lenses; **Interference:** Huygen's principle and its applications, interference by division of

wavefront, two slit interference, Fresnel's biprism, interference with white light, displacement of fringes, interference by division of amplitude, thin parallel films, antireflection coatings, wedge shaped films, Newton's rings, Michelson interferometer and its applications, multiple beam interference, Fabry Perot interferometer and etalon; **Diffraction:** Fraunhofer diffraction, single, double and multiple slit diffraction, diffraction grating, diffraction at a circular aperture, Fresnel diffraction, Fresnel half period zones, the zone plate, diffraction at a straight edge, diffraction of a plane wave by a long narrow slit and transition to Fraunhofer region; **Polarization:** Polarization and double refraction, production of polarized light, Brewster's law, Malus's law, double refraction, interference of polarized light, optical activity, polarimeters, Laurent's half shade and biquartz polarimeters, Wollaston prism, Rochon prism, plane wave propagation in anisotropic medium, ray velocity and ray refractive index, Faraday rotation.

#### References:

1. Ghatak A., "Optics", 3<sup>rd</sup> Ed., Tata McGraw Hill.
2. Hecht A. W., "Optics", 4<sup>th</sup> Ed., Pearson Education.
3. Jenkins F. A. and White H E., "Fundamentals of Optics", McGraw Hill Book Company.
4. Mathur B. K. and Pandya G., "Geometrical and Physical Optics", Gopal Printing Press.

#### PH-202M Electricity and Magnetism

Pre-requisite: PH-101

Sem. Spring

Cr:5(3-1-2)

TH:3 PR:0

**Electrostatics:** Charge distributions, potential, two dimensional potential problem, electric field, Gauss's law with examples, electrostatic energy, Laplace equation (boundary value problems), method of images, multiple expansion, dielectrics, polarization, electric displacement vector, dielectric susceptibility, force on dielectrics, Clausius-Mossotti equation, boundary conditions; **Magnetostatics:** Biot-Savart law, Ampere's law, magnetic scalar and vector potentials, multipole expansion, dia-, para- and ferromagnetism, magnetic susceptibility, boundary conditions; **Electromagnetics:** Faraday's Law of induction, self-inductance, transient currents, magnetic energy and mechanical forces, Maxwell equations, Plane waves in conducting medium and skin effect, Refraction and reflection of plane wave, Pressure due to radiation and Radiation from an oscillating dipole.

**Practicals:** 1. To determine the self-inductance of a given coil; 2. To find the resonant frequency of series LCR circuit; 3. To obtain hysteresis curve (B-H Curve) for a given ferromagnetic material; 4. To study transient effect in LCR circuits; 5. To measure the dielectric constant and dielectric loss of given material by using LCR metre; 6. To measure the magnetic flux density in the middle of various wire loops with the Hall probe and to investigate its dependence on the radius and number of turns; 7. To measure the magnetic flux density along the axis of long coils and compare it with the theoretical values obtained from Biot-Savart's Law.

#### References:

1. Bleaney B. I. and Bleaney B., "Electricity and Magnetism", Vol. 1, Oxford University Press.
2. Panofsky K H. and Phillips M., "Classical Electricity and Magnetism", Addison Wesley Publication Company.
3. Griffiths D. J., "Introduction to Electrodynamics", Prentice Hall of India.
4. Purcell E. M., "Physics Course", Vol. II, Berkeley,
5. Feynman R. P., Leighton R. B. and Sands M., "The Feynman Lectures on Physics", Vol. II, Narosa Publishing House.

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Civil Engineering	A.K. Jain	285219
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Electrical Engineering	Vinod Kumar	285231
Electronics & Computer Engg.	S.N. Sinha	285235
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Hydrology	Himanshu Joshi	285236
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Mathematics	Rama Bhargava	285249
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