सीनेट की 48वीं बैठक का कार्यवृत्त

MINUTES OF THE 48TH MEETING OF THE SENATE

20 अप्रैल 2013

20TH APRIL 2013

भारतीय प्रौद्योगिकी संस्थान रूड़की

रूड़की – 247 667 (भारत)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

ROORKEE – 247 667 (INDIA)

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE
ROORKEE-247 667 (INDIA)

Minutes for the 48th meeting of the Senate held on 20th April 2013 at 10.00 A.M. in the Senate Hall of the Institute.

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MEETING SECTION
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Minutes of the 48th Meeting of the Senate held on 20th April 2013 in the Senate Hall of the Institute.

Following were present:

1.	Prof. Pradipta Banerji	Director & Chairman
2.	Prof. S.P. Gupta	Dy. Director
3.	Prof. R. Shankar	(Architecture & Planning)
4.	Prof. S.Y. Kulkarni	(Architecture & Planning)
5.	Prof. (Mrs) Pushplata	(Architecture & Planning)
6.	Prof. (Mrs) Ritu Barthwal	(Biotechnology)
7.	Prof. G.S. Randhawa	(Biotechnology)
8.	Prof. R.P. Singh	(Biotechnology)
9.	Prof. Ramasare Prasad	(Biotechnology)
10.	Prof. I.M. Mishra	(Chemical Engineering)
11.	Prof. Bikash Mohanty	(Chemical Engineering)
12.	Prof. Vijay Kumar Agarwal	(Chemical Engineering)
13.	Prof. Ravi Bhushan	(Chemistry)
14.	Prof. Anil Kumar	(Chemistry)
15.	Prof. (Mrs.) Mala Nath	(Chemistry)
16.	Prof. U.P. Singh	(Chemistry)
17.	Prof. M.R. Maurya	(Chemistry)
18.	Prof. S.S. Jain	(Civil Engineering)
19.	Prof. M.N. Viladkar	(Civil Engineering)
20.	Prof. Deepak Kashyap	(Civil Engineering)
21.	Prof. Pradeep Kumar	(Civil Engineering)
22.	Prof. Pradeep Bhargava	(Civil Engineering)
23.	Prof. Satish Chandra	(Civil Engineering)
24.	Prof. S.K. Ghosh	(Civil Engineering)
25.	Prof. Manoj K. Arora	(Civil Engineering)
26.	Prof. M. Parida	(Civil Engineering)
27.	Prof. N.K. Samadhiya	(Civil Engineering)
28.	Prof. Akhil Upadhyay	(Civil Engineering)
29.	Prof. Z. Ahmad	(Civil Engineering)
30.	Prof. Ashwani Kumar	(Earthquake Engineering)
31.	Prof. Yogendra Singh	(Earthquake Engineering)
32.	Prof. A.K. Saraf	(Earth Sciences)

33. Prof. R.G.S. Sastry (Earth Sciences)
34. Prof. (Mrs) Sagarika Mukhopadhyay (Earth Sciences)
35. Prof. A.K. Sen (Earth Sciences)
36. Prof. Vinod Kumar (Electrical Engineering)
37. Prof. Pramod Agarwal (Electrical Engineering)
38. Prof. S. Mukherjee (Electrical Engineering)
39. Prof. S.P. Singh (Electrical Engineering)
40. Prof. R.S. Anand (Electrical Engineering)
41. Prof. A.K. Sarje (Electronics & Communication Engg.)
42. Prof. Padam Kumar (Electronics & Communication Engg.)
43. Prof. Manoj Mishra (Electronics & Communication Engg.)
44. Prof. M.J. Nigam (Electronics & Communication Engg.)
45. Prof. Dharmendra Singh (Electronics & Communication Engg.)
46. Prof. Pashupat Jha (Humanities & Social Sciences)
47. Prof. (Mrs.) Rashmi Gaur (Humanities & Social Sciences)
48. Prof. A.K. Singh (Paper Technology)
49. Prof. S.P. Singh (Paper Technology)
50. Prof. Y.S. Negi (Paper Technology)
51. Prof. Dharm Dutt (Paper Technology)
52. Prof. S.P. Sharma (Mathematics)
53. Prof. T.R. Gulati (Mathematics)
54. Prof. (Mrs) Rama Bhargava (Mathematics)
55. Prof. R.C. Mittal (Mathematics)
56. Prof. V.K. Katiyar (Mathematics)
57. Prof. Roshan Lal (Mathematics)
58. Prof. (Mrs.) Kusum Deep (Mathematics)
59. Prof. Pradeep Kumar (Mechanical & Industrial Engg.)
60. Prof. Satish C. Sharma (Mechanical & Industrial Engg.)
61. Prof. P.K. Jain (Mechanical & Industrial Engg.)
62. Prof. B.K. Gandhi (Mechanical & Industrial Engg.)
63. Prof. Ravi Kumar (Mechanical & Industrial Engg.)
64. Prof. R.P. Gakkhar (Mechanical & Industrial Engg.)
65. Prof. S.K. Nath (Metallurgical & Materials Engg.)
66. Prof. Anjan Sil (Metallurgical & Materials Engg.)
67. Prof. A.K. Jain (Physics)
68. Prof. Rajesh Srivastava (Physics)
69. Prof. Vir Singh (Physics)
70. Prof. M.L. Kansal (WRD&M)
71. Prof. Deepak Khare (WRD&M)
72. Prof. Girishwar Misra, University of Delhi
73. Dr. S.N. Rangnekar, Head, Department of Management Studies
74. Dr. C.B. Majumdar, Associate Dean, SRIC
75. Mr. Yogendra Singh, Librarian, Central Library
76. Dr. R.D. Garg, Associate Professor, Department of Civil Engineering
77. Lt. Col. (Retd) A.K. Srivastava, Registrar & Secretary, Senate

The Chairman (Director) welcomed the members to the 48th Meeting of the Senate.

At the outset, the Chairman thanked the following outgoing members of the Senate and recorded its appreciation for their valuable contribution in the meetings of the Senate.

1. Prof. Surendra Kumar, Department of Chemical Engineering
2. Prof. S.N. Sinha, Department of Electronics & Communication Engineering

The Chairman also welcomed Dr. R.D. Garg, Associate Professor, Department of Civil Engineering and Chief Warden, Jawahar Bhawan as the new member to the Senate and hoped for his valuable contributions and active participation in its functioning:

The Senate noted the communication received from the following member for not attending the current meeting.

1. Prof. V.K. Gupta, Department of Chemistry.
2. Prof. (Mrs.) Renu Bhargava, Department of Civil Engineering
3. Prof. M.L. Sharma, Department of Earthquake Engineering

The Agenda was then taken up:

Item No. 48.1: **To confirm the minutes of the 47th meeting of the Senate held on 18.02.2013.**

The minutes of the 47th meeting of the Senate held on 18.02.2013 were confirmed.

Further, Senate noted the comments received from Prof. V. K. Agarwal, Prof. Anil Kumar, Prof. D. K. Nauriyal and Prof. P. Jha on the recording minutes of 47th meeting of the Senate in respect of item No. 47.4.

Item No.48.2: **To receive a report on the actions taken to implement the decisions taken by the Senate in its 47th meeting held on 18th February 2013.**

The Senate noted the action taken on the resolutions of the 47th meeting of the Senate held on 18th February 2013.

Item No. 48.3: **To consider if the students of M. Tech and MCA Courses (except sponsored) students be allowed to leave the programme to join their jobs etc. one completion of all the course work requirements including back paper(s), if**

any and to complete the dissertation and the seminar afterwards at the work places.

The Senate decided that the students of various M.Tech. programmes may be permitted to leave the programme on completion of course work requirements including back paper(s), in case they have to take up a job. The seminar or dissertation work or both can be completed by the student later at their work place. A similar facility may be extended to the students of the M.Tech Programme in Chemistry, Physics, Nanotechnology and M.C.A. on completion of their course work including back paper(s). The fulfilment of the rest of the requirements remain the same. The minimum time for completion of the seminar and dissertation work shall be one year and the entire requirements of the Postgraduate Programme shall have to be successfully completed in three years from the date of initial registration. However, this shall not be applicable to sponsored full-time students.

Item No. 48.4: To consider the change of educational qualifications for admission to Ph.D programmes at Saharanpur Campus

As considered and recommended by the IARC, The Senate decided that the educational qualifications for admission to Ph.D programmes at the Saharanpur Campus be revised as under:

Department of Applied Science & Engineering:

(i) M.Sc. in Physics, Mathematics, Applied Mathematics, Statistics, Chemistry, Material Science, Nanomaterials, Nanoscience and Nanotechnology or its equivalent degree (with Mathematics as one subject at the Bachelor's level).

(ii) MA, M.Com., MBA, or its equivalent degree.

(iii) B.E./B.Tech./M.E./M.Tech. in Mechanical Engg., Material Science or its equivalent degree, Metallurgical Engg., Biotechnology, Nanotechnology, Solid State Technology, Chemical Engineering, Computer Science or its equivalent degree.

Department of Paper Technology:

(i) B.E./B.Tech./M.E./M.Tech. in Pulp & Paper Engineering, Chemical Engineering, Mechanical Engineering, Environmental Engineering, Electrical Engineering,

Electronics & Communication Engineering, Computer Science/ Engineering, Instrumentation Engineering, and VLSI Engineering, Information Technology, Biotechnology, Material Science or its equivalent degree.

(ii) M.Sc. in Chemistry, Environmental Science, Biotechnology, Botany or its equivalent degree (with Mathematics as one subject at the Bachelors level)

Department of Polymer and Process Engineering:

(i) B.E./B.Tech./M.E./M.Tech. in Polymer, Chemical, Process Engg., Environmental Engg., Biotechnology, Nanotechnology, Computer Science or its equivalent degree.

(ii) M.Sc. in Chemistry, Medical Sciences or equivalent, Biotechnology, Physics, Mathematics, Microbiology or its equivalent Degree (with Mathematics as one subject at Bachelors level)

Item No. 48.5: **To consider and approve the Syllabi of under mentioned 04 (Four) Institute Elective courses as proposed by Department of Management Studies under HSSMEC group.**

The Senate approved the IAPC recommended syllabi of the following courses as given at **Appendix 'A'** after incorporating the suggestions given by the Senators on the floor:

IBM-03 : Cross Cultural Management
IBM-04 : Strategic Human Resource Management
IBM-05 : Management of Self and Interpersonal Dynamics
IBM-08 : Fundamentals of Innovation and Business Models

Item No. 48.6: **To consider and approve the Structure and Syllabi of B. Tech. (Polymer Science & Technology) programme as proposed by Department of Polymer Science & Process Engineering, Saharanpur Campus, vide letter No. 3007/IITR/SC dated 11.2.2013.**

As recommended by the IAPC, the Senate decided that the modified Structure and Syllabi of 2nd year B. Tech. (Polymer Science & Technology) programme of the Department of Polymer Science & Process Engineering, as given at **Appendix 'A1'**, be approved.

Item No. 48.7: **To consider and approve the structure and syllabi of Master of Technology Programme on "Infrastructure Systems" at CTRANS received vide letter No. IITR/ CTRANS/ M.TECH./1322013 dated 13.2.2013.**

As recommended by the IAPC, the Senate decided that the modified Structure and Syllabi of M.Tech. (Infrastructure Systems) programme of CTRANS as given at **Appendix 'B'**, be approved.

Item No. 48.8: **To consider the syllabi for B. Tech. II, III, IV year and IDD in MME programme as proposed by the Department of Metallurgical and Materials Engineering vide letter No. MMED/92/DAC/D-6/12-13 dated 4.3.2013.**

As recommended by the IAPC, the Senate approved the Syllabi of the courses to be run in the second year of Bachelor of Technology (Metallurgical and Materials Engineering) and Integrated Dual Degree (Metallurgical and Materials Engineering), as given at **Appendix 'C'**.

Item No.48.9: **To consider and approve the three Pre-Ph.D. courses as suggested by the Department of Humanities & Social Sciences.**

As recommended by the IAPC, the Senate approved the syllabi of the under-mentioned three courses of the Department of Humanities & Social Sciences for the Pre-Ph.D. courses, as given at **Appendix 'D'**:

1. HS-912 : Sociological Theories
2. HS-913 : Sociology of Indian Society
3. HS-914 : Sociology of Science

The Senate further decided that for running any of the pre-Ph.D. courses, the minimum number of students should be FIVE as per the existing policy for all PG courses.

Item No. 48.10: **To consider and approve the recommendations of the committee regarding criteria for branch change.**

The Senate decided that the criteria for branch change be approved as under:

1. All students admitted through JEE, except those in the B.Arch. programme, shall be eligible for change of Branch/ Programme at the end of the Autumn Semester of the First year provided that the student satisfies the following criteria:

   (i) He/she has earned all the specified credits in the course structure at the end of the Autumn Semester.
   (ii) He/she has not failed in any course.
   (iii) He/she has not been penalized for indiscipline.

2. The change of branch/programme of a student shall be against the number of vacancies or two (02) seats in the other programme, whichever is higher.

3. The vacant seats in a programme shall be filled strictly on the basis of merit in that category. However, the extra seats (if any and maximum Two [02] in any programme) shall be filled on the basis of combined merit.

4. The eligible applicants shall be allowed change of branch/ programme strictly on the basis of inter-se-merit as reflected in their SGPA. In case the SGPA 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 the JEE.

Item No. 48.11: To consider and approve the Academic Calendar for the Academic Session 2013-14.

The Senate approved the Academic Calendar for Autumn and Spring Semesters of academic session 2013-14, as given at **Appendix 'E'**.

Item No. 48.12: To discuss and approve the Teaching Scheme and the syllabi of the courses of I Semester under New Academic curricula to be implemented from academic Session 2013-14.

As recommended by the IAPC, the Senate decided that the UG structure under New Academic curricula as given at **Appendix 'F'** be approved, with following resolutions,

(I) The course on "**Computer Programming and Data Structure**" will be taught by the Department of

Computer Science in principle. However, due to shortage of faculty in the Department of Computer Science and Engineering, as an interim arrangement, this course will be designed and taught by respective Departments to their students. If any Department is unable to provide faculty for this course to their students, that Department may request other Departments for teaching this course.

(II) A new course on **"Ethics and Self Awareness"** of 2 credits be introduced in 1st year (Autumn Semester) under the category of Institute Core Course from Humanities and Social Sciences subcategory **(HSSC)**. The course will be taught by the Department of Humanities and Social Sciences. The syllabus of this course will also be framed by the HSS Department within 15 days.

(III) The course on **"Introduction to Environmental Studies"** is shifted from 1st year (Spring Semester) to 1st year (Autumn Semester) and will be taught jointly by the Department of Civil Engineering and the Department of Chemical Engineering. Thus, 50% of the course will be taught by the Department of Civil Engineering and the remaining 50% will be taught by the Department of Chemical Engineering. The evaluation of this course will be carried out separately by each Department after completion of their respective course components (e.g., the Civil Engineering component will be evaluated at the time of MTE and the Chemical Engineering component at the time of ETE). The grades will be awarded based upon both the evaluations. However, the coordination will be done by the Department of Civil Engineering. The syllabus of this course will be developed within fifteen days by a committee consisting of faculty members from the four Departments, viz. Civil Engineering, Chemical Engineering, Pulp and Paper Technology and Humanities and Social Sciences.

(IV) The Department Specific Course-I under category of Engineering Science Course (ESC) is shifted from 1st year (Autumn Semester) to 1st year (Spring Semester).

(V) Now the total number of credits in 1st year (Autumn Semester) and 1st year (Spring Semester) shall be 21 and 24 respectively.

(VI) The courses **'Engineering Analysis and Design'** and **'Industry Oriented Problem'** have been placed in 2nd year (Autumn Semester) and 3rd year (Spring Semester) respectively. However, the Departments will have the flexibility for inter-changing their positions with any of the Departmental core courses. Further, these courses may either be of 3 credits or 4 credits within the stipulated range of total credits.

(VII) There will be an upper limit on the number of students opting for a course under the category of General Science Elective Course (GSEC) renamed now as Open Elective Course (OEC) so that a large number of electives from different streams can run.

(VIII) The courses under HSSMC category be changed to HSSMEC category where instead of the courses chosen by the department, the students can opt for one course from the basket of Humanities and Social Sciences and another course from the basket of Management Studies. There will be no upper limit on the number of students in any course. However, no course will run if the number of students in any course is less than 25. The basket of courses from Humanities and Social Sciences be offered in the 2nd year and the basket of courses from Management Studies be offered in the 3rd year.

(IX) The course on **Introduction to (Discipline) Engineering** may be taught jointly by a number of faculty members of the respective departments as the contents of this course may be module based. Its evaluation process is left to the department. However, the evaluation as adopted by a department must be mentioned in its teaching scheme. The evaluation may be done at the end of the semester like other courses or may be done by the faculty member after completion of the module(s) taught by him/her. The question paper may be Multiple Choice Question (MCQ) type.

(X) All Institute Core Courses under Basic Science Course (BSC) category will be of 4 credits. However, Lecture-Tutorial-Practical loading may vary (e.g., 3-1-0 or 3-0-2).

(XI) Regarding the selection of courses under Engineering Science Courses(ESC) and Basic Science Courses(BSC) categories, it was emphasized that the departments should select the courses to give breadth to the students so that they can go for minor specialization.

(XII) The syllabi of the courses under the Basic Science Courses(BSC) category as given at **Appendix 'F1'** were approved after minor modifications.

(XIII) The syllabi of the courses Communication Skills (Basic) and Communication Skills (Advance) under the Humanities Social Sciences Courses (HSSC) category, as given at **Appendix 'F2'**, were approved after minor modifications.

(XIV) The evaluation for 04 credits for the **Bachelor of Technology Project** be done at the end of the 4th year (Autumn Semester). However, the marks awarded will be carried over and added to the evaluation of the project at the end of the 4th year (Spring Semester) and the grades awarded.

(XV) Although, **Educational Tour** is a Non-credit course in the structure, but it is a compulsory course and the students will have to earn at least a **Satisfactory** grade in this course.

(XVI) Extra Curricular Activities are renamed Co Curricular Activities (CCA) and will be graded as given below:

1. **'Discipline'** will be of 02 credits and grades for this activity will be awarded at the end of **Final** year.

2. The activity National Cadet Core (NCC)/National Social Science (NSS) will be of 02 credits and the grade for this will be awarded at the end of the **First** year.

3. The activity **'Proficiency'** (as listed in existings Under Graduate Ordinances and Regulations) including NSS and NSO will be of 02 credits. The students are required to select only one proficiency from the list in 2nd year which will remain the same upto the Final year. The grades for the **'Proficiency'** opted for by the students will be

awarded at the end of the **Final** year. Students may pursue other co-curricular activities as hobbies.

(XVII) The departments running Integrated Mater of Technology (IMT) and Integrated Master of Science (IMS) programmes will have the flexibility of including additional BSC and ESC courses, as required, under their DCC category.

(XVIII) The teaching scheme of 1st year (Autumn Semester) of each department and syllabi of the following courses to run in the 1st year (Autumn Semester) shall be discussed in the Institute Academic Programme Committee (IAPC) and its recommendations obtained.

1. Introduction to (Discipline) Engineering.
2. Introduction to Environmental Studies.
3. Ethics and Self Awareness.
4. Computer Programming courses from the various departments.

The views of Senate members on the IAPC recommended teaching scheme and the syllabi will be taken through e-mail within a stipulated time. The Chairman, Senate will then approve the teaching scheme of 1st year (Autumn Semester) of all the departments and the syllabi of the above courses on behalf of the Senate.

Departments are requested to have a relook at their teaching schemes of all years in view of the changes made in the Undergraduate structure as given at **Appendix 'F'**. The completed structure of all the programmes from 1st year (Spring Semester) onwards as well as syllabi of the courses, shall be placed before the Senate for approval.

Item No.48.13: **Reported that the Director and Chairman Senate has approved educational qualifications and eligible GATE disciplines as follows for M.Tech (Infrastructure Systems) programme to be started from the session 2013-14 in the Centre for Transportation Systems with an intake of 15 students.**

1. Qualification/Eligibility Requirements

B.Tech (Civil Engineering / Mechanical & Industrial Engineering /Electrical Engineering / Chemical Engineering) B.Arch/B.Planning or equivalent.

2. Eligible GATE Disciplines

CE, ME/PI, EE, CH, AR

3. Intake : 15

Item No. 48.14: **To consider the report of sub-committee on the proposal for awarding a division/class to the students in the various programmes.**

The issue was discussed at length. The members agreed in principle that the students be awarded divisions as defined in the following,

(i) First division with distinction
(ii) First division
(iii) Second division

The criteria for awarding the above shall be decided based on the statistics of the last five years. The Chairman Senate shall approve the criteria on behalf of the Senate.

On the matter of issuing transcripts to the students, the Senate further decided that:

1. The existing practice of issuing grade sheets after each semester shall continue.

2. The students may be issued official transcripts as and when they require, and also mandatorily at the end of their studies.

Item No. 48.15: To review the guidelines for Instituting an award

The Senate discussed the existing guidelines for institute an award and suggested minor revision as under,

(i) The donor will have to deposit a minimum of 15 times the annual amount of the award, scholarship, fellowship, prize etc.

(ii) In the case of MoUs with foundations, a commitment for instituting the award for a minimum of 10 years shall be made by the donor.

The revised guidelines as given at **Appendix 'G'** be approved.

Item No.48.16: To finalize the date of Annual Convocation-2013

The Senate decided that every year the Annual Convocation shall be held on the third Saturday of September. Accordingly, the Annual Convocation - 2013 of the Institute shall be held on 21st September this year.

Item No. 48.17: To consider the proposal for creating "Student Career Development Fund" for the grant of funds for the multifarious academic activities of the students.

The Senate agreed in principle to create a "Student Career Development Fund" for the grant of funds for the multifarious academic activities of the students with the following remarks,

1. The fund may be named as "Student Development Fund".

2. A one time fee of Rs. 2000/- per student should be charged from all UG/PG/Ph.D. students at the time of admission for creating a corpus for this fund.

3. The interest earned on the amount in the corpus may be used to fund suitable innovative project proposals and travel grants.

4. The fund can be administered by a standing committee consisting of the following:

(a)	Director	- Chairman
(b)	Dean of Students' Welfare	- Member
(c)	Dean, Academic Studies	- Member
(d)	Dean, Academic Research	- Member
(e)	Dean, Alumni Affairs	- Member
(f)	Dean, Finance & Planning	- Member

5. The functioning of this initiative be reviewed after five years.

6. The alumni may be encouraged to contribute to this fund.

Item No.48.18: To consider the teaching of the course on Computer Programming in the 1st year of new UG structure to be implemented from 2013-14.

Discussed under **Item No. 48.12.**

Item No. 48.19: To consider the panel of Senate's Nominees on the Selection Committees for Group 'A' Academic positions.

The Senate decided that the panel of nominees as proposed by the departments be modified based on suggestions made on the floor. The members may also suggest any deletions and additions to the Dean Faculty Affairs by 15th May 2013, positively. The final list of nominees shall be placed before the Director, Chairman, Senate for approval. The Senate also recommended that the same panel may be considered for nominating the Board Nominees.

Item No. 48.20: To consider a request from the Director, National Institute of Technology, Uttarakhand, Srinagar (Pauri Garhwal) to waive off the following two conditions for the faculty of NIT, Srinagar for admission to Ph.D. programme at this institute.

The Senate decided that the under-mentioned conditions for the faculty of all the NITs for admission to Ph.D. programme in IIT Roorkee be waived:

1. CLAUSE No. R.1(II)(c) OF REGULATIONS

Research student / Candidates working in other organizations/ institutions, approved by IIT Roorkee as Research Centre or having MoU for research purposes, including all the NITs (for part time Ph.D.)

2. CLAUSE No. R.2(3)(e) OF REGULATIONS

The applicants must have been in continuous service with the sponsoring organization for at least two years at the time of submitting the application form for admission.

3. In addition, the under-mentioned Regulation for admission as part-time candidates to the Ph.D. programme stands modified as under:

(a) Clause R.2(3)(d) The facility of part time registration will also be available to all employees of the IIT Roorkee, faculty members of all the NITs or candidates working in organizations having MoUs with IIT Roorkee or organizations approved by the IIT Roorkee as Research Centres. Such applicants are exempted from the requirement of having valid GATE/NET/GPAT scores.

4. However, the under-mentioned provision for admission to the Ph.D. programmes as a part-time candidate shall remain inforce:

(a) Clause R.2(3)(f) The candidates working in Institute/ University awarding Ph.D. degree itself are not eligible for admission as part-time candidate.

The meeting ended with a vote of thanks to the Chair.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : DEPARTMENT OF MANAGEMENT STUDIES

1. **Subject Code : IBM-03** **Course Title : CROSS CULTURAL MANAGEMENT**
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0
5. **Credits:** 3 **6. Semester:** Both
7. **Pre-requisite:** Nil **8. Subject Area:** HSSMEC
9. **Objective:** To acquaint students aspiring for international assignments with cross cultural management issues.

10. **Details of the Course:**

S.No.	Contents	Contact Hours
1	**Introduction to culture :** Meaning of culture, dimensions of culture, the phenomenon of culture, layers of culture, cultural entities (level of analysis)	5
2	**Theories and dimensions of culture:** Cultural dimensions (Hofstede's model of national culture), individualism vs. collectivism, large or small power distance, strong or weak uncertainty avoidance, masculinity vs. femininity, long term - short term orientation	5
3	**Organisational culture:** Meaning, culture in organisations, importance of organisational culture, composition of culture, models and theories of organisational culture, Schein's model of organisational Culture, Hofstede's model of organisational culture, competing values framework based culture types	6
4	**Culture and communication :** Business communication across cultures, barriers to intercultural communication, developing intercultural relationships	4
5	**Culture and conflict:** Introduction, cultural factors leading to conflict, strategies for eliminating conflict arising due to cultural assumption, conflict management approaches in a team	2
6	**Negotiations across cultures:** Introduction, negotiations across cultures, negotiation styles, direct confrontation, types of negotiations, culture and negotiation, the role of cultural sensitivity in conflict resolution, cross-cultural adaptation, cultural shock, cultural homelessness, cross-cultural teams, cross-cultural leadership.	6
	Total	28

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1	David C. Thomas, "Cross-Cultural Management: Essential Concepts", 2nd Edition, Sage.	2008
2	Madhavan, S., "Cross-cultural Management: Concepts and Cases", 1st Edition, Oxford University Press	2011
3	Larry A. S., Richard E. P., McDaniel, E., Roy, C., "Communication Between Cultures", 8th Edition, Wadsworth Cengage Learning.	2013 2010
4	Moran, R., Harris, P., Moran, S., "Managing Cultural Differences", 8th Edition, Routledge.	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE : DEPARTMENT OF MANAGEMENT STUDIES

1. **Subject Code : IBM-04** **Course Title** : **STRATEGIC HUMAN RESOURCE MANAGEMENT**

2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0

3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0

4. **Relative Weightage:** **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. **Credits:** 3 **6. Semester:** Both

7. **Pre-requisite:** Nil **8. Subject Area:** HSSMEC

9. **Objective:** To develop the perspective of strategic human resource management and understand the relationship of HR strategy with overall corporate strategy.

10. **Details of the Course:**

S. No.	Contents	Contact Hours
1	**Introduction to Strategic Management :** Definition, the resource based view of the firm, process of strategic management, mission, values and objectives, analysis of organisational resources and capabilities	2
2	**Goal Setting – Strategic Path to Success :** Relationship between vision, mission and goal setting, approaches to goal setting, process of goal setting, characteristics of goal setting (SMART)	2
3	**Aligning Strategic aspects of Human Resources :** Definition, models in HRM, traditional HRM to strategic HRM, the strategic dimension of HRM, linking HR strategies with business strategies	5
4	**Strategising the HR Process: Recruitment and retention strategies -** Online recruitment, outsourcing recruitment functions, headhunting, assessment centers, methods used in assessment centers, employee retention	3
5	**Reward and Compensation Strategies :** Skill based pay, broad banding, variable pay, profit sharing, executive compensation	3
6	**Training and Developing Strategies:** Competency mapping, multi-skilling, succession planning, creating a learning organization	2
7	**Performance Management Strategies:**	4

	Meaning and importance, defining performance management, the performance management process, rewarding performance, methods for assessment, need for performance management, processes and systems for managing performance, 360 degree feedback	
8	**Developing HR as strategic value addition Function** Gaining competitive advantage through HR, HR as a strategic business partner, the VRIO framework, changing role of HR, future challenges of HR	3
9	**International Human Resource Management** Introduction, definitions, differences between domestic and International HRM, effective IHR strategy implementation, reasons for the emergence of IHRM, approaches to managing and staffing subsidiaries	4
	Total	**28**

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Mello, Jeffrey A. "Strategic Human Resource Management", 3rdEdition, Cengage Learning	2010
2	Agarwala, T., "Strategic Human Resource Management", 4th Edition, Oxford University Press	2007
3	Armstrong, M., "Armstrong's Handbook of Strategic Human Resource Management ", 5th Edition, Kogan Page	2011
4	Bratton, J.; Gold, J., "Human Resource Management: Theory and Practice", Palgrave Macmillan, 5th Edition	2012
5	Mondy, W. "Human Resource Management", 10th Edition, Pearson	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : DEPARTMENT OF MANAGEMENT STUDIES

1. **Subject Code : IBM-05** **Course Title** : **MANAGEMENT OF SELF AND INTERPERSONAL DYNAMICS**

2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0

3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0

4. **Relative Weightage:** **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. **Credits:** 3 **6. Semester:** Both

7. **Pre-requisite:** Nil **8. Subject Area:** HSSMEC

9. **Objective:** To acquaint the students with the problems of managing oneself and the conflicts that he/she may face while working with others in an organization.

10. **Details of the Course:**

S.No.	Contents	Contact Hours
1	Exploring the self- capabilities; orientation, personal growth, ego states, self assessment-strength and weaknesses	4
2	Creativity: Process of creativity, determinants of creativity, skills in creativity, creative thinking, nature and characteristics of creativity	5
3	Transactional analysis, exchange relationship - inputs and outcomes of relationships, relevance of inputs and outcomes	5
4	Issues and challenges involved in managing diversity, individual biases towards diversity management, enhancing skills for effective diversity management	4
5	Interpersonal dynamics and relationship, interaction theory, dialectical theory, inclusion and identity, cohesion and development	5
6	Self and organizational culture , personal effectiveness and self-leadership, understanding your thinking process, identifying the filers on your world	5
	Total	**28**

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1	Blanchard, K., "Leading at a Higher Level", FT Press	2010
2	Hargaden, H. and Sills, C.. "Transactional Analysis: A relational approach" , 2nd Edition, Brunner- Routledge	2002
3	Constatine , Patrick M.B. Dowsan, "Managing Change Creativity & Innovation", Sage Publications	2009
4	Berne, E., "Games people play: The psychology of human relationships" Grove Press	1964
5	Robert A. B. and Donn B., "Social Psychology: Understanding Human Interactions", Prentice Hall of India	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : DEPARTMENT OF MANAGEMENT STUDIES

1. **Subject Code : IBM-08** **Course Title : FUNDAMENTALS OF INNOVATIONS, AND BUSINESS MODELS**

2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0

3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0

4. **Relative Weightage:** **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. **Credits:** 3 **6. Semester:** Both

7. **Pre-requisite:** Nil **8. Subject Area:** HSSMEC

9. **Objective:** To acquaint students with fundamentals of innovation, entrepreneurship and new business models.

10. **Details of the Course:**

S.No.	Contents	Contact Hours
1	Introduction to innovation, process of innovation, nature of innovation within firms and their motives for innovation, collaboration with other firms in networks and strategies to protect own position	6
2	Harnessing innovation for businesses : opening of new markets and developing new ways to serve existing customers, threats of rapid pace of technological change to established businesses and existing business models, opportunities for new entrants to markets, response of established businesses	7
3	Innovation and entrepreneurship, managing innovation and entrepreneurship, challenges of innovation strategy, social entrepreneurship and innovation	5
4	Globalization of innovation, open system of innovation, recognising the opportunity, sources of innovation	5
5	Designing business models from entry into incubation, development of business models for your own innovation, analysis of business models of competitors and incumbents.	5
	Total	**28**

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1	Bessant J. and Tidd J., Innovation and Entrepreneurship, John Wiley & Sons, 2nd Edition	2011
2	Drucker P.F., Innovation and Entrepreneurship, Harper Business	1993
3	Chanal V., Rethinking Business Models for Innovation lessons from entrepreneurial projects, (e book) halshs-00566298, version 2	2011
4	George G. and Bock A.J., Models of opportunity how entrepreneurs design firms to achieve the unexpected, Cambridge University Press	2012
5	Manmohan R. and Aseem K., Managing Innovations and New Product development: Concepts and Cases, PHI Learning	2009

Program Code: 121 **B. Tech. (Polymer Science and Technology)**
Department: **Department of Polymer Science & Process Engineering**
Year: **II**

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs)		Relative Weightage (%)				
S.No	SUBJECT CODE	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Semester III (Autumn)														
1	PH-201	Physics-II	BSC	3	3	0	0	3	0	15	-	35	50	-
2	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	0	-	25	25	50	-
3	HS-201	Economics	HSSMC	3	2	1	0	2	0	25	-	25	50	-
4	PE-211	Polymer Chemistry	DCC	4	3	1	2/2	3	2	15	15	15	40	15
5	PP-211	Material and Energy Balance	DCC	4	3	1	0	3	0	25	-	25	50	-
6	PP-213	Fluid Mechanics	DCC	4	3	1	2/2	3	3	15	15	15	40	15
7	PE-213	Structure of Polymers	DCC	3	2	0	3	2	3	15	15	15	40	15
		Total		23	17	5	4							
Semester IV (Spring)														
1	MT-201B	Material Science	ESC	4	3	1	0	3	0	25	-	25	50	-
2	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	0	25	-	25	50	-
3	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	0	15	-	35	50	-
4	PP-313	Chemical Reaction Engineering	DCC	4	3	1	0	3	0	25	-	25	50	-
5	PP-214	Heat Transfer	DCC	4	3	1	2/2	3	3	15	15	15	40	15
6	PP-IE1	Institute Elective-I	BGSEC	3	2	1	0	2	0	25	-	25	50	-
7	PP-IE2	Institute Elective-II	HSSMEC	3	2	1	0	2	0	25	-	25	50	-
		Total		23	17	6	2							

Program Code: 121 B. Tech. (Polymer Science and Technology)
Department: Department of Polymer Science & Process Engineering
Year: III

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs)		Relative Weightage (%)				
S.No	SUBJECT CODE	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Semester V (Autumn)														
	PE-311	Polymerization Reaction Engineering	DCC	4	3	1	0	3	-	25	-	25	50	-
	PE-313	Process & Plant Design	DCC	4	3	1	0	3	0	25	-	25	50	
	PE-315	Polymer Blends	DCC	4	3	1	0	3	0	25	-	25	50	-
	PE-317	Properties of Polymers	DCC	3	2	0	3/2	2	0	15	15	15	40	15
	PP-311	Mass Transfer	DCC	4	3	1	2/2	3	3	15	15	15	40	15
	PP-IE3	Institute Elective III	ESEC	4	3	1	0	3	0	25	-	25	50	-
		Total		**23**	17	4	4							
Semester VI (Spring)														
1	PE-328	Minor Project/Practical/Case Studies	DCC	2	0	0	4	0	0	0	25	25	50	0
2	PE-322	Polymer Composites	DCC	3	2	0	3/2	2	3	15	15	15	40	15
3	PE-324	Polymers, Recycling & Environment	DCC	4	3	1	0	3	0	25	-	25	50	-
4	PE-326	Polymer Rheology	DCC	3	2	1	0	3	0	25	-	25	50	-
5	PP-322	Communication Skills	DCC	2	0	2	0	0	0	100	-	-	-	-
6	PE-ELE1	Departmental Elective I	DEC	3	2	1	0	2	0	25	-	25	50	-
7	PE-ELE2	Departmental Elective II	DEC	3	2	1	0	2	0	25	-	25	50	-
8	PP-IE4	Institute Elective-IV	BGSEC	3	2	1	0	2	0	25	-	25	50	-
		Total		24	15	8	6							

Program Code: 121 B. Tech. (Polymer Science and Technology)
Department: Department of Polymer Science & Process Engineering
Year: IV

Teaching Scheme					Contact Hours/Week			Exam Duration (Hrs)		Relative Weightage (%)				
S.No	SUBJECT CODE	COURSE TITLE	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Semester VII (Autumn)														
1	PE-411	Polymer Processing	DCC	4	3	0	3/2	3	3	15	15	15	40	15
2	PE-413	Process System Analysis & Control	DCC	4	3	1	2/2	3	2	15	15	15	40	15
3	PE-419	Training & Seminar	DCC	2	0	2	0	0	0	100	-	-	-	-
4	PE-420	Major Project	DCC	0	0	0	3	0	0	-	-	-	-	-
5	PE-ELE-3	Departmental Elective -III	DCC	3	2	1	0	3	0					
6	PE-415	Functional Polymers	DCC	3	2	1	0	2	0	25	-	25	50	-
7	PE-417	Rubber and Elastomer Technology	DCC	3	2	0	3/2	2	3	15	15	15	40	15
8	PE-IE5	Institute Elective V	ESEC	4	3	1	0	3	0	25	-	25	50	-
		Total		23	17	6	9							
Semester VIII (Spring)														
1	PP-ELE-4	Departmental Elective IV	DEC	3	2	1	0	2	0	25	-	25	50	-
2	PP-420	Major Project	DCC	8	0	0	12	0	0	100	-	-	-	-
3	PP-ELE5	Departmental Elective-V	DEC	3	2	1	0	2	0	25	-	25	50	-
4	PP-IE6	Institute Elective VI	HSSMEC	3	2	1	0	2	0	25	-	25	50	-
		Total		17	7	3	12							

List of Departmental Electives for B. Tech. (Polymer Science & Technology)

- **Departmental Elective I**

PE-330 Macomolecular Chemistry
PE-332 Advanced Polymer Blends
PE-334 Paint and Coating Technology
PE-336 Bio Polymers

- **Departmental Elective II**

PE-338 Polymers and Tissue Engineering
PE-340 Biomedical Polymers
PE-342 Engineering Polymers
PE-344 Electronic and Conducting Polymers

- **Departmental Elective III**

PE-421 Advanced Polymeric Composites
PE-423 Computational Polymer Science
PE-425 Polymers for Smart and Memristive Materials
PE-427 High Performance Polymers

- **Departmental Elective IV**

PE-422 Numerical Methods and Optimization in Polymer Engineering
PE-424 Petrochemical Technology
PE-426 Polymeric Fibre Technology
PE-428 Polymeric Nanomaterials

- **Departmental Elective V**

PE-430 Molecular Simulation of Polymers
PE-432 Polymeric Film & Packaging Technology
PE-434 Equipment Design
PE-436 Polymer Product Technology

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Polymer & Process Engineering**

1. Subject Code: **PE-211** Course Title: **Polymer Chemistry**
2. Contact Hours: **L: 3** **T: 1** **P: 2/2**
3. Examination Duration (Hrs.): **Theory** 3 **Practical** 2
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 15 **ETE** 40 **PRE** 15
5. Credits: 4 6. Semester: **Autumn** 7. Subject Area: **DCC**
8. Pre-requisite: **Nil**
9. Objective: To impart knowledge of chemistry of polymers

Details of Course:

1	**Introduction:** Genesis and brief history of Polymers, copolymers, bio, electronic and high performance polymers	2
2	**Molecular Weight:** Molecular weight and degree of polymerization, Weight average molecular weight, Number average molecular weight, Sedimentation & viscosity average molecular weight, polydispersity, size of polymer molecule	4
3	**Chain Polymerization :** Free radical polymerization, Initiation, propagation, termination, chain transfer, inhibitors; Ionic polymerization, coordination polymerization, Ziegler Natta catalyst	4
4	**Step polymerization:** Polycondensation, Polyaddition and Ring Opening polymerizations,	4
5	**Polymerization Techniques**: Bulk, Solution, Suspension and Emulsion polymerizations,	5
6	**Kinetics of Polymerization** Free radical Chain Polymerization, Cationic polymerization, Anionic polymerization, Polycondensation	6
7	**Copolymerization:** Free radical copolymerization, reactivity ratios; Ionic Copolymerization; Copolycondensation, block, graft, alternating and random copolymers	6
8	**Polymer Reactions** Hydrolysis, Acidolysis, Aminolysis, hydrogenation, adition, substitution and cyclization reactions, cross linking	5
9	**Chemical Characterization of Polymers:** Characterization by NMR, HPLC, GPC, IR and UV-Viz Spectra	6
		42

List of Experiments

i) End Group Analysis of Polymers
ii) Molecular weight & distribution of a polymer by GPC
iii) Synthesis of Polymethyl methacrylate
iv) Synthesis of polyvinyl acetate
v) Synthesis of phenolic and epoxy resins
vi) Synthesis of epoxy resins

vii) Study of Polymers by CHN Analyser
viii) Study of Polymers by UV Spectropholometer
ix) Study of Polymers by IR Spectropholometer
x) Study of Polymers by Hot Stage polarizing Microscope and Refractorameter

12. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication /Reprint
1.	Carraher, C. E. and Seymour, R. B., Polymer Chemistry, Taylor & Francis	2009
2	Carraher, C. E., Introduction to Polymer Chemistry, Taylor & Francis	2009
3.	Gowariker, V. R., Vishwanathan, N. V., Jaydev, S., Polymer Science, New Age	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Polymer & Process Engineering**

1. Subject Code: **PE-213** Course Title: **Structure of Polymers**
2. Contact Hours: **L: 2** **T: 0** **P: 3**
3. Examination Duration (Hrs.): **Theory** 2 **Practical** 3
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 15 **ETE** 40 **PRE** 15
5. Credits: 3 6. Semester: **Autumn** 7. Subject Area: **DCC**
8. Pre-requisite: **Nil**
9. Objective: To impart knowledge of structure of amorphous, crystalline and elastomeric polymers

10 Details of Course:

1	**Introduction:** Introduction to Amorphous, Crystalline, Elastomeric and Liquid Crystalline Polymers	2
2	**Amorphous Polymers :** Free Volume and Free Volume Theory, Kinetic Nature of the Glass Transition Phenomenon in Polymers, Characterization by SEM, TEM	3
3	**Thermodynamics, Equilibrium & Non Equilibrium :** Pressure and Path Dependence of the PVT, behavior of Polymer Glasses, Gibbs Dimarzio Theory, Factors affecting glass transition temperature, Secondary sub glass, transition temperature, Differential scanning calorimetry, differential thermal analysis, determination of glass transition temperature, enthalpy, entropy, specific heat, Physical Ageing Equilibrium and Non Equilibrium Nature of Polymeric Glasses	6
4	**Crystalline Polymers & Crystallization**: Fundamentals and Thermodynamics, of Polymer Crystallization, Structure and Structural Factors, Affecting Crystallizability, Molecular Structure of Crystalline Polymers, Spherulites, Single Crystals, Chain Folding, Helix Structure Crystallization Kinetics & Melting Temperature, Crystal growth, Fractionation and Induced Crystallization, melting temperature, melting point, crystalline structure, melting endotherm, Small and Wide angle X-ray diffraction and study of Morphology	8
5	**Rubbery Elastomeric Polymers** Five Regions of Viscoelastic Behavior, Structure of Rubbery Elastomeric Polymers, Thermodynamics of Rubber Elasticity	3
6	**Polymer Liquid Crystals:** Structure, morphology, thermodynamics, and fundamentals of lyotropic and thermotropic liquid crystals.	3
7	**Polymers Degradation** Thermal & Thermo-oxidative degradation of Polymers, mechanical and environmental degradation, effect of sun light and UV radiation, weight loss, Thermo-gravimetric analysis	3
		28

11. List of Experiments

i) Determination of Glass Transition Temperature of an Amorphous Polymer by Differential Scanning Calorimeter (DSC)
ii) Determination of Glass Transition Temperature of a Semi Crystalline Polymer by Differential Scanning Calorimeter (DSC)
iii) Determination of Glass Transition Temperature and Melting temperature of a Semi-Crystalline Polymer by Differential Scanning Calorimeter (DSC)
iv) Determination of Melting Temperature of a Semi-Crystalline Polymer by Differential Scanning Calorimeter (DSC)
v) Determination of Glass Transition Temperature of an Amorphous Polymer by Dynamic Mechanical Thermal Analyzer (DMTA)
vi) Determination of Glass Transition Temperature and Melting Temperature of a Semi-Crystalline Polymer by Dynamic Mechanical Thermal Analyzer (DMTA)
vii) Study of Five regions of Viscoelastic Behaviour of an Amorphous Polymer by Dynamic Mechanical Thermal Analyzer (DMTA)
viii) Study of Thermal Degradation of a flexible Polymer by Thermo-gravimetric Analyzer (TGA) (in Nitrogen)
ix) Study of Thermal Degradation of a semi-rigid Polymer by Thermo-gravimetric Analyzer (TGA) (in Nitrogen)
x) Study of Thermal Degradation of a quasi-rigid Polymer by Thermo-gravimetric Analyzer (TGA) (in Nitrogen)
xi) Study of Thermal Degradation of a rigid rod Polymer by Thermo-gravimetric Analyzer (TGA) (in Nitrogen)
xii) Study of Thermo-oxidative Degradation of a flexible Polymer by Thermo-gravimetric Analyzer (TGA) (in Oxygen)
xiii) Study of Thermo-oxidative Degradation of a semi-rigid Polymer by Thermo-gravimetric Analyzer (TGA) (in Oxygen)
xiv) Study of Thermo-oxidative Degradation of a quasi-rigid Polymer by Thermo-gravimetric Analyzer (TGA) (in Oxygen)
xv) Study of Thermo-oxidative Degradation of a rigid-rod Polymer by Thermo-gravimetric Analyzer (TGA) (in Oxygen)

12 Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Gedde U, Polymer Physics, Kluver,	1995
2	Bower D. I., Introduction to Polymer Physics, Cambridge University Press	2002
3.	Rubinstein M. and Colby R. H., Polymer Physics, Springer	1996

Centre for Transportation Systems (CTRANS), Indian Institute of Technology Roorkee
Structure of M. Tech (Infrastructure Systems)

I Year

Autumn Semester

Teaching Scheme					Contact Hrs. per Week			Exam. Duration		Relative Weights				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	MA-501C	Probability and Statistics	ICC	4	3	1	0	3	-	25	-	25	50	-
2.	CT-501	Quantitative Techniques for Analysis	PCC	4	3	0	2	3	-	15	15	30	40	-
3.	CT-502	Infrastructure Planning and Management	PCC	4	3	1	0	3	-	25	-	25	50	-
4.	CT-503	Public Private Partnership in Transport Infrastructure	PCC	4	3	1	0	3	-	25	-	25	50	-
5.		Open Elective – I	OEC	3/4	-	-	-	-	-	-	-	-	-	-
6.	HS-501	Technical Communication (Optional)	IEC	2	1	-	2	2	-	15	15	30	40	-
Sub Total				**19-22**										

Spring Semester

Teaching Scheme					Contact Hrs. per Week			Exam Duration		Relative Weights				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.		Programme Elective – I	PEC	4	-	-	-	-	-	-	-	-	-	-
2.		Programme Elective – II	PEC	4	-	-	-	-	-	-	-	-	-	-
3.		Programme Elective – III	PEC	4	-	-	-	-	-	-	-	-	-	-
4.		Programme Elective – IV	PEC	4	-	-	-	-	-	-	-	-	-	-
5.		Open Elective – II	OEC	3/4	-	-	-	-	-	-	-	-	-	-
6.	HS-501	Technical Communication (Optional)	IEC	2	1	-	2	2	-	15	15	30	40	-
Sub Total				**19-22**										

II Year

Autumn Semester

Teaching Scheme					Contact Hrs. per Week			Exam Duration		Relative Weights				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	CT-762	Seminar	SEM	2	-	-	-	-	-	-	-	-	100	-
2.	CT-760	Dissertation	DIS	-	-	-	-	-	-	-	-	-	-	-
			Sub Total	02										

Spring Semester

Teaching Scheme					Contact Hrs. per Week			Exam Duration		Relative Weights				
S. No.	Subject Code	Course Title	Sub. Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	CT-760	Dissertation (continued from III semester)	DIS	24	-	-	-	-	-	-	-	-	100	-
Sub Total				24										
TOTAL				64-68										

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CT – 501** Course Title: **Quantitative Techniques for Analysis**
2. Contact Hours: **L: 3 T: 0 P: 2**
3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00
5. Credits 4 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: **NIL**
9. Objective: To provide knowledge of quantitative techniques with application potential for infrastructure systems.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Data Analysis**: Vectors and Matrices, Simple estimate of centroid, standard deviation, dispersion, variance and co-variance.	4
2.	**Curve Fitting**: Method of least squares, curvilinear regression, Multiple regression, checking adequacy of model, correlation, multiple linear regression (Matrix Notation)	6
3.	**Multivariate Analysis**: Correlation Matrix, Principal Component Analysis, Discriminant Analysis.	6
4.	**Queuing Theory**: General structure, operating characteristics, deterministic queuing model, probabilistic queuing models, and simulation of queuing system.	6
5.	**Forecasting Models**: Moving averages, exponential smoothening, trend projections, causal models, time series analysis of vehicle growth & accidents.	4
6.	**Design of Experiments**: General principles, randomized block designs, latin square design.	6
7.	**Basics of Soft Computing**: Artificial neural network, Genetic Algorithm, Fuzzy Mathematics.	6
8.	**Modelling and Simulation**: Model Classification, Mathematical; Physical and Analog models, steps involved in simulation, Monte Carlo simulation, validation and verification of simulation models.	4
	Total	42

List of Practicals:

a. Application of linear and non-liner regression
b. Fitting of probability distributions
c. Random number generation by midsquare method
d. Stepwise regression analysis for MLR problem
e. Demonstration of an industry scale simulation software.
f. ANN based demand forecasting
g. Forecasting infrastructure demand.

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication /Reprint
1.	Johnson, R. A. and Wichern, D.W., "Applied Multivariate Statistical Analysis", Prentice Hall.	2012
2.	Washington, S. P., Karlaftis, M. G. and Mannering, F. L., "Statistical and Econometric Methods for Transportation Data Analysis", CRC Press.	2011
3.	Hair, J. and Anderson, R., "Multivariate Data Analysis", Prentice Hall.	2010
4.	Johnson, R., "Probability and Statistics for Engineers", Prentice Hall.	2009
5.	Vohra, N.D., "Quantitative Techniques in Management", Tata McGraw Hill.	2001
6.	Cooper, R.A. and Jweekes, A.J., "Data, Models and Statistical Analysis", Heritage Publishers.	1983

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CT – 502** Course Title: **Infrastructure Planning and Management**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits 4 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: To provide an overview of Infrastructure planning and management approaches for building an efficient infrastructure system.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Basic Concepts:** Introduction to Infrastructure, Overview of the Power Sector, Water Supply and Sanitation Sector, Road, Rail, Air, and Port Transportation Sectors, Telecommunications Sector, Urban Infrastructure, Rural Infrastructure in India, Organizations and Players in the field of Infrastructure, Infrastructure Project Lifecycle.	8
2.	**Challenges to Successful Infrastructure Planning and Implementation** Mapping and facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks, Socio-Environmental Risks, Cultural Risks in International infrastructure projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure	8
3.	**Strategies for Successful Infrastructure Projects** Risk Management framework for Infrastructure Projects, Shaping the planning phase of infrastructure projects to mitigate risks, Designing Sustainable Contracts, Sustainable Development of Infrastructure, Information Technology and Systems for successful infrastructure management, Innovative design and Maintenance of Infrastructure facilities.	10
4.	**Performance Evaluation and Life Cycle Analysis** Condition assessment, Statistical performance modeling, Inventory management, Capacity management, and Maintenance optimization, Performance Modelling and Life Cycle Analysis Techniques	8
5.	**Infrastructure Implementation** Capacity Building and Improving the Government's role in infrastructure implementation, An integrated framework for successful Infrastructure Planning and Management – Infrastructure Management Systems and Future Directions	8
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Goodman, Alvin S. and Makarand Hastak. Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw-Hill/ASCE, New York, NY.	2006
2.	Revelle, C.S., Whitlatch, E.E. and Wright, J.R. Civil and Environmental Systems Engineering; Prentice Hall.	2004
3.	Verma S.P. ed. "Infrastructure in India's Development: Power, Transport and Communication", Institute of Public Administration, New Delhi	2004
4.	Moss Timothy, Marvin "Urban Infrastructure in Transition; Networks, Buildings, Plans Earthsian Publisher, UK	2000
5.	Hudson, W.R., Haas, R. and Uddin, W. Infrastructure Management; McGraw Hill	1997

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **CENTRE FOR TRANSPORTATION SYSTEMS (CTRANS)**

1. Subject Code: **CT – 503** Course Title: **Public Private Partnership in Transport Infrastructure**

2. Contact Hours: **L: 3 T: 1 P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits 4 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **NIL**

9. Objective: To introduce various aspect of public private participation in the development of transport infrastructure projects.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** Perspectives of Transport Infrastructure Projects in India: Railways, roads, civil aviation, ports, urban transport, commercial principles, mobile infrastructures (vehicles, coaches).	6
2.	**Various Models of PPP:** BOT, BOLT, Fee/Toll Based, Revenue Sharing, Viability Gap Funding, Operation & Maintenance Contracts, Shadow Tolls.	6
3.	**Project Financing:** Financial Engineering, Commercial Dynamics of Projects	6
4.	**Model Concession Agreements:** Highways, Ports, Railways, Airport Terminals	6
5.	**Contract Agreements:** Project Agreements, Construction Contracts, O&M Contracts, Shareholder's Agreement, Insurance Cover, Agreement with Lenders	6
6.	**Conditions Precedent:** Land free of encumbrances site, Environmental Clearance, Social Impact Analysis Social Concerns	4
7.	**Welfare Aspect:** Labour Welfare, Labour Productivity, Safety Aspects of Facility and Users	4
8.	**Case Studies**	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Book / Publisher	Year of Publication / Reprint
1.	Grimsey, D. and Lewis, M. K. "Public Private Partnerships – The Worldwide revolution in Infrastructure Provision and Project Finance", Elgar Publishing Ltd.	2007
2.	Sapte, D. W., Public Private Partnerships – BOT Techniques & Project Finance, Euromoney Institutional Investor, Nestor House.	2006
3.	Nevitt, P. K. and Fabozzi, F. J. "Project Financing", Euromoney Institutional Investor, Nestor House.	2005
4.	Akintiye, A., Beck, M. and Hardcastle, C. "Public Private Partnerships – Managing Risks and Opportunities", Blackwell Publishing.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT201 **Course Title**: Introduction to Engineering Materials

2. Contact Hours: L: 2; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 2 **Practical:** 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 3 **6 Semester:** Autumn

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To impart knowledge on metals and alloys, and their processing for various engineering applications.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**History of metals**: Metals in civilization, discovery of metals before and after the 17th century, metallurgical industry and national development	3
2	**Engineering alloys:** Aluminium alloys, magnesium alloys, titanium alloys, copper alloys, lead alloys, zinc alloys, nickel alloys, steels, stainless steels, cast irons	5
3	**Cast metals**: Cast and wrought products, methods of casting, properties of casting, typical casting alloys, commercial cast alloys	4
4	**Wrought metals**: Primary working, secondary working, mechanism of deformation, recrystallization, mechanical properties of worked materials	4
5	**Glasses and Ceramics**: Glass ceramics, toughening of glass, environment-assisted cracking, ceramics – oxides, nitrides, carbides, cement and concrete	4
6	**Polymeric materials:** Classification, forming processes, mechanical properties, joining of polymers, polymer degradation	4
7	**Material failure:** Case studies – Titanic, Columbia space shuttle disaster, World trade center tragedy, Degradation of polymers, Resistance to degradation – Delhi iron pillar	4
	Total	**28**

11. Suggested Books:

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications/ Reprint
1	Martin J., Materials for Engineering, 2nd Ed., Woodhead Publishing	2002
2	Balasubramaniam R., Story of the Delhi Iron Pillar, Foundation Books	2005
3	Polmear I.J., Light Alloys, 3rd Ed., Edward Arnold	1995
4	Llewellyn D.T., Steels – Metallurgy and Applications, Butterworth	1992
5	Callister W.D., Materials Science and Engineering, Willey	2007
6	Ashby M.F., Materials Selection in Mechanical Design, 3rd Ed., Elsevier	2011

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT210 **Course Title:** Materials Characterization I

2. Contact Hours: L: 0; T: 0; P: 3

3. Examination Duration (Hrs): **Theory:** 0 0 **Practical:** 0 3

4. Relative Weightage: **CWS:** 0 0 **PRS:** 2 5 **MTE:** 2 5 **ETE:** 0 0 **PRE:** 5 0

5. Credits: 0 2 **6 Semester:** Autumn/Spring

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To impart knowledge on the microstructural analysis using standard metallographic practice.

10. List of Practicals:

1. To study the metallurgical microscope
2. To prepare the metallic sample for metallographic examination (3 turns)
3. To study the microstructure of various steel samples
4. To study the microstructure of various cast iron samples
5. To study the microstructure of modified and unmodified aluminium silicon alloys
6. To study the microstructure of various copper base alloys
7. To study the microstructure of Pb-base and Sn-base bearing alloys
8. To determine the grain size of given metallic sample by quantitative Metallography
9. Microstructural study using SEM – secondary and back scattered electron imaging
10. Chemical analysis using SEM – energy dispersive spectroscopy
11. Ductile and brittle fracture surface study using scanning electron microscope

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT211 **Course Title**: Metallurgical Thermodynamics and Kinetics

2. Contact Hours: L: 3; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 3 **Practical:** 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 4 **6 Semester:** Autumn

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To introduce the laws of thermodynamics and their applications to chemical equilibrium conditions.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Introduction to Thermodynamics:** Basic concept and definitions-concept of state, reversible and irreversible processes, path and state functions, extensive and intensive properties, thermodynamic equilibrium, zeroth law of thermodynamics	2
2	**First Law of Thermodynamics:** Internal energy, Enthalpy, Constant volume and pressure process; Isothermal and adiabatic process.	5
3	**Second Law of Thermodynamics:** Criterion for equilibrium, Entropy and disorder, Most probable microstate, Configutational entropy and thermal entropy; Auxiliary functions, Maxwell's relations, Gibbs-Helmholtz equation.	7
4	**Third Law of Thermodynamics:** Variation of Gibbs energy with temperature and pressure, Clausius-Clapeyron equation; Thermodynamic properties of mixtures of ideal and imperfect gasses; reaction in gas mixtures, reaction of pure condensed phases with gas mixture, Standard Gibbs energy of reactions, Ellingham diagrams.	8
5	**Theory and Models of Metallic Solutions:** Raoult's and Henry's law, activity of a component, Gibbs-Duhem equation, non-ideal solutions, regular solutions, quasi-chemical model of solutions, activity and alternative standard state; Reaction equilibrium in condensed systems, Gibbs phase rule; Derivation of binary phase diagrams, ternary phase diagrams	8
6	**Relation Between Chemical and Electrical Driving Forces:** Nernst equation, concentration and formation cells, Pourbaix diagram, Thermodynamics of point defects, Thermodynamics of surfaces.	6
7	**Metallurgical Kinetics:** Heterogeneous reaction; Gas-solid, solid-	6

	liquid, liquid-liquid and solid-solid systems. Empirical and Semi-empirical Kinetics, Concept of Johnson-Mehl equation, Thermal analysis.	
	Total	**42**

11. Suggested Books

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications/ Reprint
1	Dehoff R.T., Thermodynamics in Materials Science, 2nd Ed., CRC Press.	2006
2	Gaskell D.R., Introduction to Metallurgical Thermodynamics 3rd Ed., McGraw-Hill.	1995
3	Ghosh A., Textbook of Materials and Metallurgical Thermodynamics, Prentice Hall of India.	2003
4	Upadyaya G.S. and Dube R.K., Problems in Metallurgical Thermodynamics and Kinetics, Pergamon Press.	1985
5	Balluffi R.W., Allen S.M. and Carter W.C., Kinetics of Materials, John Wiley and Sons.	2005
6	Poirier D.R. and Geiger G.H., Transport Phenomena in Materials Processing Minerals, Metals and Materials Society.	1994

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT212 **Course Title:** Transport Phenomena

2. Contact Hours: L: 3; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 3 **Practical:** 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 4 **6 Semester:** Spring

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To familiarize the students with heat, mass and momentum transfer in various metallurgical processes.

10. Details of the Course:

Sl. No.	contents	Contact Hours
1	**Introduction of Metallurgical Systems:** Concept of unit operations in chemical metallurgy, engineering fundamentals of unit processes.	6
2	**Momentum Transfer:** Differential and overall balances and their applications in flow through pipes, inclined planes, packed beds and flow measuring devices such as orifice meter, Venturi meter, flow nozzles, pitot tube, rotameter, concept and working principle of supersonic nozzles; momentum transfer in turbulent flow situation.	12
3	**Heat Transfer:** Conduction- Steady state heat conduction problems in slabs, hollow cylinders, spheres, composite walls, composite pipes etc, unsteady heat transfer in metallic specimens (lumped system). Convection- Free and forced convection, heat transfer coefficient, dimensional analysis problems. Radiation- Emissivity, absoptivity, Planck's distribution law, Wein's displacement law, Stefen-Boltzman law, radiative heat transfer between two black bodies and concept of view factor.	12
4	**Mass Transfer:** Diffusive mass transfer, diffusivity, Fick's law, representation of mass fluxes, differential and overall mass balance equations and their applications, diffusion in solids and stationary media. Differential equation of convective mass transfer, concept of mass transfer coefficient and its determination by the application of dimensional analysis; interface mass transfer theories.	12
	Total	**42**

11. Suggested Books:

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications/ Reprint
1	Bird R.B., Stewart E.S. and Lightfoot E.N., Transport Phenomena, John Wiley	2002
2	Geiger G.H. and Poirier D.R., Transport Phenomena in Metallurgy, Addison-Wesley	1973
3	Kou S., Transport Phenomena in Materials Processing, John Wiley	1996
4	Coulson J.M. and Richardson J.F., Chemical Engineering, Vol. 1.	1990
5	Mohanty A.K., Rate Processes in Metallurgy, Prentice-Hall	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT220 **Course Title:** Materials Characterization II

2. Contact Hours: L: 0; T: 0; P: 3

3. Examination Duration (Hrs): **Theory:** 0 0 **Practical:** 0 3

4. Relative Weightage: **CWS:** 0 0 **PRS:** 2 5 **MTE:** 2 5 **ETE:** 0 0 **PRE:** 5 0

5. Credits: 0 2 **6 Semester:** Autumn/Spring

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To impart knowledge on the structural and chemical characterization using XRD and TEM

10. List of Practicals:

1. To study the X-ray diffractometer
2. Calculation of structure factor of different crystal structures
3. Determination of cubic crystal structure using powder XRD
4. Determination of hexagonal crystal structure using powder XRD
5. Determination of phases in multiphase powder sample using XRD
6. Precise lattice parameter determination using XRD
7. Estimation of crystallite size using Scherrer formula
8. Characterization of residual stress in a deformed sample using XRD
9. Chemical analysis using energy dispersive X-ray analysis in SEM (spot and line analysis)
10. Sample preparation for TEM
11. TEM analysis of prepared samples (2 turns)
12. Indexing of selected area diffraction patterns

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT221 **Course Title**: Structural and Chemical Characterization

2. Contact Hours: L: 3; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 3 **Practical**: 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 4 **6 Semester:** Autumn

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To impart knowledge on the arrangement of atoms in materials, defect structures and their characterization techniques

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	**Atomic structure of Solids**: Atomic Bonding; Crystal systems and space lattice; Crystal structure of metals, ceramics, polymers; Indexing crystallographic planes and directions, stereographic projections; Diffraction methods, Bragg's law	7
2	**Crystal imperfections:** Point defects – thermodynamics of defects, Schottky and Frenkel imperfection, Kröger-Vink notation, vacancy motion; Line defects – Burger's vector; Frank-Reed source, slip systems, climb and cross-slip, critical resolved shear stress, dislocation interactions; Surface imperfections – stacking faults, antiphase boundary, grain boundary, grain boundaries in block copolymers, magnetic domain walls, walls in liquid crystals	7
3	**Microstructure**: Structural hierarchy in metal forging, semicrystalline polymer; Deformation microstructure and crystallographic texture, X-ray pole figure; Solidification microstructure; Solid-solid transformation; Ni base superalloy	6
4	**Binary phase diagrams:** Isomorphous system, lever rule, eutectic system, zone refining, peritectic transformation, monotectics, intermediate phases, Cu-Zn, Fe-Fe_3C, etc	6
5	**Diffusion**: Diffusion in ideal solution; Kirkendall effect; Darken's Equation; Fick's second law; Mantano method; Determination of intrinsic diffusivities; Temperature dependence of diffusion coefficient; Chemical diffusion; Grain boundary and surface diffusion	6
6	**Characterization technique**: Imaging – Optical microscopy, scanning electron microscopy, transmission electron microscopy, scanning probe (STM, AFM); Structure – X-ray diffraction, Low	10

	energy electron diffraction (LEED); Composition – X-ray photoelectron spectroscopy (XPS), X-ray energy dispersive spectroscopy (EDS), Auger electron spectroscopy (AES), secondary ion mass spectroscopy (SIMS), Rutherford backscattering (RB); Thermal and gravimetric analysis	
	Total	**42**

11. Suggested Books:

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications/ Reprint
1	Reed-Hill R.E., Physical Metallurgy, 2nd Ed., East-West Press	2008
2	Allen S.M. and Thomas E.L., The Structure of Materials, Wiley	1999
3	Gottstein G., Physical Foundations of Materials Science, New Age	2004
4	Ragavan V., Materials Science and Engineering: A First Course, 5th Ed., PHI	2009
5	Balasubramaniam R., Callister's Materials Science and Engineering, 8th Ed., Willy	2010
6	Askeland R.D. and Askeland D., Materials Science and Engineering, Ceneage	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT222 **Course Title:** Phase Transformation

2. Contact Hours: L: 3; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 3 **Practical:** 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 4 **6 Semester:** Spring

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To introduce the fundamental principles of phase transformations in metal and alloys.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	**Phase Equilibrium:** Equilibrium in a closed system, effect of temperature and composition, order of transformation, fluctuations, stable, unstable and metastable states, single component systems, binary solutions and binary phase diagrams	6
2	**Transformation kinetics:** Types and classification of phase transformations, thermodynamic basis of phase transformation, atomic mechanism of diffusion, rate of atomic processes, empirical rate equation, determination of activation energy	6
3	**Liquid-solid transformation:** Nucleation – homogeneous and heterogeneous, rate of nucleation, growth, eutectic solidification, cellular and dendritic solidification, rapid solidification, crystallization of amorphous materials, melting and zone refining	6
4	**Diffusional transformations in solids:** Polymorphic transformations, massive transformations, order-disorder transformations, recrystallisation, precipitation, pearlitic reaction, cellular precipitation, coarsening	6
5	**Spinodal decomposition**: Mode of decomposition, points of inflexion, solubility differences, rate of decomposition, composition gradient, strain energy	6
6	**Martensitic transformations:** Thermodynamics of martensitic transformation, phenomenological theory of martensite crystallography (PTMC), orientation relationship, athermal and isothermal kinetics, reversibility, nucleation and growth mechanism, transformation kinetics	6
7	**Fe-C system**: Austenite to pearlite transformation, time-temperature-transformation curves, bainite reaction, T-T-T diagram of eutectoid steel, hypo-eutectoid steels, hyper-eutectoid steels	6
	Total	**42**

11. Suggested Books:

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications
1	Porter D.A. and Easterling K.E., Phase Transformations in Metals and Alloys, II edition, Taylor and Francis	2004
2	Jena A.K. and Chaturvedi M.C., Phase Transformations in Materials, Prentice Hall	1992
3	Burke J., The Kinetics of Phase Transformations in Metals, Pergamon Press	1996
4	Phase Transformation in Materials, Editor G. Kostoz, Wiley-VCH Verlag	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Metallurgical and Materials Engineering

1. Subject Code: MT232 **Course Title:** Electronic Materials

2. Contact Hours: L: 3; T: 1; P: 0

3. Examination Duration (Hrs): **Theory:** 0 3 **Practical:** 0 0

4. Relative Weightage: **CWS:** 2 5 **PRS:** 0 0 **MTE:** 2 5 **ETE:** 5 0 **PRE:** 0 0

5. Credits: 0 4 **6 Semester:** Spring

7. Pre-requisite: Nil **8. Subject Area:** DCC

9. Objective

To introduce the fundamental principles of electronic materials, their properties and devices.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	**Electrical and thermal conduction:** Classical theory, temperature dependence of resistivity, Matthiessen's rule, Nordheim's rule, resistivity of mixtures, Hall effect, thermal conduction, electrical conductivity of semiconductors and ionic crystals	6
2	**Modern theory of solids:** Hydrogen molecule, band theory of solids, semiconductors, density of states in an energy band, Boltzmann statistics, Fermi-Dirac statistics, Quantum theory of metals, Fermi energy significance, thermionic emission, photons	6
3	**Semiconductors:** Intrinsic and extrinsic semiconductors, temperature dependence of conductivity, recombination and minority carrier injection, optical absorption, peizorestivity, Schottky junction	6
4	**Semiconductor devices:** Ideal *pn* junction, *pn* junction band diagram, depletion layer capacitance of the *pn* junction, reverse breakdown, bipolar transistor, junction field effect transistor, metal-oxide-semiconductor field effect transistor, light emitting diodes, solar cells	5
5	**Dielectric materials**: Polarization and relative permittivity, electronic polarization, polarization mechanisms, dielectric constant and dielectric loss, dielectric breakdown, capacitor dielectric materials, piezoelectricity, ferroelectricity and electrostriction	5
6	**Magnetic properties:** Magnetization of matter, magnetic materials classification – diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism, saturation magnetization and Curie temperature, magnetic domains, soft and hard magnetic materials; Superconductivity - Zero resistance and the Meissner effect, critical current density	6
7	**Optical properties:** Light waves, refractive index, Snell's Law,	5

	total internal reflection, Fresnel's equation, light absorption, light scattering, polarization, optical fibers, LEDs	
8	**Thermal properties:** Heat, work, energy; Heat capacity – Einstein model, Debye model, Electronic contribution; Thermal conduction in metals and alloys, thermal expansion	3
	Total	**42**

11. Suggested Books:

Sl. No.	Authors/Name of Books/ Publisher	Year of Publications
1	Kasap S.O., Principles of Electronic Materials and Devices, 3rd Ed., McGraw-Hill	2009
2	Hummel R.E., Electronic Properties of Materials, 4th Ed., Springer	2011
3	White M.A., Physical Properties of Materials, 2nd Ed., CRC Press	2011
4	Kwok H.L., Electronic Materails, PWS Publications	1997
5	Streetman B. and Bannerjee S., Solid State Electronic Devices, 6th Ed., Printice Hall	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Humanities and Social Sciences**

1. Subject Code: **HS-912** Course Title: **Sociological Theories**

2. Contact Hours: **L: 2** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory** [2] **Practical** [0]

4. Relative Weightage: **CWS** [25] **MTE** [25] **ETE** [50]

5. Credits: [3] 6. Semester: **Both** 7. Subject Area: **Pre-PhD Course**

8. Pre – requisite: **Nil**

9. Objective: The course provides an advanced understanding and an in-depth discussion of classical and modern sociological theories.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction to the Social Theory:** Historical and political context; Structure of Sociological theory	4
2	**Founding Fathers:** August Comte – law of three stages, hierarchy of sciences Emile Durkheim – division of labour, social fact, religion and society	6
3	**Economy and Society:** Karl Marx: class, alienation, class struggle, historical materialism, social change Max Weber: social action, protestant ethic and spirit of capitalism, bureaucracy, power and authority, ideal type	4
4	**Structural Functionalism:** Talcott Parsons: structural functionalism, AGIL, pattern variables Robert K Merton: middle range theory, functions & dysfunctions, anomie	6
5	**Action Theory:** Symbolic interactionism, ethnomethodology and dramarturgy	4
6	**Structure and Agency:** Structuration Theory of Anthony Giddens, Post Modernism and Post Structuralism	4
	Total	**28**

11. Suggested Books:

S. No	Author/Book/Publisher	Year of Publication/Reprint
1	Allan, K. D., "Contemporary Social and Sociological Theory: Visualizing Social World", Pine Forge Press, London.	2006
2	Dillon, M., "Introduction to Sociological Theory: Theorists, Concepts, and Their Applicability to the Twenty-First Century", Wiley, New Delhi.	2009
3	Elliot, A., "Contemporary Social Theory: An introduction", Routledge, New York.	2008
4	Kivisto, P., "Illuminating Social Life: Classical and Contemporary Theory Revisited", 4th Ed., Pine Forge Press, Thousand Oaks.	2008
5	Wallace, R. A. and Wolf, A., "Contemporary Sociological Theory: Expanding the Class, 6th Ed., Prentice Hall of India.	2006

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Humanities and Social Sciences**

1. Subject Code: **HS-913** Course Title: **Sociology of Indian Society**
2. Contact Hours: **L: 2** **T: 1** **P: 0**
3. Examination Duration (Hrs.): **Theory** [2] **Practical** [0]
4. Relative Weightage: **CWS** [25] **MTE** [25] **ETE** [50]
5. Credits: [3] 6. Semester: **Both** 7. Subject Area: **Pre-PhD Course**
8. Pre – requisite: **Nil**
9. Objective: The course provides an advanced understanding of Indian social system.
10. Details of the course:

S. No.	Contents	Contact Hours
1	**Introduction to Indian Society:** Types of culture, culture and civilization; basis of Indian social organisation, *ashram* system and *purusharthas*	4
2	**Development of Sociology in India:** Approaches to the study of Indian society - indological approach, structural functional approach, subaltern approach, civilization/perspective approach; impact of the British rule on Indian society	6
3	**Social Institutions:** Caste, family and kinship and marriage - nature, different types and characteristics; recent trends	6
4	**Religion:** Origin and evolution of religion; marxist, weberian and functionalist perspectives on religion	4
5	**Social Stratification and Change**: Theories of stratification; caste system; jajmani system; sankritization; westernization and modernization	4
6	**Social Movements:** Nature of social movements; reform movements; peasant/agrarian movements; tribal movements; dalit movements; new social movements	4
	Total	**28**

11. Suggested Books:

S. No.	Author/Book/Publisher	Year of Publication/Reprint
1	Ahuja, R., "Indian Social System", Rawat Publications, Jaipur.	2009
2	Gupta, D., "Social Stratification", Oxford University Press, New Delhi.	2010
3	Harlambos,M. and Heald, R.M., "Sociology-Themes and Perspective", Oxford University Press, New Delhi.	2008
4	Madan, T.N., "Religion In India", Oxford University Press, New Delhi.	2000
5	Shah, G., "Social Movements in India: A Review of the Literature", Sage, New Delhi.	1990
6	Singh, Y., "Modernization of Indian Tradition", Rawat Publications, Jaipur.	2006
7	Srinivas, M. N., "Social Change in Modern India", Orient Blackswan, New Delhi.	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Humanities and Social Sciences**

1. Subject Code: **HS-914** Course Title: **Sociology of Science**

2. Contact Hours: **L: 2** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory** [2] **Practical** [0]

4. Relative Weightage: **CWS** [25] **MTE** [25] **ETE** [50]

5. Credits: [3] **6.** Semester: **Both** **7.** Subject Area: **Pre-PhD Course**

8. Pre – requisite: **Nil**

9. Objective: The course provides an advanced understanding of inter-relationship between science, technology and society.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction to Sociology of Science**: Development of modern science; the industrial and french revolutions and their technological and scientific implications	4
2	**Social Significance of Science and Technology**: Contextual nature of science; scientist as indexical and analogical reasoner	6
3	**Robert Merton's approach to science**: Ethos of science; matthew effect in science; thomas theorem and matthew effect	6
4	**Perspectives on scientific knowledge:** Karl Marx, Emile Durkheim, Karl Manheim's sociology of knowledge, Thomas Kuhn's structures of scientific revolutions and Karl Popper's theory of falsification	6
5	**Recent trends in Sociology of Science:** Science and technology in developing and developed countries, Indian context, information technology and globalisation, Manuel Castell's network society, internet and social inequality	6
	Total	**28**

11. Suggested Books:

S. No.	Author/Book/Publisher	Year of Publication/Reprint
1	Box, S. and Cotgrove, S., "Science, Industry and Society: Studies in the Sociology of Science", Routledge, New York.	2008
2	Bucchi, M., "Science in Society: An Introduction to Social Studies of Science", Routledge, New York.	2004
3	Krishna, V.V., "A Portrait of the Scientific Community in India: Historical Growth and Contemporary Problems", Gaillard et al. (eds). Scientific Communities in the Developing World, Sage, New Delhi.	1997
4	Kuhn, T., "Structure of Scientific Revolutions", Chicago University Press, Chicago.	1996
5	Merton, R. K., Social Theory and Social Structure, Amerind, New York.	1981
6	Wenda K. B., Jennifer C. and Sal R., "Science, Technology, and Society: A Sociological Approach", Willey-Blackwell, Indianapolis.	2005

Appendix 'E'

Item No. Senate/48.11

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ACADEMIC CALENDAR FOR AUTUMN SEMESTER 2013-14

Event	Description	Autumn Semester	
		I Year UG/IDD/IMT/IMS	Others (UG/PG/Ph.D.)
INSTITUTE REOPENING		**Jul 16, 2013 (Tue)**	
ACADEMIC REGISTRATION	Reporting of new Ph.D students		Jul 10, 2013 (Wed)
	All new Ph.D students		Jul 12, 2013 (Fri)
	All old students in respective Departments/ Centres		Jul 17, 2013 (Wed)
	All new UG/IDD/IMT/IMS students	Jul 23, 2013 (Tue)	
	All new PG students		Jul 17, 2013 (Wed)
	PG (against Vacant Seats)		Jul 24, 2013 (Wed)
	Closing of Admission (other than Ph.D)		Jul 24, 2013 (Wed)
	Submission of remaining documents by all new students	Sep 30, 2013 (Mon)	
	Closing of Admission (Ph.D)		Sep 30, 2013 (Mon)
	Online pre-registration for all students for next semester	Oct 01-08, 2013 (Tue-Tue)	
ORIENTATION PROGRAM	All new Ph.D students		Jul 10-15, 2013 (Wed-Mon)
	All new UG/IDD/IMT/IMS students Language Proficiency Test NCC/NSS/NSO selections Visits to Institute Facilities Visits to Department Facilities Familiarisation with online registration	Jul 24–30, 2013 (Wed–Tue)	
CLASSES BEGIN / END	**Begin** For all students (except newly admitted)		Jul 18, 2013 (Thu)
	For new PG/Ph.D students		Jul 18, 2013 (Thu)
	For new UG/IDD/IMT/IMS students	Jul 31, 2013 (Wed)	
	End For all students	Nov 08, 2013 (Fri)	
SUBJECT REGISTRATION	Addition/Deletion of courses for old students		Jul 26, 2013 (Fri)
	Online subject registration for new students	Jul 27-30, 2013 (Sat-Tue)	
	Institute Elective Courses Notification to UG/IDD/IMT/IMS students about courses to be offered	Sep 06, 2013 (Fri)	
	Online subject registration by the UG/IDD/ IMT/IMS students for next semester	Sep 16-23, 2013 (Mon-Mon)	
	Course withdrawal Last date for applying	Sep 23, 2013 (Mon)	

	Online subject pre-registration for all students for next semester	Oct 01-08, 2013 (Tue-Tue)	
PROJECT/ SEMINAR	Last date for assignment of major projects to all B.Tech. students		Aug 05, 2013 (Mon)
	Last date for evaluation of M.Tech. seminar reports		Oct 31, 2013 (Thu)
SHORT ATTENDANCE	**First compilation** Warning to students by Departments/ Centres.	Sep 27, 2013 (Fri)	
	Communication to parents/guardian	Oct 21, 2013 (Mon)	
	Last compilation Intimation by Chairman DAC/ Coordinators to Course coordinators for the submission of final list of students.	Oct 28, 2013 (Mon)	
	Display of list of students by Departments /Centres and communication to academic office.	Nov 11, 2013 (Mon)	
	Display of list of detained students for ETE by Academic office.	Nov 12, 2013 (Tue)	
TIME TABLES	Finalisation by Academic office	Oct 12, 2013 (Sat)	
	Finalisation by all Departments /Centres	Oct 26, 2013 (Sat)	
RESPONSE FORMS	Filling of response forms by all students	Oct 28-Nov 01, 2013 (Mon-Fri)	
EXAMINATIONS	**Mid Term Examination** Notification for MTE schedule	Aug 20, 2013 (Tue)	
	MTE dates	Sep 10-13, 2013 (Tue-Fri)	
	End Term Examination Notification for ETE schedule	Oct 22, 2013 (Thu)	
	ETE dates i) Theory ii) Practical (The exam may also be conducted during last lab classes)	i) Nov 13-20, 2013 (Wed-Wed) ii) Nov. 21-24 (Thu – Sun)	
	Last date for showing of answer scripts to Students	Nov 27, 2013 (Wed)	
	Re-examination Notification	Nov 20, 2013 (Wed)	
	Last date for applying	Dec 02, 2013 (Mon)	
	Re-examination dates	Dec 09-10, 2013 (Mon-Tue)	
GRADES / RESULT	Display of marks of course work evaluation	Nov 11, 2013 (Mon)	
	Finalization of Grades by Grade Moderation Committee and display for all courses and last date for sending to Academic office.	Nov 29, 2013 (Fri)	
	Last date of all examination results by academic office	Dec 16, 2013 (Mon)	
NCC CAMP		Nov 26-Dec 06, 2013 (Tue-Fri)	

PROGRESS REPORT	Submission of Reports of Ph.D. students by the Departments/Centres		Dec 02, 2013 (Mon)
WINTER BREAK	Students (other than IID final Yr/PG and Ph.D students)	Dec 02-31, 2013 (Mon-Tue)	
	Faculty Members §	Dec 02-31, 2013 (Mon-Tue)	
INSTITUTE CELEBRATIONS	**Convocation 2013**	Sep 21, 2013 (Sat)	
	Engineers' Day	Sep 15, 2013 (Sun)	
	Thomso	Oct 04-06, 2013 (Fri-Sun)	
	Jubilee Alumni Meet i) Diamond and Golden ii) Silver	 i) Nov. 11-12 (Mon-Tue) ii) Nov. 18-19 (Mon-Tue)	
	Charter/Alumni Day	Nov. 25, 2013 (Mon)	

§ *Faculty members may choose up to a maximum of 65 days vacation in an academic year from the Winter and Summer breaks.*

TEACHING DAYS IN AUTUMN SEMESTER 2013-14 (w.e.f. 18.07.2013 TO 08.11.2013)

DAY	MONTH							
	July	August	September	October	November	Less for MTE	Adjustment in Teaching Day*	**Total Days**
Monday	22,29	5,12,19,26	2,9,16,23,30	7,14,21,28	-	-	-1	**14**
Tuesday	23,30	6,13,20,27	3,**10**,17,24	1,8,15,22,29	-	1		**14**
Wednesday	24,31	7,14,21	4,**11**,18,25	9,23,30	6	1	+2	**14**
Thursday	18,25	1,8,22,29	5,**12**,19,26	3,10,17,24,31	7	1	-1	**14**
Friday	19,26	2,16,23,30	6,**13**,20,27	4,11,18,25	1,8	1		**15**
Total Days	**10**	**19**	**21**	**21**	**4**	**4**		**71**

* Wednesday Time Table shall be followed on *September 09 (Monday)* and *November 07 (Thursday)* to compensate less number of working Wednesdays; accordingly the adjustment in Teaching day is shown.

** Classes for all **I Year UG/IDD/IMT/IMS** courses shall be held on ***eight Saturdays*** as per the following schedule to compensate the less number of available working days due to late registration.

Saturday	**Time Table to be followed**
Aug 03	Monday
Aug 10	Tuesday
Aug 17	Wednesday
Aug 24	Thursday
Aug 31	Friday
Sep 21	Monday
Sept 28	Tuesday
Oct 05	Thursday

Details of MTE (September 10–13, 2013) :

i. September **10**, 2013 (Tuesday) – Working day
ii. September **11**, 2013 (Wednesday) – Working day
iii. September **12**, 2013 (Thursday) – Working day
iv. September **13**, 2013 (Friday) – Working day

List of Holidays in 2013

(Source: www.iitr.ac.in)

During the Calendar year 2013

SL. No.	Holidays	Date	Day of Week
1.	Id-e-Milad* (Birthday of Prophet Md.)	January 25	Friday
2.	Republic Day	January 26	Saturday
3.	Holi	March 27	Wednesday
4.	Good Friday	March 29	Friday
5.	Ram Navami	April 19	Friday
6.	Mahavir Jayanti	April 24	Wednesday
7.	Buddha Purnima	May 25	Saturday
8.	Idu'l Fitr*	August 09	Friday
9.	Independence Day	August 15	Thursday
10.	Janmashtami	August 28	Wednesday
11.	Mahatma Gandhi's Birthday	October 02	Wednesday
12.	Dussehra (Vijay Dashmi)	October 13	Sunday
13.	Idu'l Zuha (Bakrid)*	October 16	Wednesday
14.	Diwali (Deepawali)	November 03	Sunday
15.	Govardhan Puja	November 04	Monday
16.	Bhai Duj	November 05	Tuesday
17.	Moharram*	November 14	Thursday
18.	Guru Nanak's Birthday	November 17	Sunday
19.	Christmas Day	December 25	Wendesday

*** Subject to change on visibility of moon.**

* In the event of any change in the date(s) of the above holiday(s) announced by the Govt. of India through the media. (T.V / AIR / Newspaper etc.) depending upon visibility of the Moon, the institute shall automatically observe the subject holiday(s) accordingly and no notice in this regard shall be issued.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ACADEMIC CALENDAR FOR SPRING SEMESTER 2013-14

Event	Description	Spring Semester
INSTITUTE REOPENING		Jan 01, 2014 (Wed)
ACADEMIC REGISTRATION	Reporting of new Ph.D students	Dec 30, 2013 (Mon)
	All new Ph.D students	Jan 01, 2014 (Wed)
	All students in respective Departments/ Centres	Jan 01, 2014 (Wed)
	Online pre-registration for all students for next semester	Mar 10-Mar 18, 2014 (Mon-Tue)
	Closing of Admission (Ph.D)	Feb 28, 2014 (Fri)
	Last date for submission of remaining documents by new Ph.D students	Feb 28, 2014 (Fri)
ORIENTATION PROGRAM	All new Ph.D students	Dec 30-31, 2013 (Mon-Tue)
CLASSES BEGIN / END	**Begin** For all students	Jan 02, 2014 (Thu)
	End For all students	Apr 17, 2014 (Thu)
SUBJECT REGISTRATION	Addition/Deletion of courses for old students	Jan 10, 2014 (Fri)
	Online subject registration for new Ph. D students	Jan 10-12, 2014 (Fri-Sun)
	Online subject pre-registration for all students for next semester	Mar 10-Mar 18, 2014 (Mon-Tue)
	Institute Elective Courses Notification to UG/IDD/IMT/IMS students about courses to be offered	Feb 14, 2014 (Fri)
	Online subject registration by the UG/IDD/ IMT/IMS students for next semester	Feb 24-Mar 03, 2014 (Mon-Mon)
	Course withdrawal Last date for applying	Mar 03, 2014 (Mon)
PROJECT/ DISSERTATION	Mid Term Evaluation for M. Tech/IDD/IMS/IMT students	Mar 31, 2014 (Mon)
	B.Tech. Project Viva-voce	May 6-7, 2014 (Tue-Wed)
SHORT ATTENDANCE	**First compilation** Warning to students by Departments/ Centres.	Mar 21, 2014 (Fri)
	Communication to parents/guardian	Apr 1, 2014 (Tue)
	Last compilation Intimation by Chairman DAC/ Coordinators to Course coordinators for the submission of final list of students.	Apr 10, 2014 (Thu)
	Display of list of students by Departments /Centres and communication to academic office.	Apr 19, 2014 (Sat)
	Display of list of detained students for ETE by Academic office.	Apr 20, 2014 (Sun)

TIME TABLES	Finalisation by Academic office	Mar 10, 2014 (Mon)
	Finalisation by all Departments/Centres	Mar 24, 2014 (Mon)
RESPONSE FORMS	Filling of response forms by all students	Apr 07-11, 2014 (Mon-Fri)
EXAMINATIONS	**Mid Term Examination** Notification for MTE schedule	Jan 30, 2014 (Thu)
	MTE dates	Feb 20-23, 2014 (Thu-Sun)
	End Term Examination Notification for ETE schedule	Mar 27, 2014 (Thu)
	ETE dates i) Theory ii) Practical (The exam may also be conducted during last lab classes)	i) Apr 21-27, 2014 (Mon-Sun) ii) Apr 28-30 (Mon-Wed)
	Last date for showing of answer scripts to Students	May 02, 2014 (Fri)
	Re-examination Notification	Apr 23, 2014 (Wed)
	Last date for applying	May 05, 2014 (Mon)
	Re-examination dates	Jul 18-19, 2014 (Fri-Sat)
	GATE / JAM – 2014 Online Offline	To Be Decided
	JEE – 2014 Main Advanced	To Be Decided
GRADES / RESULT	Display of marks of course work evaluation	Apr 17, 2014 (Thu)
	Finalization of Grades by Grade Moderation Committee and display for all courses and last date for sending to Academic office.	May 05, 2014 (Mon)
	Last date of all examination results by academic office	May 16, 2014 (Fri)
PROGRESS REPORT	Submission of Reports of Ph.D. students by the Departments/Centres	Jun 16, 2014 (Mon)
SUMMER BREAK	Students (except M.Tech/IDD final year and Ph.D)	May 05-Jul 14, 2014 (Mon-Mon)
	Faculty Members §	May 06-Jul 14, 2014 (Tue-Mon)
INSTITUTE CELEBRATIONS	Science Day	Feb 28, 2014 (Mon)
	Srishti (Hobbies club annual exhibition)	Mar 08-09, 2014 (Sat-Sun)
	Sangram	Mar 15-16, 2014 (Sat-Sun)
	Cognizance-2014	Mar 21-23, 2014 (Fri-Sun)

§ *Faculty members may have a maximum of 65 days vacation in an academic year from the Winter and Summer breaks.*

TEACHING DAYS IN SPRING SEMESTER 2013-14 (w.e.f. 02.01.2014 TO 17.04.2014)

DAY	MONTH						
	January	February	March	April	Less for MTE	Adjustment in Teaching Day**	**Total Days**
Monday	6,13,20,27	3,10,17,**24**	3,10,24,31	7,14	1	+1	**14**
Tuesday	7,14,21,28	4,11,18,**25**	4,11,18,25	1,8,15	1		**14**
Wednesday	8,15,22,29	5,12,19,**26**	5,12,19,26	2,9,16	1		**14**
Thursday	2,9,16,23,30	6,13,20,**27**	6,13,20,27	3,10,*17*	1	-1	**14**
Friday	3,10,17,24,31	7,14,21,28	7,14,28	4,11	-		**14**
Total Days	**22**	**20**	**19***	**13**	**4**		**70**

*The third Friday in March (21.03.2014) shall be a **Non-Teaching** working day due to Cognizance 2014.

** Monday Time Table shall be followed on *April 17 (Thursday)* to compensate less number of working Mondays; accordingly the adjustment in Teaching day is shown.

Details of MTE (February 24-27, 2014) :

i. February **24**, 2013 (Monday) – Working day
ii. February **25**, 2013 (Tuesday) – Working day
iii. February **26**, 2013 (Wednesday) – Working day
iv. February **27**, 2013 (Thursday) – Working day

List of Holidays in 2014

(Source - http://www.officeholidays.com/countries/india/2014.php)

Day	Date	Holiday
Monday	January 13	Milad-un-Nabi
Sunday	January 26	Republic Day
Monday	March 17	Holi
Tuesday	April 08	Ram Navami
Sunday	April 13	Mahavir Jayanti
Friday	April 18	Good Friday
Tuesday	May 13	Buddha Purnima
Monday	July 28	Idul Fitr
Friday	August 15	Independence Day
Sunday	August 17	Janmashtami
Thursday	October 02	Mahatma Gandhi Birthday
Saturday	October 04	Idul Juha
Monday	October 06	Dussehra
Thursday	October 23	Deewali
Friday	October 24	Govardhan Puja
Saturday	October 25	Bhai Duj
Monday	November 03	Muharram (10th Day)
Thursday	November 06	Guru Nanak Birthday
Thursday	December 25	Christmas Day

PROPOSED CREDITS FOR B.TECH. PROGRAMME

CURRICULAR COMPONENTS	Credits
(a) Institute Core Courses (ICC)	
a) Humanities and Social Sciences (HSSC)	**04**
b) Basic Sciences (BSC)	**08+08***
c) Engineering Sciences (ESC)	**04+12***
d) General Science (GSC)	**03**
	*** Department Specific**
Total	**39**
(b) Department Core Courses (DCC)	
a) Class Contact Core courses	**60-64**
b) Introduction to (Discipline) Engineering	**02**
c) Engineering Analysis and Design	**03-04**
d) Industry Oriented Problem/ Lab based project/ Practical Problem/ Case study	**03-04**
e) Technical Communication	**02**
f) B.Tech. Project	**12**
g) Educational Industrial Tour	**Satisfactory/Unsatisfactory**
h) Practical Training/ Internship	**02**
Total	**84-88**
(c) Humanities, Social Sciences and Management Elective Courses (HSSMEC)	
a) Humanities and Social Sciences	**03**
b) Management Studies	**03**
Total	**06**
(d) Open Elective Course (OEC)	**03**
(e) Departmental Elective Courses (DEC)	**22-26**
(f) Minor Specialization Courses (MSC)/ Departmental Honour Courses(DHC)	**18-20**
(g) Co-Curricular Activities (CCA)	
a) Discipline (To be awarded after Final year)	
b) NCC/NSS (First Year)	**02**
c) NSO/Proficiency (Second year to Final year and to be awarded after final year)	**02**
	02
Total	**06**
Grand Total (For those who **do not opt** for minor specialization/honours)	**160-170**

Grand Total (For those who **opt** for degree with minor specialization)	**178-190**
Grand Total (For those who **opt** for degree with honours)	**178-190**

INSTITTUE CORE COURSES

B.TECH. PROGRAMME

	CREDITS	Contact Hours / Week			
		L	**T**	**P**	**Total**
(i) Humanities and Social Sciences (HSSC)					
1. Communication Skills (Basic/ Advanced)	02	1	0	2	03
2. Ethics and Self-awareness	02	2	0	0	02
	04	**03**	**0**	**2**	**05**
(ii) Basic Sciences (BSC)					
1. Mathematics-I	04	3	1	0	4
2. Mathematics-II (Module form)	04	3	1	0	4
3. Department specific course-I*	04	3	1	0(2/2)	4
4. Department specific course-II*	04	3	1	0(2/2)	4
(* Either from Physics or Chemistry)					
	16	**12**	**3**	**0(2)**	**16**
(iii) General Science (GSC)					
1. Introduction to Environmental Studies	03	3	0	0	3
	03	**3**	**0**	**0**	**3**
(iv) Engineering Sciences (ESC)					
1. Department specific course on Computer Programming	04	3	0	2	5
2. Department specific course-I	04	3	1	0	4
3. Department specific course-II	04	3	1	0	4
4. Department specific course-III	04	3	1	0	4
Total	**16**	**12**	**3**	**2**	**17**

INSTITTUE ELECTIVE COURSES

	CREDITS	Contact Hours / Week			
		L	T	P	Total
(i) Humanities, Social Sciences and Management Elective Course (HSSMEC)					
1. Course from Humanities and Social Sciences	03	2	1	0	03
2. Course from Management Studies	03	3	0	0	03
Total	**06**	**5**	**1**	**0**	**06**
(ii) Open Elective Course (OEC)					
1. Any one course from Basic Science, Engineering Science, Humanities & Social Science and Management streams (The student can select any course from this basket.)	03	3	0	0	3
	03	**3**	**0**	**0**	**3**

LIST OF COURSES UNDER DIFFERENT CATEGORIES

	CREDITS	Contact Hours / Week			
		L	T	P	Total
(i) Humanities, Social Sciences and Management (HSSMEC)					
Humanities and Social Sciences (Any ONE from the list*) 1. Economics 2. English Literature 3. Gender and Cultural Studies 4. Linguistics 5. Philosophy 6. Psychology 7. Sociology	03	3	0	0	03
Management Studies (Any ONE from the list*) 1. Innovation & Business Models and Entrepreneurship 2. Managing Innovation and Change 3. Cross Cultural Management 4. Strategic Human Resource Management 5. Management of Self and Interpersonal Dynamics 6. Marketing Research 7. Quality Management	03	3	0	0	03
(ii) Engineering Sciences (ESC)					
Department Specific Courses-I,II, III (Any THREE from the list)					
1. Engineering Drawing	04	2	0	4	6
2. Fluid Mechanics	04	3	1	0	4
3. Thermodynamics	04	3	1	0	4
4. Solid mechanics	04	3	1	0	4
5. Electrical Science	04	3	1	2/2	5
6. Introduction to Electronics	04	3	1	2/2	5
7. Electrical and Electronic Materials	04	3	1	0	4
8. Material Science	04	3	1	0	4
9. Systems Engineering	04	3	1	0	4
10. Engineering Hydrology	04	3	1	0	4
11. Basic Manufacturing Processes	04	3	1	2/2	5
12. Mechanical Engineering	04	2	0	4	6

Drawing					
13. Energy Engineering	04	3	1	0	4
14. Process Industry Materials of Construction	04	3	1	0	4
15. Electrical and Electronic Polymers	04	3	1	0	4
16. Corrosion and Wear	04	3	1	0	4
17. Electrochemical Science and Engineering	04	3	1	0	4
(Courses at serial no. 14-17 are for academic programmes at Saharanpur Campus)					

Course Structure for B.Tech. First Year

Autumn Semester

S. No.	Subject	Credit	Category
1.	Mathematics-I	4	BSC
2.	Introduction to (Discipline) Engineering	2	DCC
3.	Department specific Programming Course	4	ESC
4.	Departmental Specific Course –I	4	BSC
5.	Ethics and Self-Awareness	2	HSSC
6.	Communication Skills (Basic/Advanced)	2	HSSC
7.	Introduction to Environmental Studies	3	GSC
	Total	**21**	

Spring Semester

S. No.	Subject	Credit	Category
1.	Mathematics-II (Module to be selected by dept)	4	BSC
2.	Departmental Core Course-I	4	DCC
3.	Departmental Core Course-II	4	DCC
4.	Departmental Core Course-III	4	DCC
5.	Departmental Specific Course –II	4	BSC
6.	Departmental Specific Course –I	4	ESC
	Total	**24**	

Second Year

Autumn Semester

S. No.	Subject	Credit	Category
1.	Departmental Specific Course –II	4	ESC
2.	Departmental Core Course-IV	4	DCC
3.	Departmental Core Course-V	4	DCC
4.	Departmental Core Course-VI	4	DCC
5.	Engineering Analysis and Design	3-4	DCC
6.	Humanities and Social Sciences Elective Course*	3	HSSMEC
	Total	**19-23**	

Spring Semester

S. No.	Subject	Credit	Category
1.	Departmental Specific Course –III	4	ESC
2.	Departmental Core Course-VII	4	DCC
3.	Departmental Core Course-VIII	4	DCC
4.	Departmental Core Course-IX	4	DCC
5.	Departmental Core Course-X	4	DCC
6.	Humanities and Social Sciences Elective Course*	3	HSSMEC
	Total	**20-23**	

***NOTE:** The course from Humanities and Social Sciences category can be kept either in Autumn Semester or Spring Semester.

Third Year

Autumn Semester

S. No.	Subject	Credit	Category
1.	Departmental Core Course-XI	4	DCC
2.	Departmental Core Course-XII	4	DCC
3.	Departmental Core Course-XIII	4	DCC
4.	Departmental Elective Course-I	4	DEC
5.	Technical Communication	2	DCC
6.	Open Elective Course**	3	OEC
	Management Studies Elective Course**		HSSMEC
	Total	**21**	

Spring Semester

S. No.	Subject	Credit	Category
1.	Departmental Core Course-XIV	4	DCC
2.	Departmental Core Course-XV	4	DCC
3.	Departmental Elective Course-II	4	DEC
4.	Open Elective Course**	3	OEC
	Management Studies Elective Course**		HSSMEC
5.	Minor Specialization Course - I Departmental Honour Course – I	4	MSC/DHC
6.	Industry Oriented Problem/Case Study/ Lab based project/ Practical Problem	3-4	DCC
7.	Educational Tour	Non-credit	DCC
	Total	**18/23**	

****NOTE:** The courses from Management and Open Elective be kept in different semesters.

Fourth Year

Autumn Semester

S. No.	Subject	Credit	Category
1.	Departmental Elective Course-III	4	DEC
2.	Departmental Elective Course-IV	4	DEC
3.	Minor Specialization Course –II Departmental Honour Course – II	4	MSC/DHC
4.	Minor Specialization Course –III Departmental Honour Course – III	4	MSC/DHC
5.	Training Seminar	2	DCC
6.	B.Tech. Project	4	DCC
	Total	**14/22**	

Spring Semester

S. No.	Subject	Credit	Category
1.	Departmental Elective Course-V	4	DEC
2.	Departmental Elective Course-VI	4	DEC
3.	Minor Specialization Course-IV Departmental Honour Course – IV	4	MSC/DHC
4.	Minor Specialization Course-V Departmental Honour Course – V	4	MSC/DHC
5.	B.Tech. Project (Contd. from Autumn Sem.)	8	DCC
	Total	**16/24**	

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CY-001** Course Title: **Physical Chemistry**

2. Contact Hours: **L: 3** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 10 **PRS** 15 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **Nil**

9. Objective: To provide a theoretical and experimental knowledge of fundamental physical chemistry to engineering students.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Quantum Chemistry:** Postulates, commuting and non-commuting operators, Schrödinger equation, particle in a one-, two- and three dimensional box and their implications, H-atom - radial and angular wave functions, shapes of orbitals (s, p and d), application of quantum chemistry concepts to hydrogen-like atoms and their atomic spectra.	7
2.	**Chemical Equilibria:** Description of equilibrium, feasibility of chemical reaction, Gibbs-Helmholtz equation, phase transition - Clapeyron equation, Clausius- Clapeyron equation, free energy changes in reversible processes, chemical potential, partial molar quantities, activity coefficient and fugacity, basic concepts of statistical thermodynamics.	6
3.	**Reaction Dynamics:** Collision theory of bimolecular reactions and its drawbacks, potential energy surfaces, transition state theory using partition functions, thermodynamic formulation of transition state theory and mapping of transition states using ultrafast processes.	6
4.	**Photochemistry:** Laws of photochemistry, photophysical and photochemical processes and their quantum efficiencies, spontaneous and stimulated processes. Franck-Condon principle, photosensitizers - photosynthesis and solar cells.	6

5.	**Catalysis:** Homogeneous catalysis – kinetics of acid, base and enzyme catalyzed reactions with suitable examples. Heterogeneous catalysis – surface phenomena, porosity, derivation of Langmuir adsorption isotherm, Langmuir-Hinshelwood and Rideal-Eley mechanisms, comparison of rates of homogeneous and heterogeneous reactions based on activated complex theory.	**6**
6.	**Spectroscopy:** Interaction of electromagnetic radiation with matter, instrumental spectroscopic techniques (AAS, ICP, UV-Vis and IR spectroscopy), application of spectroscopy techniques to atomic and molecular systems.	**6**
7.	**Solid-State Chemistry:** Bonding in solids, diffraction methods – scattering of X-rays from a crystal, structure factor and systematic absences, methods of synthesis of solids–ceramic, sol-gel, hydrothermal, microwave and sonochemical.	**5**
	Total	**42**

List of Experiments:

i)	Determination of iron in iron ore using potassium dichromate (internal indicator method).
ii)	Heat of neutralization of a strong base by a strong acid.
iii)	Determination of surface excess concentration of 1-butanol in aqueous solution.
iv)	To study the kinetics of a redox reaction.
v)	Blue printing using sunlight.
vi)	pH metry/ potentiometry titrations a) Strong acid – strong base; b) Strong acid – weak base c) Weak acid – strong base; d) Redox titration: Fe^{2+} or Mn^{2+}
vii)	Acid base titrations using conductivity meter. a) Strong acid – strong base; b) Strong acid – weak base c) Weak acid – strong base.
viii)	Spectrophotometry: Determination of [Fe (III)] by colorimetry.
ix)	Determination of hardness of water by EDTA- complexometry titration.
x)	Determination of the composition of mixtures of liquids using viscometry.

11.**Suggested Books**:

S. No.	Authors/ Title/ Publisher	Year of Publication
1.	Silbey R.J. and Alberty R.A., "Physical Chemistry", 3rd Ed, John Wiley & Sons, Inc.	**2003**
2.	Atkins P. and Paula J. Physical Chemistry, 8th Ed., Oxford University Press.	**2006**

3.	West A.R., Solid State Chemistry and its Applications, Wiley-India Edition	**2003**
4.	Levine, I. N, Quantum Chemistry, Pearson Education	**2000**
5.	Turro N.J., Ramamurthy V. and Scaiano J.C., Modern Molecular Photochemistry of Organic Molecules, University Science Books	**2008**
6.	Skoog D.A., Holler F.J. and Crouch S.R., "Principles of Instrumental Analysis", 6th Ed., Thomson Brooks	**2006**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CY-002** Course Title: **Organic and Inorganic Chemistry**

2. Contact Hours **L: 3** **T: 1** **P: 2/2**

3. Examination Duration (Hrs): **Theory** 3 **Practical** 0

4. Relative Weightage : **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 0

5. Credits: 4 6. Semester: **Spring**

7.Subject Area: **Basic Science** 8. Pre-requisite: Nil

9.Objective: To impart knowledge on organic reaction mechanisms and organo-metallic chemistry

10. Details of Course:

S.No	Contents	Contact Hrs
1.	**Introduction to elements other than carbon in organic chemistry:** Classification of organic functional groups by oxidation level, aromaticity, reactivity and synthesis of thiophene, pyridine, furan and pyrrole.	6
2.	**Stereochemistry and Reaction Mechanisms:** Stereochemistry of addition at carbon-carbon double bond; addition of bromine to cis and trans butane, oxidation across the double bond through peroxides and permanganate; Diels Alder reaction [4+2] and [2+2] cycloaddition reactions. Aromatic nucleophilic substitution mechanisms (S_NAr, S_N1 and Arynes) reactivity and reactions.	8
3.	**Synthesis in action:** Examples of some important compounds such as benzocaine, saccharin, salbutamol and thyroxine. Introduction to mass spectroscopy and NMR spectroscopy for structural prediction of organic compounds.	9
4.	**Polymerization and Novel Polymers:** Addition and condensation polymerization, Coordination polymerization, copolymerization, classification of polymers, Molecular mass of polymers, Some common addition and condensation polymers. Conducting polymers, doping, Shirakawa experiments, oxidation of aniline to polyaniline, introduction to biodegradable polymers and plastics	5
5.	Coordination Chemistry: Crystal field theory– d-orbitals and degeneracy, splitting in octahedral geometry, low-spin and high-spin	7

	complexes, the pairing energy and crystal field stabilization energy, splitting in tetrahedral geometry, factors affecting the magnitude of Δ, spectrochemical series, applications of crystal field theory, ionic radii, hydration enthalpy/stability of complexes, color and magnetism of complexes, Jahn-Teller effect– definition and examples from d^9 case, static and dynamic effects.	
6.	**Organometallic Chemistry:** Factors affecting M-C bond formation, MO of CO molecule and concept of antibonding (π^*) orbitals, metal carbonyls, models of M-CO bonding, spectroscopic features of carbonyl compounds, synthesis and reactions of carbonyls, transition metal-π complexes, e.g. metal-alkene complexes– synthesis, reactions, bonding and stability, applications of organometallic compounds in catalytic processes.	7
	Total	42

List of Experiments:

i) Identification of functional groups in an organic compound.
ii) Determination of the equivalent weight of an acid.
iii) Characterization of an organic compound by UV/Vis; IR spectra.
iv) Preparation of acetanilide or aspirin and determination of melting point, and matching with known sample
v) Preparation of m-dinitrobenzene from benzene.
vi) Preparation of tribromoaniline from aniline.
vii) Studies on complex formation between Ca^{2+} and EDTA in solution.
viii) Synthesis of coordination/organometallic compounds.

11. Suggested Books:

S.No.	Name of Authors/ Books/ publisher	Year of Publication
1	Morrison R. T. and Boyd R.N., " Organic Chemistry", 6th Ed., Prentice Hall of India.	2001
2	Clayden, Greeves, Warren and Wothers, "Organic Chemistry" Oxford University Press	2009
3	Lee J.D., "Concise Inorganic Chemistry", 5th Edn., Chapman & Hall.	2010
4	Huheey J.E., Keiter E.A., Keiter R.L. and Medhi O.K. "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Pearson Education Asia.	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Mathematics Department**

1. Subject Code: **MA-001** Course Title: **Mathematics I**

2. Contact Hours: **L: 3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **None**

9. Objective: **To provide essential knowledge of basic tools of Differential Calculus, Integral Calculus , Vector Calculus and Matrix Algebra for degree students.**

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Matrix Algebra:** Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations. Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Normal & Unitary matrices and their elementary properties. Eigen-values and Eigenvectors of a matrix, Cayley-Hamilton theorem, Diagonalization of a matrix.	8
2.	**Differential Calculus:** Limit, Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations, Tangent plane and normal. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Error approximations. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers	12
3.	**Integral Calculus:** Review of curve tracing and quadric surfaces, Double and Triple integrals, Change of order of integration. Change of variables. Gamma and Beta functions. Dirichlet's integral. Applications of Multiple integrals such as surface area, volumes, centre of gravity and moment of inertia..	12
4.	**Vector Calculus:** Differentiation of vectors, gradient, divergence, curl and their physical meaning. Identities involving gradient, divergence and curl. Line and surface integrals. Green's, Gauss and Stroke's theorem and their applications.	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	E. Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley and Sons, Inc., U.K.	2011
2.	R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House.	2005
3.	M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, 11th Edition, Pearson Education.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Physics Department**

1. Subject Code: **PH-001** Course Title: **Mechanics**

2. Contact Hours: **L: 3** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 10 **PRS** 15 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **None**

9. Objective: **To familiarize students with the basic principles of mechanics**

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**STATICS OF PARTICLES** Vectorial representation of forces and moments- Vector Operation-Concepts of Particles and Rigid bodies – Composition of concurrent forces in Plane Free body Diagram – Equilibrium of Rigid bodies in Two and three dimensions-Moment of a force about a point and about an axis-Couple moment-Reduction of a force system to a force and a couple	8
2.	**PROPERTIES OF SURFACES, MOMENTS AND PRODUCTS OF INERTIA** Definition of Moment of Inertia for areas- Parallel axis theorem - Perpendicular axis theorem-Moment of inertia for composite area-product of inertia for an area-mass moment of inertia	6
3.	**FRICTION** Laws of coulomb Friction – Coefficient of Friction – Dry Friction – Sliding Friction –Ladder friction – Belt friction — Rolling Resistance.	4
4.	**KINEMATICS OF PARTICLES** Principle of virtual work for a particle and rigid body-condition for equilibrium for a conservative system, stability-particle dynamics in rectangular coordinate, cylindrical coordinate and in terms of path variables-General motion of a system of particles-	8
5.	**WORK ENERGY METHODS, IMPULSE AND MOMENTUM** Work Energy Method – Conservation of Energy – Impulse and Momentum Relation – Impulsive Forces – Impact force – Conservation of momentum – Moment of Momentum Equation.	8
6.	**RIGID BODY MOTION;**	8

	Translation and rotation of rigid bodies- Derivative of a vector fixed in moving reference-General relationship between time derivative of a vector for different references-Moment of momentum equations-Kinetic energy of a rigid body-Work and energy relations-Euler's equation of motion-Three dimensional motion about a fixed point	
	Total	**42**

List of experiments:

1. Study of magnetic field of a pair of coils in Helmholtz arrangement
2. Determination of e/m
3. Determination of first excitation potential of a gas by Frank-Hertz experiment
4. Determination of Stefan's constant
5. Determination of Planck's constant by radiation
6. To study and verify Malus' law
7. Study of polarization of light using quarter wave plate
8. Determination of Brewster's angle at glass-air interface
9. Determination of width of a slit by single-slit diffraction pattern
10. Four probe method of finding resistivity of semiconductor
11. Quinck'e Method for determining mass susceptibility
12. Wavelength of Na light by Newton's ring method

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Irving H. Shames and G.Krishna Mohana Rao, "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education	2006
2.	R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, ", 11th Edition, Pearson Education	2010
3.	Beer F.P and Johnson E.R., "Vector Mechnics for Engineers – Statics and Dynamics", Tata McGraw-Hill Publishing Company Ltd.,	2001
4.	J.L.Meriam and L.G.Kraige, "Engineering Mechanics", John Willey and Son's	

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : PHYSICS

1. Subject Code: **PH-003** Course Title: **Electromagnetic Theory**

2. Contact Hours: **L: 3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory** 0 3 **Practical** 0 0

4. Relative Weightage: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 00

5. Credits: 0 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **None**

9. Objective:
The objective of the course is to present the basic elements of Electrostatics, Magnetostatics, Maxwell's equations, and Electromagnetic Wave propagation.

10. Details of Course:

S.No.	Particulars	Contact Hours
1	**Vectors and Fields:** Cartesian coordinate System, Cylindrical and Spherical coordinate Systems, Constant coordinate surfaces, Del operator, Gradient, Divergence of a Vector and Divergence Theorem, Curl of a vector and Stoke's theorem, Gradient, Divergence, Curl and Laplacian in the three coordinate Systems, Laplacian of a scalar, Scalar & Vector Fields, Classification of Vector field. Sinusoidally time-varying fields, Complex Numbers and Phasor technique.	8
2	**Electrostatics:** Field intensity, Gauss's law & its applications, Maxwell's 1st eqn. (Electrostatics), Electric Energy and potential, the line integral, Potential gradient, the dipole fields, Energy density in an electrostatic field. Current and current density, Continuity of current, Metallic conductors, Conductor properties and boundary conditions, the nature of Dielectric materials and related Boundary conditions, Capacitance, Capacitance of a two-wire line, Current analogies. Electrostatic boundary-value problems, Laplace's and Poisson's equations, Uniqueness theorem, General procedure for solving Laplace's and Poisson's equation, Resistance and capacitance, Method of images.	10

3	**Magnetostatics:** Biot-Savart's law, Ampere's circuital law, Applications of Ampere's law, Magnetic flux and magnetic flux density - Maxwell's eqn., Maxwell's eqn. for static electromagnetic fields, Scalar and vector magnetic potentials. Magnetic dipole, Force due to Magnetic field on a differential current element, force between two differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Inductors and inductances, Magnetic energy, Magnetic circuits, Potential energy and force on magnetic materials.	**12**
4	**Maxwell's equations and Electromagnetic wave propagation:** Faraday's law, Displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, Kirchoff's Voltage law and Kirchoff's Current law from Maxwell's equations, EM waves in general, EM wave propagation in Lossy Dielectrics, Wave propagation in lossless dielectrics, Plane waves in free space, Plane waves in Good conductors, Power & Poynting Vector, Reflection of a plane wave at normal incidence, Reflection of a plane wave at oblique incidence.	**12**
	Total	**42**

11. Suggested Books:

S. No.	Name of Books / Authors/ Publishers	Year of Publication
1.	Engineering Electromagnetics, William H Hayt, Jr., and John A. Buck, Tata McGraw Hill Publishing Company Ltd, New Delhi, 7th edition	2005
2.	Elements of Engineering Electromagnetics, Matthew N.O. Sadiku, Oxford University Press, 3rd Edition	2003
3.	Elements of Engineering Electromagnetics, Nannapaneni Narayan Rao, Prentice Hall of India, New Delhi, 4th Edition	2000
4.	Introduction to Electrodynamics, D.J. Griffiths, Prentice Hall, 3rd Edition	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Physics Department**

1. Subject Code: **PH-005** Course Title: **Electrodynamics and Optics**

2. Contact Hours: **L: 3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **None**

9. Objective: **To familiarize students with the basic principles of electrodynamics and optics and extend its applications to interference, diffraction, and lasers.**

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Basic principles of electrostatics and magnetostatics, Maxwell's equations in differential form, physical significance of Maxwell's equations., wave equation and its solution for a dielectric medium, plane waves in a dielectric, concept of polarization, linear, circular and elliptical polarization, the Poynting vector, energy density and intensity of an e-m wave, reflection and refraction at the interface of two dielectrics	14
2.	Interference of light waves, Young's double slit experiment, interference pattern, intensity distribution, interference with white light, displacement of fringes, phase change on reflection. Interference by division of amplitude, interference by a plane parallel film when illuminated by a plane wave, interference by a film with two non-parallel reflecting surfaces (wedge shaped films), colours of thin films, Newton's rings, the Michelson interferometer. Coherence, Young's double slit and Michelson interferometer to explain coherence, the line width, spatial coherence, optical beats.	10
3.	Fraunhofer diffraction, single-slit diffraction pattern, diffraction by a circular aperture, directionality of laser beams, focusing of laser beams, limit of resolution, resolving power of a microscope, two-slit Fraunhofer diffraction, N-slit Fraunhofer diffraction, diffraction grating, grating spectrum and resolving power.	6
4.	Polarization and double refraction, wire grid polarizer, polarization by reflection and double refraction, Malus law, Brewster's law, superposition	6

	of two disturbances, the mathematical analysis. Phenomenon of double refraction, normal and oblique incidence, interference of polarized light, quarter-wave and half-wave plates, analysis of polarized light, optical activity.	
5.	Basic properties of lasers, spontaneous and stimulated emissions, main components of a laser, ruby and He-Ne laser, semiconductor diode laser	**6**
	Total	**42**

11. Suggested Books:

S. No.	**Name of Authors/ Books/Publishers**	**Year of Publication/Reprint**
1.	D. J. Griffiths, "Introduction of Electrodynamics," PHI Learning Pvt. Ltd.	2009
2.	M. N. O. Sadiku, " Elements of Electromagnetics," Oxford Univ. Press	2009
3.	A. Ghatak, "Optics," 6th Ed., Tata McGraw-Hill Publishing Co. Ltd.	2012
4.	E. Hecht, "Optics," 4th Ed., Pearson Education Pvt. Ltd.	2003
5.	F. Jenkins and H. White, "Fundamentals of Optics," 4th Ed. McGraw Hill	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : PHYSICS

1. Subject Code: **PH-007** Course Title: **Modern Physics**

2. Contact Hours: **L: 3** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 0 3 **Practical** 0 0

4. Relative Weightage: **CWS** 10 **PRS** 15 **MTE** 25 **ETE** 50 **PRE** 00

5. Credits: 0 4 6. Semester: **Autumn** 7. Subject Area: **BSC**

8. Pre-requisite: **None**

9. Objective:
The objective of the course is to present the basic elements of electrodynamics, quantum mechanics, electric and magnetic properties and lasers.

10. Details of Course:

S. No.	Particulars	Contact Hours
1	**Electrodynamics** Basic principles of electrostatics and magnetostatics, Maxwell's equations in differential form, physical significance of Maxwell's equations., wave equation and its solution for a dielectric medium, plane waves in a dielectric, concept of polarization, linear, circular and elliptical polarization, the Poynting vector, energy density and intensity of an e-m wave, reflection and refraction at the interface of two dielectrics	12
2	**Quantum mechanics** Basic postulates of quantum mechanics and meaning of measurement, Schrodinger wave equation, physical meaning of wave functions. Expectation values, probability current density, stationary states, particle in a 1-D box, 1-D step potential, reflection and transmission by a barrier and tunneling, 1-D harmonic oscillator.	9
3	**Electric and magnetic properties** Free electron theory of metals: allowed k values using periodic boundary conditions for 3-dimensional case, Fermi energy, Density of states and average energy, electrical conductivity of metals ; Electron in periodic potentials, velocity and effective mass of	15

	electrons, origin of the energy gap, Band theory of solids, classification of solids into metals, semiconductors and insulators. Magnetic properties of solids: derivation for diamagnetism and paramagnetism, ferromagnetism (qualitative description), Magnetostriction, Properties of dia, para and ferro magnetic materials - Langevin's theory of diamagnetism and paramagnetism - Weiss theory of ferromagnetism-antiferrimagnetism and ferrimagnetism	
4	**Laser Physics:** Basic properties of lasers, spontaneous and stimulated emissions, main components of a laser, ruby and He-Ne laser, semiconductor diode laser	**6**
	Total	**42**

List of experiments:

1. Study of magnetic field of a pair of coils in Helmholtz arrangement
2. Determination of e/m
3. Determination of first excitation potential of a gas by Frank-Hertz experiment
4. Determination of Stefan's constant
5. Determination of Planck's constant by radiation
6. To study and verify Malus' law
7. Study of polarization of light using quarter wave plate
8. Determination of Brewster's angle at glass-air interface
9. Determination of width of a slit by single-slit diffraction pattern
10. Four probe method of finding resistivity of semiconductor
11. Quinck'e Method for determining mass susceptibility
12. Wavelength of Na light by Newton's ring method

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1	D. J. Griffiths, "Introduction of Electrodynamics," PHI Learning Pvt. Ltd.	2009
2	M. N. O. Sadiku," Elements of Electromagnetics," Oxford Univ. Press	2009
3	Arthur Besiser, Concepts of Modern Physics, , Tata Mc Graw Hill	2003
4	Karl F Renk, Basics of Laser Physics, Springer-Verlag, Berlin	2012
5	S P Sukhatme, J K Nayak, Solar energy - Tata McGraw - Hill Publishing Company Ltd., New Delhi. 1st Reprint	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Humanities & Social Sciences**

1. Subject Code: **HS-001A** Course Title: **Communication Skills (Advanced)**

2. Contact Hours: **L: 1** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 2 **Practical** 0

4. Relative Weight: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 2 6. Semester: **Autumn/Spring** 7. Subject Area: **HSS**

8. Pre-requisite: **NIL**

9. Objective: The course intends to train the learners in using both verbal and non-verbal communication effectively.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Advanced Communication Skills: Scope, Relevance, & Importance	01
2.	Soft Skills: Interpersonal Communication; Verbal & Non-verbal, Persuasion, Negotiation, Neuro-Linguistic Programming	03
3.	Communication and Media (Social and Popular), The Social and Political Context of Communication, Recent Developments and Current Debates in Media	04
4.	Cross-cultural and Global Issues in Communication: Race, Ethnicity, Gender & Diaspora	03
5.	Rhetoric and Public Communication, Audience Awareness, Emotionality	03
	Total	**14**

List of Experiments:

i) Discussion on the Process of Communication in Personal and Professional Life
ii) Group Discussion, Case Studies and Role-Play
iii) Assignments on E-mail Etiquette, Social Networking, Blog Writing, Discussions on Current Issues
iv) Non-Verbal Communication in Cross-Cultural Situations, Case Studies, Group Discussions and Readings on Topics Related to Race, Ethnicity , Gender and Diaspora
v) Individual Presentations (Audience Awareness, Delivery and Content of Presentation)

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Rentz, Kathryn, Marie E. Flatley & Paula Lentz. *Lesikar's Business Communication CONNECTING IH A DIGITAL WORLD*, McGraw-Hill, Irwin	2012
2.	Bovee, Courtland L & John V. Thill. *Business Communication Today*. New Delhi, Pearson Education	2010
3.	McMurrey, David A. & Joanne Buckley. *Handbook for Technical Writing*, New Delhi, Cengage Learning.	2009
4.	Jones, Daniel. *The Pronunciation of English*, New Delhi, Universal Book Stall.	2010
5.	Allan & Barbara Pease. *The Definitive Book of Body Language,* New York, Bantam	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Humanities & Social Sciences**

1. Subject Code: **HS-001B** Course Title: **Communication Skills (Basic)**

2. Contact Hours: **L: 1** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 2 **Practical** 0

4. Relative Weight: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 2 6. Semester: **Autumn/Spring** 7. Subject Area: **HSS**

8. Pre-requisite: **NIL**

9. Objective:
The course intends to build the required communication skills of the students having limited communicative abilities, so that they may communicate effectively in real-life situations

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Understanding the Basics of Communication Skills: Listening, Speaking, Reading & Writing, Scope and Importance	01
2.	Grammar & Composition: Time and Tense, Agreement, Active-Passive, Narration, Use of Determiners, Prepositions & Phrasal Verbs	05
3.	Vocabulary Building & Writing: Word-formation, Synonyms, Antonyms, Homonyms, One-word Substitutes, Idioms and Phrases, Collocations, Abbreviations of Scientific and Technical Words	02
4.	Introduction to Sounds (Vowels & Consonants) Organs of Speech, Place and Manner of Articulation, Stress & Intonation, Listening Comprehension (Practical Sessions in Language Laboratory)	02

5.	Speaking, Countering Stage-fright and Related Barriers to Communication.	**02**
6.	Reading and Comprehension: Two lessons to be identified by the department.	**02**
	Total	**14**

List of Practicals:

i) Ice-breaking Exercises
ii) Assignments on Time and Tense, Agreement, Active-Passive
iii) Laboratory Session on Narration, Use of Determiners, Prepositions & Phrasal Verbs, Revisionary Exercises & Quiz
iv) Laboratory Session on Synonyms, Antonyms, Homonyms
v) Assignments and Practice Sheets on One-word Substitutes, Idioms and Phrases, Collocations, Abbreviations of Scientific and Technical Words
vi) Laboratory Session on Practice of sounds, Intonation and Stress, Listening Comprehension
vii) Individual presentation, debates, Extempore & Turncoats
viii) Exercises in Composition and Comprehension

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Murphy, Raymond. *Intermediate English Grammar*, New Delhi, Cambridge University Press.	**2009**
2.	Quirk, Randolph & Sidney Greenbaum. *A University Grammar of English*, New Delhi, Pearson.	**2009**
3.	McCarthy, Michael & Felicity O' Dell. *English Vocabulary in Use*, New Delhi, Cambridge University Press	**2010**
4.	Jones, Daniel. *The Pronunciation of English*, New Delhi, Universal Book Stall.	**2010**
5.	Birchfield, Susan M. *Fowler's Modern English Usage*, New Delhi, OUP.	**2004**
6.	Llyod, Susan M. *Roget's Thesaurus of English Words and Phrases.* New Delhi: Penguin.	**2010**

Appendix 'G'
Item No. Senate/48.15

GUIDELINES FOR INSTITUTING AN AWARD

A donor may institute an award, scholarship, etc. as defined above for the student(s). The donor is entitled to specify the discipline/ specialization/ branch and the criteria for these awards.

Name of the Award

The awards/ prizes / scholarships/ fellowships etc. can be instituted in the name of a person/ organization/ Institution.

Conditions of Award

(a) The prizes/ scholarships/ fellowships etc. can be instituted and awarded to deserving students(s) on merit-cum-means basis to help meritorious but poor students to meet rising cost of studies and living.

(b) The prizes/ scholarships/ fellowships etc. can be instituted and awarded to student(s) with merit as the sole selection criteria.

(c) The award must be non-political and non –denominational in character.

(d) The prise/ scholarship/ fellowship etc. can not be based on caste, creed, religion or restricted to a specific geographical area. However, the donor can specify that the prize/ scholarship/ fellowship should be awarded to a girl or boy in a particular discipline.

(e) Part-time/Sponsored/Foreign students are not eligible for scholarships/ fellowships. However, they ca be considered for cash prizes/ medals.

Duration of Award :

A scholarship/ fellowship will be awarded to 10 months every year to a meritorious student.

Amount of Award:

The amount of scholarship. Fellowship and assistantship to a student should be at least Rs.2000/- p.m. which may be reviewed every five years.

Prize:

The amount of prize should not be less than Rs.10,000.00 (Rs. Ten thousand) per annum.

Full/ Half Freeship:

A donor may institute full/half fee tuition fee waivers to be awarded on the basis of merit or merit-cum-means to help support a deserving student.

Amount of donation:

i) The donor will have to deposit a minimum of 15 times the annual amount of the award, scholarship, fellowship, prize etc. The amount may be deposited by the donor in one/ two instalments within the first two years of the institution of the award. However, the selection of the awardees shall be made only after sufficient funds are available to start the award.

ii) In the case of MoUs with foundations, a commitment for instituting the award for a minimum of 10 years shall be made by the donor.