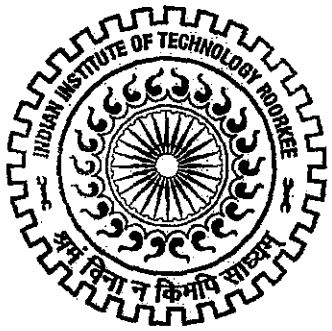
सीनेट की अट्ठाहरवीं बैठक का कार्यवृत्त

MINUTES OF THE 18TH MEETING OF THE SENATE

10TH APRIL 2007



भारतीय प्रौद्योगिकी संस्थान रूड़की
रूड़की - २४७ ६६७ (भारत)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ROORKEE – 247 667 (INDIA)

MEETING SECTION
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ROORKEE – 247 667

No.IITR/MS/18th Senate (04/2006)/1294 Dated 9th May 2007

ALL MEMBERS OF THE SENATE
Indian Institute of Technology Roorkee

Subject: Minutes of the 18th Meeting of the Senate held on 10th April 2007 and adjourned meetings held on 12th & 18th April 2007, respectively in the Senate Hall of the Institute.

Enclosed herewith please find a copy of the Minutes of the 18th Meeting of the Senate of this Institute held on 10th April 2007 at 03.00 P.M. and adjourned meetings held on 12th & 18th April 2007, respectively in the Senate Hall, for your perusal. Your comments, if any, on the minutes may please be sent within 15 days.

Offtg. Registrar

Encl: as above

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-546** Course Title: **Design of Electric Drive**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Basic Course on Electric Drives** 8. Subject Area: **PG-13**

9. Objective:

The objective of the course is to examine the interdependence of various elements of the closed loop system (load motor, power converter, supply system) for evolving an efficient operating strategy. The design modifications of motors are also considered to minimize the adverse effects of harmonics introduced by the converter supply. The course includes application examples of selected industrial drives used in traction, textile and paper mills, steel mills and cement mills.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of drive system, power converters and their influence on supply systems, mechanical system, nature of load	4
	Drive characteristics, range of speed control	2
2.	Design of power converters – choppers, phase controlled converters, inverters and cycloconverter, selection of devices, protection and cooling	10
3.	Design modifications of input transformers and converter fed drives	4
4.	Design of closed loop drives, Synthesis of AC & DC drives	8
5.	Energy conservation concept in drives, Optimization of operational efficiency of drive	10
6.	Specific case studies of industrial drives.	4
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Leonard W., "Control of Electric Drives", Springer Press, New York.	2002
2.	Murphy J.M.D., Turnbull F.G., "Power Electronics Control of AC Motors", Pergamon Press, New York.	1988
3.	Andreas J.C., Dekker M., "Energy Efficient Electric Motor, Selection and Application"	2004
4.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distribution.	2001
5.	Dubey G.K., "Fundamental of Electrical Drives" Narosa Publising House, New Delhi.	2005

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Minutes of the 18th Meeting of the Senate held on 10th April 2007 and adjourned meetings held on 12th April 2007 and 18th April 2007 in the Senate Hall of the Institute.

The following were present: -

1. Prof. S.C. Saxema, Director		- Chairman
2. Prof. H.K. Verma, Dy. Director		
3. Prof. S.Y. Kulkarni	(Arch. & Planning)	(12th April only)
4. Prof. G.S. Randhawa	(Biotechnology)	(10th April only)
5. Prof. B.M.J. Periera	(Biotechnology)	(10th & 12th April only)
6. Prof. R.P. Singh	(Biotechnology)	
7. Prof. I.M. Mishra	(Chemical Engg.)	
8. Prof. Bikash Mohanty	(Chemical Engg.)	
9. Prof. Shri Chand	(Chemical Engg.)	
10. Prof. I.D. Mall	(Chemical Engg.)	(10th & 12th April only)
11. Prof. G. Bhattacharjee	(Chemistry)	
12. Prof. R.N. Goyal	(Chemistry)	(10th April only)
13. Prof. Ravi Bhushan	(Chemistry)	(10th & 18th April only)
14. Prof. Kamaluddin	(Chemistry)	(12th & 18th April only)
15. Prof. V.K. Gupta	(Chemistry)	
16. Prof. Anil Kumar	(Chemistry)	
17. Prof. (Mrs) Mala Nath	(Chemistry)	(10th & 18th April only)
18. Prof. S.M. Sondhi	(Chemistry)	(10th April only)
19. Prof. G.L. Asawa	(Civil Engineering)	
20. Prof. A.K. Jain	(Civil Engineering)	(10th April only)
21. Prof. N.M. Bhandari	(Civil Engineering)	(10th & 12th April only)
22. Prof. V.K. Gupta	(Civil Engineering)	(10th & 12th April only)
23. Prof. S.S. Jain	(Civil Engineering)	
24. Prof. Deepak Kashyap	(Civil Engineering)	(10th April only)
25. Prof. Indu Mehrotra	(Civil Engineering)	(10th & 12th April only)
26. Prof. (Mrs) Renu Bhargava	(Civil Engineering)	(10th & 12th April only)
27. Prof. C.S.P. Ojha	(Civil Engineering)	(10th & 12th April only)
28. Prof. Pradeep Bhargava	(Civil Engineering)	(10th April only)
29. Prof. Satish Chandra	(Civil Engineering)	(10th April only)
30. Prof. D.K. Paul	(Earthquake Engg.)	(10th April only)
31. Prof. G.I. Prajapati	(Earthquake Engg.)	
32. Prof. Ashwani Kumar	(Earthquake Engg.)	
33. Prof. H.R. Wason	(Earthquake Engg.)	(10th & 12th April only)
34. Prof. H. Sinvhal	(Earth Sciences)	
35. Prof. R.P. Gupta	(Earth Sciences)	
36. Prof. A.K. Awasthi	(Earth Sciences)	
37. Prof. H.O. Gupta	(Electrical Engg.)	
38. Prof. S.P. Gupta	(Electrical Engg.)	(10th & 12th April only)
39. Prof. Vinod Kumar	(Electrical Engg.	(10th & 12th April only)
40. Prof. Pramod Agarwal	(Electrical Engg.)	
41. Prof. S. Mukherjee	(Electrical Engg.)	(10th April only)
42. Prof. R. Mitra	(E. & C. Engg.)	
43. Prof. D.K. Mehra	(E. & C. Engg.)	(10th & 12th April only)

44. Prof. A.K. Sarje	(E. & C. Engg.)	(10th April only)
45. Prof. A.K. Saxena	(E. & C. Engg.)	(10th & 12th April only)
46. Prof. S.K. Verma	(E. & C. Engg.)	
47. Prof. S.N. Sinha	(E. & C. Engg.)	(10th & 12th April only)
48. Prof. Padam Kumar	(E. & C. Engg.)	(10th & 12th April only)
49. Prof. Ranvir Singh	(Hydrology)	(10th & 12th April only)
50. Prof. N.K. Goel	(Hydrology)	(10th April only))
51. Prof. D.K. Nauriyal	(Hum. & Soc. Sc.)	(10th & 12th April only)
52. Prof. (Ms) Renu Rastogi	(Hum. & Soc. Sc.)	(10th & 12th April only)
53. Prof. M.C. Bansal	(Paper Technology)	
54. Prof. A.K. Ray	(Paper Technology)	
55. Prof. A.K. Singh	(Paper Technology)	
56. Prof. J.S. Upadhyay	(Paper Technology)	
57. Prof. Satish Kumar	(Paper Technology)	(12th & 18th April only)
58. Prof. V.K. Nangia	(Management Studies)	(12th & 18th April only)
59. Prof. G.S. Srivastava	(Mathematics)	
60. Prof. S.P. Sharma	(Mathematics)	
61. Prof. T.R. Gulati	(Mathematics)	(18th April only)
62. Prof. (Mrs) Rama Bhargava	(Mathematics)	(18th April only)
63. Prof. R.C.Mittal	(Mathematics)	(10th & 18th April only)
64. Prof. P.N. Agarwal	(Mathematics)	(18th April only)
65. Prof. V.K. Katiyar	(Mathematics)	
66. Prof. Roshan Lal	(Mathematics)	
67. Prof. Y.K. Gupta	(Mathematics)	(10th & 18th April only)
68. Prof. (Mrs) Sunita Gakkhar	(Mathematics)	(10th & 18th April only)
69. Prof. S.C. Jain	(Mech. & Indl Engg.)	(10.4.07)
70. Prof. Pradeep Kumar	(Mech. & Indl. Engg.)	(10th & 18th April only)
71. Prof. Satish C. Sharma	(Mech. & Indl Engg.)	
72. Prof. Dinesh Kumar	(Mech. & Indl Engg.)	(10th & 18th April only)
73. Prof. P. K. Jain	(Mech. & Indl Engg.)	(10th April only)
74. Prof. Satya Prakash	(Met. & Mat. Engg.)	(10th & 12th April only)
75. Prof. R.D. Agarwal	(Met. & Mat. Engg.)	(18th April only)
76. Prof. S. Ray	(Met. & Mat. Engg.)	
77. Prof. P.K. Ghosh	(Met. & Mat. Engg.)	(10th & 12th April only)
78. Prof. S.K. Nath	(Met. & Mat. Engg.)	
79. Prof. Jagdish Rai	(Physics)	
80. Prof. A.K. Jain	(Physics)	(10th & 18th April only)
81. Prof. G.S. Singh	(Physics)	
82. Prof. Rajesh Srivastava	(Physics)	(10th & 12th April only)
83. Prof. Vir Singh	(Physics)	(10th & 18th April only)
84. Prof. Ddevadutta Das	(W.R.D. & M.)	(10th & 18th April only)
85. Prof. S.K. Tripathi	(W.R.D. & M.)	(10th & 18th April only)
86. Prof. Ram Pal Singh	(W.R.D. & M.)	(10th April only)
87. Prof. Ashwani K. Chaudhry	(I.I.C.)	(10th & 12th April only)
88. Prof. Karmeshu, JNU, New Delhi		(10th April only)
89. Prof. N.K. Sharma, IIT Kanpur		(10th April only)
90. Mr. Arun Kumar, Head, AHEC		(10th & 12th April only)
91. Mr. R.K. Jain, Associate Dean of Student Welfare		(10th 12th April only)
92. Mr. Yogendra Singh, Librarian		(10th April only)
93. Dr. N.P. Padhey, Chief Warden, Jawahar Bhawan		(10th & 12th April only)

94. Dr. R.P. Maheshwari, Assoc. Professor, Electrical Engg. (10th April only)
95. Dr. M.R. Maurya, Assoc. Professor, Chemistry (10th 7 12th April only)
96. Dr. Manoj Arora, Assoc. Professor, Civil Engineering (10th April only)
97. Lt.Col. (Retd.) A.K. Srivastava, Registrar - Secretary

The Chairman welcomed the members to the 18th Meeting of the Senate specially Prof. Karmeshu and Prof. N.K. Sharma, outside members.

Before taking up the agenda items, the Senate thanked the under-mentioned outgoing members and recorded its appreciation for their valuable contribution in the meetings of the Senate.

1. Prof. N.K. Gupta, I.I.T. Delhi;
2. Prof. Devi Singh, Director, I.I.M., Lucknow;
3. Dr. R.P. Saini, Chief Warden, Cautley Bhawan, I.I.T. Roorkee;
4. Prof. A.K. Jain, Department of Chemistry;
5. Prof. M.K. Mittal, Department of Civil Engineering;
6. Prof. K.K. Singh, Department of Civil Engineering;
7. Prof. S.S. Srivastava, Department of Earth Sciences;
8. Prof. Asha Kapoor, Department of Humanities & Social Sciences;
9. Prof. B.S. Mathur, Department of Hydrology;
10. Prof. V.K. Goel, Department of Mechanical & Industrial Engineering;
11. Prof. Gopal Chauhan, Water Resource Development & Management.

The Senate also welcomed the under-mentioned new members and hoped for their valuable contribution and active participation in its functioning:

1. Prof. H.C. Gupta, Dy. Director, IIT Delhi.
2. Prof. N.K. Sharma, IIT Kanpur
3. Dr. N.P. Padhey, Chief Warden, Jawahar Bhawan

Communication was received from the under-mentioned members for not attending the meeting:

1. Prof. H.C. Gupta, IIT Delhi.
2. Prof. S.P. Gupta, Department of Electrical Engineering
3. Prof. I.D.Mall, Department of Chemical Engineering
4. Prof. D.K. Paul, Department of Earthquake Engineering

The agenda was then taken up.

Item No.18.1.1 **To confirm the minutes of the 16th Meeting held on 7th August 2006 and 17th Meeting (Special Meeting) held on 27th October 2006, respectively.**

The Senate confirmed the minutes of the 16th Meeting held on 7th August 2006 and 17th Meeting (Special Meeting) held on 27th October 2006, respectively.

Item No.18.1.2 **To receive a report on the actions taken to implement the decisions taken by the Senate in its 16th meeting held on 7th August 2006 and 17th Meeting (Special Meeting) held on 27th October 2006, respectively.**

The Senate noted that the actions have been taken on the decisions taken by the Senate in its 16th meeting held on 7th August 2006 and 17th Meeting (Special Meeting) held on 27th October 2006, respectively.

ITEMS FOR CONSIDERATION:

Item No. 18.2.1: **To consider a proposal of Dean, Post Graduate Studies & Research regarding increase of seats in Ph.D. programmes with MHRD Assistantship over and above the seats equal to number of faculty strength in existence.**

As considered and recommended by the Board, PGS&R, the Senate decided that the changes in the existing regulations be approved as under:

R. 20 Financial Assistance:

(c) The total number of MHRD assistantships in a department will be equal to the total number of faculty members+ eligible scientist in the department.

150 nos. of MHRD Assistantship per annum will be added over and above the existing position for the next two years. The increased seats will be allocated among the academic departments/ Centres in the proportion of the faculty in position.

(d) A faculty member/ eligible scientist may supervise up to three Ph.D. scholars singly OR six jointly getting MHRD assistantship but within the limit decided by the Senate from time to time.

The Senate FURTHER DECIDED that in addition to the above increase, the four Institute MHRD Assistantships be given to each Centre of Excellence, namely, Centre for Disaster Mitigation & Management, Centre for Nano-Technology and Centre for Transportation Systems with the following proviso. The faculty engaged for supervising the candidates in these three Centres will be given these seats within the guidelines stated in (d) above :

(i) Applications for these Assistantships may be obtained by including the name of the three Centres in the Institute's advertisement.

(ii) Selected candidates working in the Centres may be allowed to register in the departments of the Institute, wherever they are eligible.

(iii) A Centre Research Committee (CRC) will be constituted for each Centre of Excellence.

(iv) Student Research Committee (SRC) will be constituted by the concerned department with a nominee of the Centre Research Committee (CRC).

STILL FURTHER DECIDED that 10 seats be kept in pool at the discretion of the Director (Chairman, Senate) to be allocated for the interdisciplinary work in Departments/Centres or in extra ordinary circumstances.

Item No: 18.2.2 To consider the revised syllabus of EE-501 (On-line Computer Application Techniques) for M.Tech. (Electrical).

As considered and recommended by the Board, PGS&R, the Senate decided that the revised syllabus of EE-501 (On-line Computer Application Techniques) for M.Tech. (Electrical) be edited. The Senate

authorized the Director (Chairman, Senate) to approve the same.

Item No.18.2.3: To consider the Minimum Qualification for Ph.D. Programme in the Centre for Disaster Mitigation and Management.

Refer to item No. 18.2.34.

Item No.18.2.4: To consider new elective course for PG and Pre-Ph.D. level and revision of Inorganic Chemistry Syllabi for existing M.Sc programme.

As considered and recommended by the Board, PGS&R, the Senate decided that the revised Inorganic Chemistry Syllabus for existing M.Sc. programme for courses CY-511, CY-512, CY-612(I), CY-622(I), CY-631 and the new Elective Courses i.e CY-681, CY-911, CY-912, CY-921, CY-922 as given at **Appendices 'A' to 'I-1'**, respectively, be approved.

The Senate **FURTHER** decided that the revised syllabus of CY-922 be referred back to the concerned Department for incorporating the suggestions made by the Senators on the floor and placed in the next meeting of the Senate.

Item No.18.2.5: To consider renaming the existing course Power Apparatus and Electrical Drives to Electric Drives and Power Electronic and revised course structure of M.Tech Electrical Engineering Department Programme and its syllabi.

As considered and recommended by the Board, PGS&R, the Senate decided that the existing M.Tech. course "Power Apparatus and Electrical Drives" be renamed to **"Electric Drives and Power Electronics".**

The Senate **FURTHER** decided that the teaching scheme and revised syllabi of M.Tech. Electrical Engineering Department (EE-540 to EE-558) as given at **Appendix 'J' and Appendix 'K',** respectively be approved with the proviso that the objectives of the course be clearly spelt out by the Department, and editorial corrections be made, where required.

Item No.18.2.6: To consider the recommendation of DRC dated 05.09.2006 regarding enhancing the MHRD assistantship from Rs.8,000.00 per month to Rs.9,000/- per month in respect of Ms. Vidhi Choudhary, Research Scholar (Full-Time) of chemistry Department.

As considered and recommended by the Board, PGS&R, the Senate decided that the MHRD assistantship of Ms. Vidhi Choudhary, Research Scholar (Full Time) of Chemistry Department be enhanced from Rs.8,000.00 per month to Rs.9,000.00 per month.

Item No.18.2.7: To consider shifting of major elective of M.Tech. (SSEM) Courses.

As considered and recommended by the Board, PGS&R, the Senate decided that the Major Elective II, M.Tech. (SSEM) be shifted from 1st Semester to 2nd Semester (Spring) and PH-722 Simulation & Computer Applications be shifted from 2nd Semester to 1st Semester (Autumn).

Item No.18.2.8: To consider new elective courses in the Centre of Nanotechnology.

As considered and recommended by the Board, PGS&R, the Senate decided that the new elective courses in the Centre of Nanotechnology be referred back to the concerned Centre to take into consideration of the observations made by the Senators on the floor of the house and placed before the Senate in the next meeting.

Item No.18.2.9: To consider changes/modification in programme structure, eligibility, No. of seats, minimum qualification for admission in Postgraduate programmes.

As considered and recommended by the Board, PGS&R, the Senate decided that the changes/ modification in programme structure, eligibility, number of seats, minimum qualification for admission in Postgraduate programmes be approved as under:

Electronics & Computer Engineering Department

1. **Changes in Seats** – increase the seats from existing 6 to 10 in Control and Guidance Programme

2. **Changes in Essential Qualification**

Architecture & Planning Department

(i) Masters Degree in Geography be deleted from minimum Educational qualification for MURP Course.

Mechanical & Ind. Engg. Deptt.

(ii) Bachelors degree in Chemical Engg. be deleted from minimum educational qualification from M.Tech. Welding Engg.Programme of MIED.

Physics Department

(iii) B.Tech. Engg. Physics be added in the minimum educational qualification for M.Tech. SSEM. Programme.

The same be implemented from the session 2008-09.

Item No.18.2.10: To consider the minimum Educational qualification for admission to PG Programme (Pulp & Paper) for the session 2008- 09.

As considered and recommended by the Board, PGS&R, the Senate decided that the minimum Educational qualification for admission to PG Programme (Pulp & Paper) be approved as under:

"B.Tech./ B.E. degree in Chemical Engineering or Chemical Technology/ Pulp & Paper Engg./ Mechanical Engg./ Polymer Engg./ Biotechnology/ Cellulose Technology /Alcohol, food and Fermentation Technology or its equivalent".

Note: The two years post B.Sc. diploma awarded by the IPT/DPT plus a minimum of two years relevant experience in Industry/ Research Organisation will be considered equivalent to a B.Tech/ B.E degree for admission to the PG Programme (Pulp & Paper).

The Educational qualification be implemented w.e.f. 2008-09 session.

Item No.18.2.11: To consider the award of MHRD assistantship to Final Year students of three year M.Tech (Applied Geology/Geophysics)

As considered and recommended by the Board, PGS&R, the Senate decided that-

(i) M.Tech. (Post B.Sc.) final year students with CGPA not less than 8 or who have qualified the GATE be granted MHRD Assistantship.

(ii) The granting of MHRD assistantship in the final year of five year Integrated M.Tech students at par with IDD students be approved.

(iii) The report of the committee constituted to consider the award of MHRD assistantship to Final Year students of three year M.Tech. (Applied Geology/Geophysics) as given at **Appendix 'L'** be approved.

Item No.18.2.12: To consider the contingency rules as suggested by Deptts./ Centres on request of Research Scholars and M.Tech. students.

The issue be withdrawn.

Item No.18.2.13: To consider the new Institute Electives proposed by the Physics Department.

As considered and recommended by the Board, UGS, the Senate decided that the modified syllabi of the under-mentioned Institute Electives be approved:

1. IPH-01: Quantum Devices
2. IPH-02: Nano Materials

3. IPH-03: Fiber Optics
4. IPH-04: Space Science and Technology

The detailed syllabi are given at **Appendix 'M'.**

The Senate **FURTHER** decided that the Dean, UGS will ensure that the similar courses may not be run in the other Department.

Item No.18.2.14: To consider the proposal of Department of Electrical Engineering to introduce a new Departmental Elective EE-426: Digital Control Systems.

As considered and recommended by the Board, UGS, the Senate decided that the modified syllabus of a new Departmental Elective EE-426: Digital Control Systems of Department of Electrical Engineering as given at **Appendix 'N'** be approved.

Item No.18.2.15: To consider the provision of Summer Term for all courses.

As considered and recommended by the Board, UGS, the Senate decided that the existing provision for summer term may not be changed. However, a course/subject of Autumn/ Spring semester be allowed to run in other semester (Spring/Autumn) on the basis of recommendations of department concerned, provided the minimum number of students in the course is five.

Item No.18.2.16: To consider the request of Head of the Department of Electronics & Computer Engineering to include some of PG courses as electives for undergraduate programme.

As considered and recommended by the Board, UGS, the Senate decided that the request of the Head of the Department of Electronics & Computer Engineering to include some of the PG courses as electives for undergraduate programme and replacing some of the undergraduate electives by PG courses with the same title as given in **Appendix 'O'** be approved.

Item No.18.2.17: To consider the review of format of transcript.

The issue be deferred for the next meeting.

Item No.18.2.18: To consider the inclusion of Associate Dean (Academic) as member of Board of Undergraduate Studies (BUGS) and Board of Postgraduate Studies & Research (BPGS&R).

As considered and recommended in the joint meeting of the Boards, UGS & PGS&R, the Senate decided that the inclusion of Associate Dean (Academic) as (ex-officio) member of Board of Undergraduate Studies (BUGS) and Board of Postgraduate Studies & Research (BPGS&R) be approved.

Item No.18.2.19: To consider the award of Fellowship/Assistantship to the students punished for unfair-means.

As considered and recommended in the joint meeting of the Boards, UGS & PGS&R, the Senate decided that those students, who have been punished for unfair-means during MTE/ETE or for serious act of indiscipline, be not awarded Merit-cum-Means Scholarship, Fellowship/ Assistantship/ Trust Scholarship for the entire remaining period of programme. However, the student shall not be considered for Medals, Prizes and Awards, for that session only. Grade 'C' or below in discipline will be treated a serious act of indiscipline.

Item No.18.2.20: To consider the amendment in the "Instruction for penalty for use of unfair-means.

As considered and recommended in the joint meeting of the Boards, UGS & PGS&R, the Senate decided that the amendment in existing regulation No. 57.10.7(h)(b) "Instruction for penalty for use of unfar-means" be approved as under:

"A student found using unfair means leading to the cancellation of one paper *or* the whole examination in the First Year shall not be allowed to rejoin the Institute".

Item No.18.2.21: To consider the format of degree to be used for the session 2006-07 and onwards.

As considered and recommended in the joint meeting of the Boards, UGS & PGS&R, the Senate decided that the modified format of degree to be used from the ensuing sessions 2006-07, as given at **Appendix 'P'** be approved.

Item No.18.2.22: To consider the proposal of allowing International Students to take course(s)/Training/project etc. for short duration at their own expense.

The issue be withdrawn. Further, a detailed proposal in this regard be prepared by the Dean, UGS, Dean, PGS&R and Prof. I.M. Mishra and placed before the next meeting of the Senate.

Item No.18.2.23: To consider the minor modification in the criteria, by which the students are kept on academic probation after each semester.

As considered and recommended in the joint meeting of the Boards, UGS and PGS&R, the Senate decided the minor modification in the criteria, by which the students are kept on academic probation after each semester, be approved as under:

(i) The Summer Term be not considered for counting the number of semesters for which a student has registered.

(ii) The earned credits in the Summer Term be considered.

Item No.18.2.24: To consider the proposal of Prof. M.N. Saxena, to institute a PRIZE in memory of his wife Mrs. Leila Saxena. of Rs.5,000/- per annum.

After discussion, the Senate decided that the report of the committee for instituting a **PRIZE** in the memory of Mrs. Leila Saxena wife of Prof. M.N. Saxena, of Rs.5,000/- per annum to the best student of B. Tech. IV year class of the Metallurgical & Materials Engineering Department, as given at **Appendix 'Q'** be approved within the norms.

Item No.18.2.25: To consider the number of students in each branch due to 27% increase in intake.

The issue be deferred. Further, the Senate authorized the Executive Committee of the Senate (ECS) to implement the same, for UG & PG programmes, if 27% OBC increase is approved by the Government.

Item No.18.2.26: To consider the course structure of B.Arch.

As considered and recommended by the Board, UGS, the Senate decided that the new structure of B. Tech. / IDD 1st year programme be adopted as such so that the students of B.Arch. 1st year also become eligible for change of branch on the basis of 1st year CGPA and the department is also able to fill all seats of B.Arch. 1st year through JEE.

Item No.18.2.27: To consider the proposal of Electrical Engineering Department to start a new IDD programme

As considered and Recommended by the Board, UGS, the Senate decided that the proposal of Electrical Engineering Department to start the new IDD Programme in B.Tech. (Electrical Engineering) and M.Tech. (Power Electronics) alongwith the course structure as given at **Appendix 'R'** be approved.

The Senate also considered the proposal of the Department to allocate 10 seats to IDD programme out of the present 77 seats allocated to B.Tech. (Electrical Engg.). The Senate resolved that the new IDD Programme as proposed be started w.e.f. 2007-08, with intake of 8 seats. It was further resolved that the intake of B.Tech. (Electrical) will remain 77 as in 2006-07. These 8 seats will be in addition to 77 seats of B.Tech. (Electrical).

Item No.18.2.28: To consider the Course Structure of B.Tech./ B.Arch. / IDD programmes

As considered and recommended by the Board, UGS, the Senate decided that the course structure for B.Tech. & IDD programmes and the teaching scheme for the Institute Core Courses in 1st year

and 2nd year, as given at **Appendices 'S' to 'W'** and the Course Structure A & B as given at **Appendix 'X'** be approved for B.Tech./IDD 1st year & 2nd year and B.Arch. 1st year .

The Senate **FURTHER** decided that half of the batches of 1st year will opt Structure 'A' and rest will opt Structure 'B' to avoid overloading of departments.

Item No.18.2.29: To consider the restructuring of academic programmes in the Department of Paper Technology.

After discussion, the Senate decided that the issue be placed before the next meeting of the Senate alongwith the Scheme of Teaching.

Item No.18.2.30: To consider the syllabi of new courses PT:211 Polymer Science and PT:212 Introduction to Polymer Engineering & Technology of Five Year Integrated M.Tech. (Polymer Science & Technology)

As considered and recommended in the Joint meeting of the Board for Undergraduate Studies (BUGS) and the Board for Postgraduate Studies & Research (BPGS&R), the Senate decided that the syllabi of the two new courses for Five Year Integrated M.Tech. (Polymer Science & Technology) as given at **Appendix 'Y'** be approved.

Item No.18.2.31: To consider the proposals of Three Engineering Departments to start new IDD Programmes.

As considered and recommended in the joint meeting of the Board for Undergraduate Studies and the Board for Postgraduate Studies & Research, the Senate decided that the new 5 years IDD B.Tech. (Process Engineering) and MBA Programme with the intake of 20 per year in the Department of Paper Technology be approved.

The Senate **FURTHER** decided that the scheme of teaching and examination for IDD B.Tech. (Process Engineering) and MBA programme as given at

Appendix 'Z' be approved. This programme be started from the session 2007-08.

Item No.18.2.32: To consider the payment of Assistantship/ Scholarship to Ph.D. Scholars of the Institute after completion of 4 years.

As considered and recommended in the Joint meeting of the Board for Undergraduate Studies (BUGS) and the Board for Postgraduate Studies & Research (BPGS&R), the Senate recommended that the issue be placed before the Board of Governors for approval.

Item No.18.2.33: To consider the revision of Assistantship/ Scholarship to Ph.D. Scholars of the Institute.

As considered and recommended by the Joint meeting of Board for Undergraduate Studies (BUGS) and the Board for Postgraduate Studies & Research (BPGS&R), the Senate recommended the issue be placed before the Board of Governors for approval please.

Item No.18.2.34: To consider minimum qualification for admission in Ph.D programme in the Centre for Transportation Systems.

After deliberations, the Senate decided that the minimum qualification for admission in the Ph.D. programme in the three Centres of Excellence namely, Centre for Transportation Systems, Centre for Nanotechnology and Centre for Disaster Mitigation & Management, will be at par with the concerned Department in which the candidates will be registered.

The Senate further decided that the under-mentioned procedure be followed for admission in the Ph.D. programme in the above cited three Centre of Excellence:

1. The Research areas will be advertised by the concerned Centre and the applications will be received in these Centres.

2. Centre's Research Committee (CRC's) will screen the applications received from the applicant for admission in Ph.D.

3. After the screening, the candidates will be interviewed by the concerned Department of the Institute where they are eligible. The Head of the concerned Centre or his nominee will be a member of the Selection Committee.

4. The selected candidates will be registered in the concerned department.

Item No.18.2.35: To consider the syllabi of institute core/common courses of 1st and 2nd year.

As considered and recommended by the Board, UGS, the Senate decided that the under-mentioned syllabi of Institute core/common course of 1st and 2nd year be approved:

S. No.	Course Code	Course Title
1.	MA-101	Mathematics –I
2.	MA-102	Mathematics –II
3.	PH-101	Physics-I
4.	PH-201	Physics-II
5.	CY-101	Chemistry
6.	HS-101	Technical Communication
7.	HS-102	Behavioral Science
8.	HS-201	Economics
9.	BM-201	Management Concepts and Practices
10.	EE-101	Electrical Science
11.	EC-102	Fundamentals of Electronics
12.	MI-101	Thermodynamics
13.	MI-102	Manufacturing Techniques
14.	MI-201	Solid Mechanics
15.	CE-101	Engineering Graphics
16.	CE-102	Environmental Studies
17.	CE-201	Computer Aided Graphics
18.	BT-101	Fundamentals of Biotechnology
19.	ES-201	Introduction to Geo-Science
20.	MT-201A	Material Science
21.	CH-201	Energy Resources & Conservation
22.	EC-101A	Computer System & Programming
23.	EC-101B	Fundamental of Object Oriented Programming

The detailed syllabi are given at **Appendix 'AA'**

Item No.18.2.36: **To consider the Academic Calendar for the Autumn Semester – 2007-2008 session.**

After discussion, the Senate decided that the Academic Calendar for the Autumn Semester-2007-08 session as given at **Appendix 'BB'** be approved.

Item No.18.3.1: **To report that the Director on the recommendation of ECS has approved the procedure of admission to PG programme for the year 2007.**

Noted.

Item No 18.3.2: **To report that the Director on the recommendation of ECS has approved the intake of seats for various M.Sc. and 5 years integrated M.Sc./ M.Tech. programme in Science Departments for the year 2007.**

Noted.

Item No 18.3.3: **To report that the Director on the recommendation of ECS has approved the minimum educational qualification for admission to M.Sc. (Physics) and eligibility requirements for admission to PG programmes through JAM for the year 2007.**

Noted.

Item No.18.3.4: **To report the amendment made in the Academic Calendar for the Spring Semester of the session 2006-07.**

The under-mentioned amendments made in the Academic Calendar for the Spring Semester of the session 2006-07 at S.No. 7 & 14 be noted:

S.No.	Events	Dates	Days
7.	First Mid Term Examination for all UG/ PG students	Feb. 14 & 15, 2007	Wednesday & Thursday
14.	Mid Semester Break (For Students only)	March 05-09, 2007	Monday to Friday

Item No.18.3.5: To report the request of Mr. Rinzin Namgay, B.Tech. (Civil) IV year for permission to register in Spring Semester-2006-07 to complete the course MA-201 has not been accepted.

Noted.

Item No. 18.3.6 To report the nomination of two persons on the Students Affairs Council (SAC) for a period of one year.

The nomination of the under-mentioned two persons on the Students Affairs Council (SAC) be noted:

(i) Prof. G.S. Srivastava, Mathematics Department.
(ii) Prof. V.K. Gupta, Civil Engineering Department.

Item No.18.3.7: To report that the Director has approved the institution of the following Scholarships and Cash Prizes.

The institution of the following Scholarships and Cash Prizes be noted:

1. "Ashwani Kumar Goel, ALEO Manali Hydropower Scholarship"
2. "Shyam Lata Memorial Scholarship"
3. "Dewan Chand Bewtra Scholarship"
4. "1940 Batch Alumni Scholarship".
5. "Bihar Hydro Awards

Item No. 18.3.8: To report letter No. 14-40/2007-TS.II dated 5th April 2007 of Mr. Ravi Mathur, Joint Secretary to the Government of India, MHRD, New Delhi for not issuing any offers of admissions in the IIT for the ensuring academic session until further communication in this regard is received from the Central Government.

Noted.

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

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-511** Course Title: **Quantum Mechanics and Chemical Bonding**
2. Contact Hours: **L-03; T-01; 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	**Spring**	**Both**

7. Pre-requisite: **Basic knowledge of atomic structure and chemical bonding.**
8. Subject Area : **Inorganic Chemistry for 2 yr. M. Sc. program**
9. Objective of Course :

   The course deals with basic concepts and mathematical treatment of atomic model and chemical bonds.

10. Details of Course:

Existing M.Sc. syllabus	**Revised M.Sc. syllabus**
Wave mechanics *Matter and waves, the uncertainty principle, the wave nature of electron, interpretation of the wave function, normalized and orthogonal wave functions, the wave equation, the principle of superimposition, the particle in one dimensional box, the particle in three dimensional box, degeneracy.* The hydrogen atom; transformation of coordinates and separation of variables, the radial equation, quantum states, the electron spin, the energy states of hydrogen atom, the self consistent field method, wave functions of hydrogen atom, radial distribution curves, angular dependence of wave functions. **Chemical bonding** *The ionic bond (energetics), Born Haber Cycle;* the variation method, application to the calculation of ground state energy of hydrogen atom, the secular equations. Molecular orbital theory, the hydrogen	**1. Quantum mechanics: Basic notions of quantum mechanics, observables, operators, fuctions;** Eigen values and Eigen functions, Schrödinger, wave equation, hydrogen atom, transformation of coordinates, separation of variables, The Φ equation, The θ equation, The radial equation, quantum states, the electron spin, energy states of hydrogen atom, wave functions of hydrogen atom, radial distribution curves and angular dependence of wave function, graphical representation of orbitals, multielectron systems, term symbols and symmetry concept. **(Contact hour – 14)** **2. Chemical bonding:** Approximation methods–Variation and perturbation methods, treatment of helium atom, linear variation approximation and separation of nuclear and electronic determinants, LCAO approximations of MO's. Valence bond treatment of H_2 molecule, mathematical treatment of $sp/sp^2/sp^3$ hybridization, quantitative M.O. theory of homo- and hetero-nuclear diatomic molecules, geometry of polyatomic molecules, Walsh MO diagrams and molecular shapes, Hückel M.O theory for

molecule ion, homonuclear diatomic molecules, heteronuclear diatomic molecules, polyatomic molecules and delocalised molecular orbitals. The valence bond theory, the hydrogen molecule, *resonance, directional bonding (use of localised atomic orbitals in terms of valence bond theory).* Hybridization mathematical treatment of Sp^3 hybridization and the discussion of other important hybridizations. Comparison of M.O. and valence bond theories, atomic spectra and Term symbols. *The hydorgen bond, metallic bond.*	conjugated systems, Kronig-Pemey model of solids; Comparison of MO and VB theories. **(Contact hour – 14)** 3. **Metal-ligand bonding: Crystal field and ligand field theory of 4-, 5- and 6-coordinated complexes, d-orbitals splitting in octahedral, square planar, tetrahedral, square pyramidal and trigonal bipyramidal complexes, Jahn-Teller distortion, spectrochemical series, Nephelauxetic series, measurement of CFSE in weak /strong ligand fields, variation of lattice energy and heats of hydration across 1st row transition metal ions. (Contact hour – 08)** 4. **Molecular orbital theory of coordination compounds: Composition of ligand group orbitals, molecular orbital energy diagrams of octahedral, tetrahedral, square planar complexes including both σ and π bonding; angular overlap model. (Contact hour – 06)**

Suggested books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Day (MC) and Selbin (J), Theoretical Inorganic Chemistry, 2nd Ed., East-West Press, student, Ed	1985
2.	Chandra (AK), Quantum Chemistry, Tata McGraw-Hill, 3rd Ed.,	1989
3.	Murell (JN), Kettle (SFA) and Tedder (JM), Valency Theory, ELBS, John Wiley and Sons Ltd.,	1974
4.	McQuarrie (DA), Quantum Chemistry, Oxford University Press,	1983
5.	Datta (SN), Lectures on Chemical Bonding and Quantum Chemistry, Prism Books, Bangalore,	1998
6.	Huheey(JE), Keiter (EA) and Keiter (RL), Inorganic Chemistry, Principles of Structures and Reactivity, 4th Ed., Low Print Edition, Pearson Education Ltd, Asia, reprinted in India, 2001, ISBN-81-7808-385-X.	2001
7.	Levine (IR), Quantum Chemistry, Printice Hall India (Ltd.),	1995
8.	Szabo (A) and Ostlund (NS), Modern Quantum Chemistry, McGraw Hill,	1989
9.	Veszpremi(T) and Feher (M.), Quantum Chemistry Fundamentals to Applications, Kluwer Academic,	1999
10.	Figgis (BN), Introduction to Ligand Fields, John Wiley & Sons, reprinted in India, Wiley Eastern Ltd., 1976, ISBN-0- 85226-275-2	1976
11.	Drago (RS), Physical Methods for Chemists, Van Nostrand Reinhold co., 2nd East –West reprint,	1971

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry**

1. Subject Code: **CY-512** Course Title: **Chemistry of Main Group and Transition Elements**
2. Contact Hours: **L-03; T-01; 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	Spring	Both
	√	

7. Pre-requisite: **Basic knowledge of inorganic chemistry.**
8. Subject Area: **Inorganic chemistry for 2 year M. Sc. program**
9. Objective of Course :

   To familiarize the students with chemistry of compounds of main group elements.

10. Details of Course:

Chemistry of Non Transition Elements
With special reference to the structure and bonding of the following compounds: Boranes, graphite compounds, silicones, *silicates, nitrogen & phosphorous cyclic compounds, boron-sulphur/nitrogen cyclic compounds, fluorocarbons, interhalogens, polyhalides and noble gas compounds.*

Chemistry of Transition Elements
Comparative studies of first, second and third row transition elements based on their elctronic configuration, physical and chemical properties.

Magnetic properties of free ions; paramagnetism, diamagnetism, ferro and antiferromagnetism and ferrimagnetism; magnetic properties of 4 and 6 coordinated complexes in presence of weak and strong field ligands and their hybridisations; spin and orbital moment and spin orbital coupling, quenching of orbital momentum, spin paired and spin free equilibria in complexes; metal-metal direct spin exchange interaction and

1. **Structure and bonding in different types of inorganic chains, rings, cages and clusters: Borohydrides,** higherboranes, carboranes, **metallo- boranes,** silicones, **polysilanes,** graphite compounds, **nitrides, phosphides, arsenides,** sulphur-nitrogen compounds, **tetrasulphur tetranitride, sulphides of phosphorus, polyphosphazenes, polythiazenes, clusters compounds of B, P, Ge, Sn, Pb, As, Sb, Bi, Te.**
   (Contact hours – 14)
2. **Main group organometallics: Factors controlling metal-carbon bond formation, review of the comparative aspects of synthetic methods, reactivity and bonding in ionic and covalent-main groups organometallic compounds, metal alkyls, metal aryls, electron deficient organometallic compounds, metal–hydrogen/halogen exchange reactions, tramsmetallation reactions, important reactions of Grignard reagent. (Contact hours – 11)**
3. **Applications of main group organometalllics: Applications of Grignard reagent, organolithium, organoaluminium (Ziegler–Nattacatalyst), organosilicon, organotin and organophosphorous compounds in organic synthesis/processes, enantioselective synthesis via organometallic compounds; industrial,**

super exchange interaction through bridging ligands. **Lanthanides** *Oxidation states, complex formation, colour and absorption properties, magnetic properties, extraction and separation using modern methods.* *Actinides* *Oxidation states, complex formation, production and separation*	**agricultural and biological applications of organosilicon, organotin and organophosphorous compounds.** **(Contact hours– 06)** 4. **Coordination chemistry of transition metals: Classification of ligands based on donor atoms,** nomenclature of complexes of polydentate ligands, geometrical isomerism, optical isomerism-**enantiomers based upon chirality of chelate rings, designation of absolute configurations, index number**, stereospecific and stereoselective effects, themodynamic and kinetic stability of complexes, stability constants of complexes and their determination (spectrophotometric, potentiometric and polarographical methods), factors affecting the stability of the complexes. **(Contact hours – 11)**

Suggested books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Greenwood (NN) and Earnshaw, (A), Chemistry of the Elements, 1st Ed., reprinted in 1985, Pergamon Press, Oxford, ISBN-0-08-022057-6 (Flexi cover); 2nd Ed., Elsevier	2005
2.	Cotton (FA), Wilkinson (G) and Gaus (PL), Basic Inorganic Chemistry, 3rd Ed., WSE Wiley & Sons, Inc. New York, reprinted in 2002, ISBN-9971-51-175-4	1985
3.	Shriver (DF) and Atkins (PW), Inorganic Chemistry, 3rd Ed., Oxford University Press, 2002, ISBN-0-19-850331-8	2002
4.	Huheey (JE), Keiter (EA) and Keiter (RL), Inorganic Chemistry, Principles of Structures and Reactivity, 4th Ed., Low Print Edition, Pearson Education Ltd, Asia, reprinted in India, 2001, ISBN-81-7808-385-X.	2001
5.	Miessler (GL) and Tarr (DA), Inorganic Chemistry, 3re Ed., Pearson Education (Singapore) Pvt. Ltd	2004
6.	Wilkinson (G), Stone (FGA) and Abel (E), Eds. Comprehensive Organometallic Chemistry, Vol. I, Pergamon Press, New York	1995
7.	Spessard, (GO) and Miessler (GL), Organometallic Chemistry, Printice Hall	1997
8.	Powell (P), Principles of Organometallic Chemistry, 2nd Ed., Chapman and Hall, London	1988
9.	Doughlas (BE), Daniel (DHMc) and Alexander (JJ), Concepts and Models in Inorganic Chemistry, 3rd Ed., Wiley VCH	1994
10.	Cotton (FA), Wilkinson (G), Advanced Inorganic Chemistry, A Comprehensive Text, 4th Ed., John Wiley & Sons, New York, 1980, ISBN 0-471-02775-8	1980

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry**

1. Subject Code: **CY-612(I)** Course Title: **Advanced Inorganic Chemistry – I**
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	Spring	Both
	√	

7. Pre-requisite: **Knowledge of coordination chemistry.**
8. Subject Area : **Inorganic chemistry for 2 yr. M. Sc. program**
9. Objective of Course :

   To familiarize the students with mechanisms of inorganic reactions and bio-inorganic chemistry.

10. Details of Course:

Stability Constants of the Complexes
Determination of stability constants by: spectrsocpic methods, monovariation method, matching absorbance method, method of Bent and French, Bjerrum' pH-metric method, conductometric method, polarographic methods, ion-exchange method, solvent extraction method.

Factors affecting the stability of complexes
Uses of stability constants in analytical chemistry resoluting of enantiomorphs, preparation of cis- and trans- isomers and the determination of their configuration.

Kinetics and Mechanism of Inorganic Reactions
Law of microscopic reversibility, activaiton energy, reaction profile SN, SE reactions.

Substitution in octahedral complexes: exchange reactions, acid-hydrolysis, base-hydrolysis; ennation reaction, stereochemistry of substitution

1. **Inorganic Reaction Mechanism**
   Substitution reactions in octahedral complexes: exchange reactions, acid- and base-hydrolysis, annation reaction, solvolytic and catalysed reactions.
   Substitution reactions in square-planar complexes: effect of non-participation of ligands on reactivity, *cis* and *trans* effects.
   (Contact hours – 08)
2. **Electron transfer reactions**:
   Outer- and inner-sphere mechanisms, factors affecting electron transfer reaction rates, theories of electron transfer reactions, solvated electron.
   (Contact hours – 06)
3. **Bio-inorganic chemistry:**
   Metalloproteins and enzymes: **Role of metal ions in the active sites, structure and functions of metalloproteins and enzymes containing Mg, Ca, V, Mn, Fe, Co, Ni, Cu and Zn ions.**
   (Contact hours – 06)
   Detailed structure and mechanistic studies of the following:
   Mn-photosystem-II, catalase, pseudocatalase; oxygen carriers– Hb, Mb; non-porphyrin oxygen carriers: hemerythrin, hemocyanin; **Fe-ribonucleotide reductase,** cytochrome c **oxidases,** cytochrome P-450s; **Ni- urease, hydrogenase;** nitrogen fixation; Cu-blue copper

reactions. ***Substitution in square planar complexes :*** Theory of trans- effect, mechanism of substitution. Substitution in tetrahedral complexes Mechanism of dissociation and formation of square planar complexes with linear and cyclic ligands. ***Redox reactions:*** outer-sphere reactions, tunnelling effect, varcus-Hush theory, inner sphere reaction bridged-intermediate mechanism, no electron transfer reaction, hydrated electron. Reactions in organo-metallic compounds.	protein, **tyrosinase, galactose oxidase, superoxide dismutases; Zn-carbonicanhydrase, carboxy-peptidase, alcohol dehydrogenase. (Contact hours – 12)** **4. Chemical Toxicity and metallo- therapy: Toxic chemicals in the environment; toxic effects of arsenic, cadmium, lead, mercury, carbon monoxide, cyanide and other carcinogens; metal containing drugs in therapy; interaction of heavy metal ions with DNA; DNA cleavage; structure-activity relationship and mode of action. (Contact hours – 10)**

Suggested books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Huheey (JE), Keiter (EA), Keiter (RL), Inorganic Chemistry: Principle of Structure and Reactivity, 4th Ed., Low Print Ed., Pearson Education Ltd, Asia, reprinted in India, 2001, ISBN-81-7808-385-X.	2001
2.	Wilkins (RG), Kinetics and Reaction Mechanism of Transition Metal Complexes, 1991, 2nd Revised Ed., VCH, New York.	1991
3.	Mukherjee (GN), Das (A), Elements of Bioinorganic Chemistry, Ist Ed., U.N. Dhur & Sons Pvt. Ltd., Calcutta.	
4.	Gillman (G), Pharmacological, Basis of Therapeutic, 9th Ed., McGraw Hill.	1996
5.	Lehninger (AL), Biochemistry, The Molecular Basis of Cell Structure and Function, Worth Publishers.	1982
6.	Eichhorn (GL), Inorganic Biochemistry, Vol. 2, Elsevier Scientific Publishing Company, New York.	1973
7.	Que (JL), Tolman (WB), Comprehensive Coordination Chemistry, Ed. McCleverty (JA) and Meyer (TJ), Pergamon Press.	1988
8.	Advaned Inorganic Biochemistry, Ed. Marzelli (LG) and Eichhorn (GL), Elsevier Scientific Publishing Company.	1993
9.	Cotton (FA), Wilkinson (G), Advanced Inorganic Chemistry, A Comprehensive Text, 4th Ed., John Wiley & Sons, New York, 1998, ISBN 0-471-02775-8.	1998

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-622(I)** Course Title: **Advanced Inorganic Chemistry – II**
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	Spring	Both
	√	

7. Pre-requisite: **Knowledge of inorganic chemistry.**
8. Subject Area : **Inorganic Chemistry for 2 yr. M. Sc. program**
9. Objective of Course :

   To familiarize the students with crystal structures of common inorganic compounds and characterization methods for metal complexes.

10. Details of Course:

Common Crystal Structure of Inorganic Compounds: Hexagonal close-packing, face centred cubic close-packing, mixed hexagonal and cubic close-packing, body centered cubical packing, unit cell, coordination number. **Ionic crystals containing two different elements:** cesium chloride, rock salt, zince blend and wurtzite structures; ionic cyrstals containing two kinds of ions each having a different coordination number. Fluorite, antifluorite and rutile structures; crystals containing three different elements, the ilmenite, spinel and pervoskite structures, defect structures and non-stoichiometric compounds. **Non-Ionic Crystals:** Giant molecules, layer structure, crystals composed of discrete molecules. Determination of ionic radii.	**1. Crystal structure of inorganic compounds:** Crystalline solids, hexagonal close packing, face centered cubic- and body centered cubic close packing, packing efficiency, octahedral and tetrahedral interstitial sites, limiting radius ratios in different geometrical arrangements, method of determination of ionic radii. **(Contact hours – 06)** **Ionic crystals containing two different elements:** Caesium chloride, rock salt, zinc blende, Wurtizite, Fluorite, Antifluorite, **NiAs, CdI_2** and Rutile structures. **(Contact hours – 06)** **Ionic crystals containing 3 different elements:** Ilmenite, spinels, inverse spinels, garnets perovskite and K_2NiF_4. **(Contact hours– 04)** **Non-ionic crystals:** giant molecules, layer structure, crystals composed of discrete molecules. **(Contact hour – 02)** **Defect structures:** Schottky and Frenkel defects, solid electrolytes, nonstoichiometric compounds. **(Contact hours – 02)**

High Temperature Chemistry: Introduction to high temperature chemistry, relative stabilities of solids at high temperature, synthesis of new solids, high temperature techniques, gaseous monohalide and gaseous oxide molecules. **Thermal Methods** ***Thermogravimetric Analysis:*** description of thermobalance factors governing thermogravimetry, applications of thermogravimetry differential thermal analysis, description of apparatus, factors affecting results and its applications. **Differential Scanning Calorimetry** Techniques based on the measurement of electrical and magnetic properties, techniques based on the detection of volatile products. (thermal methods are condensed in the revised syllabus)	**2. Amorphous inorganic materials: Glasses, refractories, materials obtained from organometallic chemical vapour deposition (OCVD).** **New materials: Conducting polymers, Carbon nanotubes, carbon nanorods and fullerenes. (Contact hours– 06)** **Electronic materials: Insulating, semi-conducting, superconducting materials, dielectrics.** **(Contact hours – 06)** **3. Photochemistry of metal complexes: Introduction to inorganic photochemistry, photochemically excited states and excited state processes for transition metal complexes, photochemical reactions of coordination compounds (Cr, Fe and Ru complexes), types of photochemical reactions in transition metal complexes — substitution, decomp-osition, fragmentation, rearrange-ment and redox reactions, Applications of photochemical inorganic reactions in synthesis, catalysis, biological processes , in lasers. (Contact hours– 06)** **4. Structural characterization of metal complexes by physical methods:** **Extended X-ray absorption spectroscopic (EXAFS), electron spin spectrometric (ESR), electron spectroscopy for chemical analysis (ESCA) studies, multinuclear 2 D NMR, HMBC, HMQC and Mössbauer spectroscopic studies of metal complexes. Redox potential determined by polarographical and cyclic voltametric studies of coordination compounds containing one or more redox centers, coupled chemical reactions — EE and EEE mechanisms;** thermal methods. **(Contact hours– 10)**

Suggested books

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Doughlas (BE), Daniel (DHMc), Alexander (JJ), Concepts and Models of Inorganic Chemistry, 3rd Ed., Wiley VCH.	1994
2.	Doughlas (BE), Daniel (DHMc), Alexander (JJ), Solution Manual of Concepts and Models of Inorganic Chemistry, 3rd Ed., John Wiley &	2001

	Sons, Inc, New York.	
3.	Greenwood (NN), Earnshaw (EA), Chemistry of Elements., 1st Ed., reprinted in 1985, Pergamon Press, Oxford, SBN-0-08-022057-6 (Flexicover); 2nd Ed., Elsevier.	2005
4.	. Cotton (FA), Wilkinson (G), Murillo (CA), Bochmann (M), Advanced Inorganic Chemistry, 6th Ed., John-Wiley, New York.	1999
5.	Drago (RS), Physical Methods for Chemists, Van Nostrand Reinhold co., 2nd East-West reprint.	1971
6.	West (AR), Solid State Chemistry and its Applications, John Wiley & Sons, New York.	1989
7.	Chakraborty (DK), Solid State Chemistry, New Age International.	1996
8.	Cox (PA), Electronic Structure and Chemistry of Solids, Oxford University Press.	1991
9.	Balzani (V), Carasiti (V), Photochemistry of Coordination Compounds, Academic Press.	1970
10.	Wrighton (WS), Inorganic and Organometallic Photochemistry, ACS Publishers.	1978
11.	Geoffrey (GL), Wrighton (WS), Organometallic Photochemistry, Academic Press.	1979

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-631** Course Title: **Advanced Coordination Chemistry**
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**) ☐ (**Spring**) ☐ (**Both**)
7. Pre-requisite: **Basic knowledge of coordination chemistry.**
8. Subject Area : **Inorganic Chemistry for 2 yr. M. Sc. program**
9. Objective of Course: The course aims to strengthen co-ordination chemistry.
10. Details of Course:

Isomerism
Isomerism in complexes, stereoisomerism with special reference to four and six coordinated complexes.

Valence Bond Theory
Geometry of the complexes, Inner and outer orbital types of complexes. Normal and penetration complexes, shortcomings.

Crystal Field Theory
Difference between VBT and CFT, splitting of d-orbitals in octahedral, tetragonal, square planar and tetrahedral fields; factors affecting crystal field splitting, Jahn-Teller effect; high spin and low spin complexes, CFSE, shortcomings.

Molecular orbital theory of Complexes
Composition of ligand group orbitals, octahetral, tetrahedral and square planar complexes including both σ and π bonding.

1. **Electronic spectra of coordination compounds: Energy states from spectral terms of d^n configurations, selection rules for ligand-field and charge transfer transitions in metal complexes, band intensities, factors influencing band widths, splitting of various terms,** Orgel and Tanabe-Sugano diagrams of octahedral and tetrahedral d^n complexes, calculation of ligand field parameters; **luminescence, phosphorescent complexes; optical rotatory dispersion and circular dichroism in complexes. (Contact hours – 10)**
2. **Magnetic properties of coordination compounds:** Magnetic susceptibility and magnetic moment; diamagnetic and paramagnetic behavior of transition metal complexes, spin-orbit coupling effects (L-S coupling and j-j coupling) on magnetic moments of complexes, orbital angular moment and its quenching in octahedral and tetrahedral complexes, temperature independent paramagnetism (TIP) of complexes, spin-free and spin-paired equilibria, spin cross over phenomenon, metal-metal direct spin interaction and super exchange spin-spin interaction through bridging ligands, ferromagnetic, anti-ferromagnetic, ferrimagnetic behaviour of transition metal compounds, comparison of the effect of temperature on various magnetisms in complexes. **(Contact hours – 08)**

Electronic Spectra of Complexes Term symbols, S, P, D and F terms in a cubic field; Orgel and Tanabe-Sugano diagrams, spectrochemical series, Nephelauxetic series. **Complexes of π Bonding Organic Ligands** Two electron ligands: Olefinic and actylenic complexes; three electron ligands: allylic complexes; four electron ligands: butadiene and cyclobutadiene complexes; five electron ligands: cyclopentadienyl complexes; six electron ligands: benzene, cycloheptatriene and cyclooctatriene complexes. **Metal Complexes of Biological Significance** Metal complexes as oxygen carriers: haemoglobin and myoglobin; non-porphyrin oxygen carriers: hemerythrin and hemocyanin; electron transfer proteins: ferridoxin, cytochromes, chlorophyll in photosynthesis; vitamin B_6 and B_{12} coenzymes; biological nitrogen fixation.	3. **Organotransition metal chemistry: σ–Bonded transition metal-alkyls, - aryls, -alkenyls(vinyls), -alkynyls- (acetylides), reactions in σ–organyls — hemolytic cleavage, reductive elimination, electrophilic cleavage, insertion, β-metal hydrogen elimination, α-abstraction or α-elimination.** **(Contact hours – 05)** 4. **Transition metal organyls with metal-carbon multiple bonding: Transition metal-carbenes, -carbynes, -bridging carbenes and -carbynes, reactions of carbene/ and carbyne complexes —ligand substitution, nucleophilic, electrophilic attack, dismutation, ligand coupling reactions.** **(Contact hours – 05)** 5. **Organotransition compounds with multicenter bonds (non-classically bonded):** Concept of hapticity, transition metal complexes of alkenes, Ziese salt, allenes, alkynes, allyls, butadienes; cyclic π-metal complexesof cyclobutadienes, cyclopentadienyls, arenes, cycloheptatrienylsand cyclooctatetraenes; reactions and bonding in ferrocene; **stereochemical non-rigidity in organometallic compounds, bimetallic and cluster complexes.** **(Contact hours – 08)** 6. **Applications of transition metal organic compounds in catalysis--- hydroformylation, hydrogenation of olefins, synthesis of chiral pharmaceuticals, olefins metathesis, Wacker process, importance of organometallic compounds in certain biological systems.** **(Contact hours – 06)**

Suggested books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Huheey (JE), Keiter (EA) and Keiter (RL), Inorganic Chemistry, Principles of Structures and Reactivity, 4th Ed., Low Print Edition, Pearson Education Ltd, Asia, reprinted in India, 2001, ISBN-81-7808-385-X.	2001
2.	Cotton (FA), Wilkinson (G), Murillo (CA), Bochmann (M), Advanced Inorganic Chemistry, 6th Edition, John-Wiley, New York.	1999
3.	Greenwood (NN) and Earnshaw, (A), Chemistry of the Elements, 1st Ed., reprinted in 1985, Pergamon Press, Oxford, ISBN-0-08-022057-6 (Flexicover); 2nd Ed., Elsevier.	2005
4.	Figgis (BN), Introduction to Ligand Fields, John Wiley & Sons, reprinted in India, Wiley Eastern Ltd., 1976, ISBN-0- 85226-275-2.	1976
5.	Doughlas (BE), Daniel (DHMc) and Alexander (JJ), Concepts and Models in Inorganic Chemistry, 3rd Ed., Wiley VCH.	1994

6.	Cotton (FA), Wilkinson (G), Advanced Inorganic Chemistry, A Comprehensive New York, 1980, reprinted in 1998.	1998
7.	Lever (ABP), Inorganic Electronic Spectroscopy, 2nd Ed., Elsevier.	1988
8.	Que (JL), Tolman (WB), Comprehensive Coordination Chemistry, McCleverty (JA) and Meyer (TJ), (Eds.), Pergamon Press.	1988
9.	Hill (AF), Organotransition Chemistry, The Royal Society of Chemistry, Thomas Graham House Science Park, Cambridge, U. K.	2002
10.	Callman (JP), Hegedus (LS), Norton (JR) and Finke (RG), Principles and Applications of Organotransition Metal Chemistry, University Science Books, Valley, CA.	1987

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-681** Course Title: **Chemical Applications of Nanoscale Materials**
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	Spring	Both
	√	

7. Pre-requisite: **Nil**

8. Subject Area: **Chemistry advance level course for M.Sc., M.Tech, and Ph.D. students**

9. Objective of the Course:

The present course will introduce various aspects of chemical applications of nanoparticles, as the nanoscale materials have attracted wide attention of the scientific community in recent times. The course will help understanding the size-dependent changes in chemical properties of nanoscale materials that present enormous opportunities for the advances in science and technology.

10. Details of Course:

S. No.	Particulars	Contact Hours
1	***Introduction:*** Nanoscale materials, difference between nanoscale and bulk materials, different types of nanoscale materials; quantum dots, nanotubes, and nanorods, synthesis, and characterization methods.	4
2	***Reactivity of Nanoparticles:*** Increased reactivity of nanoscale materials, reasons for high reactivity, effect of size and shape of nanocrystals on reactivity, comparison of nanocrystalline versus macro-crystalline materials in terms of reactivity.	5
3	***Metal Oxide Nanoparticles:*** Unique characteristics, aerogel method to produce materials with very high surface area, textural studies, determination of size, defects in nanocrystalline metal oxides, comparison of nanoscale metal oxides with other porous materials such as zeolites, clays etc.	4
4	***Testing Chemical Reactivity:*** Typical reactions used for testing reactivity; SO_2 and CO_2 adsorption, H_2S adsorption, CCl_4 adsorption, adsorption of stimulant molecules of chemical warfare agents.	4
5	**Chemical Modification of Nanoparticles:** Prevention of agglomeration, Impregnation / incorporation of suitable chemical agents on the surface of nanoparticles, increasing dispersibility in solution.	5

6	***Applications as Adsorbents:*** Adsorbents based on nanostructured materials, destructive adsorption, decontamination of toxic chemicals, detoxification of surrogates of chemical warfare agents, air purification, desulfurization, destruction of chlorinated compounds.	**9**
7	***Applications using Modified Nanoscale Metal Oxides:*** Mixed metal oxides, Lewis acid incorporated nanocrystalline metal oxides, model reactivity studies using modified nanocrystalline metal oxides.	**4**
8	***Biocidal Applications:*** Killing bacteria, spores and other harmful germs using halogenated nanoparticles, mechanism of biocidal action, advantages of using biocides based on nanoparticles.	**4**
9	***Toxicology:*** Concerns in using nanoparticles, inhalation toxicity, oral toxicity, governmental regulations, case studies on toxicology, precautions.	**3**

Recommended Books:

A few relevant text books (some are listed below) and a few monographs will be used. The references will be provided during the lectures.

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Klabunde (KJ) Ed., Nanoscale Materials in Chemistry, Wiley-Interscience, NY 2001.	2001
2.	Schmid (G) Ed., Nanoparticles: From Theory to Application, Wiley-VCH, Weinheim.	2004

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-911** Course Title: **Organic Semiconductors: Synthesis and Applications**
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	Spring	Both
	√	

7. Pre-requisite: **Basic organic chemistry and spectroscopy**

8. Subject Area: **Pre Ph D course**

9. Objective of Course:

The course will deal with rapidly emerging areas in organic electronic materials. The students will be exposed to the synthesis and characterization of organic oligomers, dendrimers and polymers. Topics covering the properties of conjugated organic molecules and their application in electronic devices such as organic light-emitting diodes, photovoltaics, field-effect transistors and sensors will be focused.

10. Details of Course:

S. No.	Particulars	Contact Hours
1.	**Introduction**: General description of conjugated organic oligomers, dendrimers and polymers. Conjugated polymer structural types (polyacetylenes, polyphenylenevinylenes, polyphenyeleneethynylenes, polyfluorenes, polythiophenes, polyphenylenes, polyanilines, water soluble polymers, phosphorescent polymers). Carbon-rich compounds, Cross-conjugation.	**6**
2	**Synthesis**: Useful synthetic methods for the construction of conjugated organic oligomers and polymers. C-C and C-Heteroatom coupling reactions - Historical context and latest developments. Representative examples. Mechanistic consideration. All-benzenoid polycyclic aromatic hydrocarbons: synthesis, self-assembly and applications in organic electronics. Solid state strategy for the preparation of carbon-rich polymers.	**10**
3	**Properties**: Electronic structure of organic semiconductors - Relationship between two view points: solid state physics and molecular picture of conjugated organics. Electrochemistry, electrochromism and energy level measurements. Charge transport (electronic conduction in photoactive molecular-wires). Luminescence. Energy transfer and electron transfer. Excitation dynamics in organic semiconductors. Fluorescence sensing. Non-linear optical properties.	**14**
4.	**Applications**: Field-effect transistors, Light-emitting diodes, photovoltaics and solar cells - Device architectures, materials, characterization and theory	**12**

	of operation. Biosensors - Electrochemical detection, fluorescence optical amplification (protein & DNA and RNA sensing), solid state applications (DNA chips and micro arrays).	

Recommended Books: There is no suitable text. Extracts from various relevant textbooks & monographs will be used and primary literature references will be given throughout the course.

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Haley (MM), Tykwinski (RR) Ed., Carbon-Rich Compounds: From Molecules to Materials Wiley, 2006. ISBN: 3-527-31224-2.	2006
2.	Singh (J) Smart Electronic Materials: Fundamentals and Applications, Cambridge University Press, 2005 ISBN: 0521850274.	2005
3.	Fraxedas (J) Molecular Organic Materials: From Molecules to Crystalline Solids, Cambridge University Press, 2006. ISBN: 0521834465.	2006
4.	Miyata (S) Organic Electroluminescent Materials and Devices, Taylor & Francis (CRC Press), 1997. ISBN: 2919875108.	1997
5.	Schubert (EF) Light-Emitting Diodes, Cambridge University Press, 2nd Ed., 2006. ISBN-10: 0521865387	2006
6.	Brabec (C), Dyakonov (V), Parisi (J) and Sariciftci (NS) Ed., Organic Photovoltaics, Springer, 2003. ISBN: 354000405X.	2003
7.	Agranovich (VM) Ed., Organic Nanostructures, IOS press, 2002. ISBN: 1586032712.	2002
8.	Norio (M) Ed., Cross-Coupling Reactions A Practical Guide, Springer, 2002. ISBN: 3-540-42175-0.	2002
9.	Schroder (DK) Semiconductor Material and Device Characterization, Wiley-IEEE Press, 2006. ISBN: 0-471-73906-5.	2006
10.	Brütting (W) Ed., Physics of Organic Semiconductors, Wiley, 2005. ISBN: 3-527-40550-X.	2005
11.	Irene (EA) Electronic Materials Science, Wiley, 2005. ISBN: 0-471-69597-1.	2005

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-912** Course Title: **Supramolecular Chemistry**
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	Spring	Both
√		

7. Pre-requisite: **Basic chemistry and spectroscopy**

8. Subject Area: **Pre Ph D Course**

9. Objective of Course:

Supramolecular chemistry is a new emerging domain lying amidst chemistry, biochemistry, physics, and materials science. The students will be learning exciting phenomena unthinkable within the realm of classical organic chemistry that not only provide the basis for revolutionizing numerous branches of industry but also improve our understanding of the functioning of living organisms and of the origin of life. It will be a journey from the chemistry of the entities generated by intermolecular noncovalent interactions into their application in electronic devices.

10. Details of Course:

S. No.	Particulars	Contact Hours
1.	***Fundamentals of Supramolecular Chemistry:*** Definitions, brief overview and examples; types of noncovalent interactions (H-bonding, electrostatic (ion-ion, ion-dipole, dipole-dipole), hydrophobic and steric, π-π, Van der Waals); concepts of host-guest complexation with examples from ionophore chemistry; complexation of ions; molecular baskets, chalices and cages: podands, crown ethers, cryptands, calixarenes; macrocyclic effect; complexation of neutral molecules; self-assembly; molecular boxes and capsules; catenanes and rotaxanes; self-complementary species and self-replication.	8
2	***Supramolecular Chemistry and Biological Processes:*** Cation binding (biological relevance, affinity and selectivity, artificial ionophores, natural and artificial cation channels); Anion and neutral molecule binding (relevance, factors affecting affinity and selectivity, anion and neutral molecule binding in biology, artificial hosts for anions, katapinands, guanidinium receptors, receptors based upon Lewis acid-base concepts, enantioselective anion recognition, cyclodextrins, anion binding based upon ion-dipole interactions, simultaneous anion-cation binding, neutral molecule recognition and binding) Receptor-substrate interactions; drug binding; protein folding.	8

3	***Synthesis of Supramolecules:*** Synthesis of macrocycles; synthesis of receptors for cations anions, and neutral molecules; non-covalent synthesis; Metal directed self-assembly of complex supramolecular architecture: chains, racks, ladders, grids, macrocycles, cages, nanotubes and self-intertwining strands (Helicates).	**6**
4.	***Physical Methods in Supramolecular Chemistry:*** Spectroscopy in supramolecular chemistry; determination of stoichiometry, stability constants, and geometry of complexes; binding constant determination; dynamics of supramolecular systems (solid state vs. solution behavior).	**8**
5.	***Application of Supramolecular Chemistry:*** Supramolecular catalysis; membrane transport; sensors; phase-transfer catalysis; supramolecular devices and switches; memories, logic gates and related systems; molecular scale machines (mechanical rotors, gears, brakes, etc.; conversion of light into fuels and light into electricity.	**12**

Recommended Books

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Steed (JW) and Atwood (JL) Supramolecular Chemistry, Wiley, 2000. ISBN: 0-471-98791-3.	2000
2.	Beer (PD), Gale (PA)and Smith (DK) Supramolecular Chemistry, Oxford Chemistry Primers, 1999. ISBN-10: 0-19-850447-0; ISBN-13: 978-0-19-850447-4.	1999
3.	Lehn (JM), Supramolecular Chemistry: Concepts and Perspectives, Wiley-VCH, 1996. ISBN 3527293116.	1996
4.	Schneider (HJ) and Yatsimirsky (A), Principles and Methods in Supramolecular Chemistry, Wiley-VCH, 2000. ISBN: 0-471-97253-3.	2000
5.	Cragg (P), A Practical Guide to Supramolecular Chemistry, Wiley-VCH, 2005, ISBN: 0-470-86654-3.	2005
6.	Haiduc (I) and Edelmann (FT), Supramolecular Organometallic Chemistry, Wiley-VCH, 2000, ISBN 352729533X.	2000
7.	Encyclopedia of Supramolecular Chemistry, Marcel Dekker, 2004, ISBN 0824747240.	2004
8.	Dodziuk (H), Introduction to Supramolecular Chemistry, Springer, 2001, ISBN 1402002149.	2001
9.	Lindoy (LF) and Atkinsoin (IM), Self-Assembly in Supramolecular Systems, Royal Society of Chemistry, 2001, ISBN 0854045120.	2001

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-921** Course Title: **Frontiers in Inorganic Biochemistry**
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 [ ] Spring [√] Both [ ]
7. Pre-requisite: **Knowledge of inorganic chemistry and spectroscopy**
8. Subject Area: **Chemistry advance level course for Ph. D. students**
9. Objective of Course:

The course will deal with frontier areas in inorganic biochemistry. Metalloproteins from cellular and molecular biological point of view will be discussed along with structural biology of metalloproteins especially NMR of metalloproteins. Several new areas which are now emerging in the post genomic era will be an integral part of this course.

10. Details of Course:

S. No.	Particulars	Contact Hours
1.	**Homeostatic Mechanism :** Cellular Components and Pathways in the context of metal ions, homeostatic mechanism in prokaryotes and eukaryotes to human. Evolutionary pathway metals, metallocofactors and prosthetic groups.	3
2	**Metal Ion Transport and Assembly of Metalloproteins:** Details of the metal transport in Yeast and in higher organisms : Proteins involved in uptake and efflux, metallochaperones, transcription factors (Ace1 and Mac1, copper sensor). Assembly of metals in protein, photoactivation. Heme synthesis, covalent and non-covalent interactions of heme with protein, Assembly of heme in heme proteins- cytochrome c vs cytochrome b5, heme chaperoning and role of CCME. Identification of a protein as heme protein, Heme Oxygenase, Reconstitution of hemeproteins with modified heme/other cofactors and their application in biocatalysis and electron transfer.	6
3	**Molybdenum and Tungsten in Biology:** Hyperthermophilic and thermophilic bacteria. Mo and W containing enzymes, mechanism of catalytic activity- nitrogenase, sulfite oxidase, nitrate reductase, acetylene hydratase, xanthine oxidase, DMSO reductase. Structural and functional modeling of Mo and W sites and their applications as biocatalysis.	6
4.	**Iron in Biosystem: (a) Non-Heme: (i) Iron-Sulphur Proteins (ii) Other non-heme iron proteins:** Lipoxygenase and its implication in cancer research Nitrile Hydratase and its application to industry. . Structural and	5

	functional modeling of heme and non-heme metal-sites and their applications as biochemistry and biocatalysis with examples such as nitrile hydratase, lipoxygenase, acetylene coenzyme synthetase (ACS), DAP1 **(b) Heme:** Catalytic mechanism of Nitric Oxide Synthease and Heme Oxygenase,	
6.	**Metal ions and Disease:** (a) Role in Alzheimer's disease: Aggregation of proteins, role of copper, zinc and iron. Application of radiochemistry for the identification of metal ions. (b) Metal binding in prion protein: Binding of copper and manganese. (c) Manganism: Occupational exposure, manganese toxicity, effect on calcium channel, proteomics of manganese toxicity. (d) Inorganic NO-donor and their applications.	**8**
7.	**Bioinformatics and Postgenomic Era:** (a) Search of metalloprotein and metal binding motif (eg Dap1). De novo design of proteins, artificial heme binding protein, target protein. (b) Modeling with protein structure from protein data bank (c) DNA intercalation and electron transfer through DNA, RNA metal interactions.	**5**
8.	**Biomineralization:** Biomineralization in the context of bone, teeth and mollusk cells, application into materials science and biomimetic engineering **Bioorganometallic Chemistry:** Introduction and applications.	**4**
9.	**NMR Structural Biology and Structure Solution of Metalloproteins:** (a) Selection of a target protein, Plasmid preparation and overexpression, Preparation of sample for NMR, (b) Overexpression of heme protein: cytochrome c vs cytochrome b (c) labeling of protein by 15N and 13C, standardization of overexpression and purification (heme as well as nonheme) . (b) Details of the NMR Experiments for Spectral Analysis, paramagnetic NMR, structure solution	**5**

References:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Cotton (FA) and Wilkinson (G) Advanced Inorganic Chemistry, A Comprehensive Text, 4th Ed. John Wiley & Sons, New York, 1980, ISBN 0-471-02775-8.	1980
2.	Huheey (JE), Keiter(EA) and Keiter(RL) Inorganic Chemistry, Principles of Structures and Reactivity, 4th Ed., Low Print Edition, Pearson Education Ltd, Asia, Reprint in India, 2001, ISBN-81-7808-385-X.	2001
3.	Lippard (SJ) and Berg (JM) Principles of Bioinorganic Chemistry University Science Book.	
4.	Bertini (I), Gray (HB) Lippard (SJ) and Valentine (JS) Bioinorganic Chemistry, University Science Book, South Asian Edition Reprint..	2004
5.	Pecoraro (VL) *Manganese Redox Enzymes,* VCH: New York.	1992
6.	(a) Wuthrich (K). "NMR of Proteins and Nucleic Acids. Wiley, New York,. (b) Bertini (I).; Sigel (A).; Sigel (H). Handbook on Metalloproteins, Marcel Dekker,	(a) 1986 (b) 2001

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-922** Course Title: **Modern Trends in Nuclear Instrumental Techniques**
2. Contact Hours: **L-2; 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) ( ) (Spring) ( ) (Both)

7. Pre-requisite: **Nil**

8. Subject Area: **Pre-Ph.D. Course**

9. Objective of Course:

The course deals some exciting nuclear analytical techniques like nuclear microprobe analysis (NMP), accelerator mass spectrometry (AMS), proton beam writing (PBW) and positron emission tomography (PET) have emerged strongly. In addition, nuclear techniques for material modification (by ion implantation) and nanomaterial synthesis (patterning nanostructures and ion beam mixing). Besides, the course features introduction to radionuclides for biomedical research, especially involving radiolabelled compounds for pre-clinic drugs, radiochemicals for receptor studies, radioisotopes for cancer research.

10. Details of Course:

Sl. No.	Particulars	Contact Hours
1	***Basic Radiochemistry:*** Types of radioactivity, nuclear reactions and their energetics, decay methods, radioactive equilibrium and its importances, choice and production of radionuclides of analytical, biomedical and industrial applications.	3
2	***Interaction of radiation with matter***: Methods of radiation detection: properties of a detector, gas filled counters, scintillation and semiconductor detectors. Radiation Biology: Radiation effect on cellular level. Effect of low dose ionizing radiation, somatic and genetic effect of radiation,	3
3	***Applications of Radioactivity:*** Chemistry of tracer concentrations, Principles and applications of: (a) Isotope dilution analysis, reverse isotope dilution and stoichiometric method (b) radio-reagent method, radiometric titration, (c) radioimmunoassay (d) radiochemical methods for determining biological activity of enzymes. (e) neutron activation analysis (f) radiochromatography (g) tracers in industrial applications and agriculture (h) radiochemical separation, (i) radiochemistry for Positron Emission Tomography	7
4	***Introductory course on Radiochemicals in Biomedical research:*** Radiotracers for biology and medicine, tracers for radiation therapy, role of radiolabelled compounds in pre-clinic drug, radiochemicals for receptor studies, radiochemicals for clinical oncology and cancer research, radioactive ligands for harmone-receptor interaction.	5
5	***Concepts and Principles of Ion Beam Analysis:*** Ion – atom interactions and	6

	related concepts, Analytical techniques – Proton Induced X-ray Emission (PIXE), Rutherford Backscattering spectrometry (RBS), Energy loss measurements, Nuclear Reactions Analysis. Basics of X-ray Spectroscopy, γ-ray spectroscopy and charged particle spectoscopy and their respective detection methods. Prospects Nuclear Microprobe analysis: μ-PIXE, μ-RBS, scanning transmission ion microscopy (STIM), quantitative elemental mapping, depth profiling, Ion implantation.	
6	***Sample Preparation methods:*** Biological specimen preparation: cryosectioning, freeze drying, Staining methods, cell and tissue culture, thin sample and thick sample related quantitative concepts, Concepts on internal and external standards.	**3**
7	***Applications based on Case study:*** Biomedical quantitative elemental imaging based on Physiology, Pharmacology, Pathology, toxicology, dermatology, oncology, clinical trials, Other applications – in earth science related, materials science, nanomaterials synthesis by ion beam mixing, ion implantation, environmental science, archaeology, single cell irradiation technique, Nanotoxicology.	**8**
8	***Other nuclear techniques***: Accelerator mass spectrometry (AMS) – principle and applications in biomedical, environmental and geochemical studies. Proton beam writing (PBW): basic concepts of proton beam writing, comparison with electron beam writing, type of resist materials, dose dependence, micro and nanostructural features, self standing micro and nanostructures, nanoimprint lithography, applications based on case study.	**7**

Recommended Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Lieser (KH) Nuclear and Radiochemistry, 2nd Edition, Wiley-VCH, Berlin.	2004
2.	Ehmann (WD), Vance (DE), Radiochemistry and Nuclear Methods of Analysis, John Wiley and Sons, New York.	1991
3.	Sood, (DD), Reddy (AVR), Ramamoorthy (N). Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, Mumbai.	2004
4.	Evans (EA) and Oldham (KG) Ed., Critical Reports on Applied Chemistry Vol.24, Radiochemicals in Biomedical Research, John Wiley and Sons.	1988
5.	Johansson (SAE), Campbell (JL) and Malmqvist (KG) Ed., Particle Induced X-ray Emission Spectrometry (Chemical Analysis: A series of Monographs on Analytical Chemistry and Applications), Ist Edition, Wiley Interscience.	1995
6.	Jenkins (R), X-ray Fluorescence Spectrometry (Chemical Analysis: A series of Monographgs on Analytical Chemistry and its Applications, Wiley-Interscience, 2nd Edition.	1999
7.	Meyer (JW), Rimini (E) Ed., Ion Beam Handbook for Material Analysis, Academic Press.	1977

M.Tech. (Electric Drives & Power Electronics)

I Year

Autumn Semester

Teaching Scheme					Contact Hrs. Per Week			Exam. Duration		Relative Weightage				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	MA-501C	Advanced Mathematics	PG-11	4	3	1	0	3	-	25	-	25	50	-
2.	EE-501	On-line Computer Application Techniques	PG-13	5	3	1	2	3	-	15	15	30	40	-
3.	EE-540	Advanced Power Electronics	PG-14	5	3	1	2	3	-	15	15	30	40	-
4.	EE-541	Electric Drives-I	PG-14	4	3	1	2/2	3	-	15	15	30	40	-
5.	EE-542	Analysis of Electric Machines	PG-14	4	3	1	0	3	-	25	-	25	50	-
			Subtotal	22										

Spring Semester

Teaching Scheme					Contact Hrs. Per Week			Exam. Duration		Relative Weightage				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	EE-503	Modelling, Simulation and Evolutionary Techniques	PG-12	4	3	-	2	3	-	15	15	30	40	-
2.	EE-543	Electric Drives-II	PG-14	4	3	1	2/2	3	-	15	15	30	40	-
3.		Major Elective-I	PG-14	4	-	-	-	-	-	-	-	-	-	-
4.		Major Elective-II	PG-14	4	-	-	-	-	-	-	-	-	-	-
5.		Major Elective-III	PG-14	4	-	-	-	-	-	-	-	-	-	-
6.		Minor Elective	PG-15	4	-	-	-	-	-	-	-	-	-	-
			Subtotal	24										

Appendix 'J'
Item No. Senate/18.2.5

II Year

Autumn Semester

Teaching Scheme					Contact Hrs. Per Week			Exam. Duration		Relative Weightage				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	EE-601	Seminar	PG-18	4	-	-	-	-	-	-	-	-	-	-
2.	EE-602	Project	PG-19	4	-	-	-	-	-	-	-	-	-	-
3.	EE-603	Dissertation (to be continued next semester but evaluated in this semester also)	PG-20	12	-	-	-	-	-	-	-	-	-	-
			Subtotal	20										

Spring Semester

Teaching Scheme					Contact Hrs. Per Week			Exam. Duration		Relative Weightage				
S. No.	Sub Code	Course Title	Sub Area	Credits	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	EE-603Y	Dissertation (contd. From III semester)	PG-20	24	-	-	-	-	-	-	-	-	-	-
			Subtotal	24										
			Total	90										

List of Core Courses

S.No	Course Code	Course Title	Remark
1.	MA-501C	Advanced Mathematics	No Change
2.	EE-501	On-Line Computer Application Techniques	No Change
3.	EE-540	Advanced Power Electronics	**Syllabus Modified**
4.	EE-541	Electric Drives-I	**Course Renamed**
5.	EE-542	Analysis of Electrical Machines	**New Course**
6.	EE-503	Modeling, Simulation and Evolutionary Techniques	No Change
7.	EE-543	Electric Drives-II	**New Course**

List of Electives

S. No	Course Code	Course Title	Remark
1.	EE-544	Microprocessor Controlled Electric Drives	**Syllabus Modified**
2.	EE-545	Embedded Controllers and Its Applications	**New Elective**
3.	EE-546	Design of Electric Drives	**Course Code Changed**
4.	EE-547	Instrumentation in Electric Drivers	**Course Code Changed**
5.	EE-548	Drive System in Electric Traction	**Course Code Changed**
6.	EE-549	Control Techniques in Power Electronics for AC Drives	**Course Code Changed**
7.	EE-550	Pulse Width Modulation for Power Converters	**Course Code Changed**
8.	EE-551	Topologies of Enhanced Power Quality AC/DC Converters	**Course Code Changed**
9.	EE-552	Switch Mode Power Supply	**Course Code Changed**
10.	EE-553	Power Quality Improvement Techniques	**New Elective**
11.	EE-554	FACTS Devices	**Course Code Changed**
12.	EE-555	CAD of Power Apparatus	**New Elective**
13.	EE-556	Selected Topics in Machines and Transformers	**New Elective**
14.	EE-557	Synchronous Machine and System Stability	**Course Code Changed**
15.	EE-558	Special Machines	**Course Code Changed**

Appendix 'K'
Item No. Senate/18.2.5

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-501** Course Title: **On-Line Computer Application Techniques**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 05 6. Semester √ **Autumn** ☐ **Spring** ☐ **Both**

7. Pre-requisite: **Knowledge of Microprocessors** 8. Subject Area: **PG-13**

9. Objective:

This course aims at teaching the concept of real time application of microprocessors, microcontrollers and PCs. Computer communication techniques and networking fundamentals are also covered.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Introduction: On-line, off-line and real-time computer application; Embedded verses PC-based systems; Microprocessors, microcontrollers and digital signal processors; ASIC and field programmable devices; Industrial sensors	3
2.	Review of 16 bit microprocessor, Addressing modes, Instruction set, Programming	6
3.	I/O techniques, Data acquisition, Interfacing of keys, LCD, LED, sensors and actuators, Review of programmable interface devices (PPI, PIT, PIC, Keyboard and Display Interface, PCI, DMA controller)	8
4.	Overview of microcontrollers and digital processors	6
5.	Assembler, Compiler and Simulator	2
6.	Real Time Operating System	4
7.	Languages for real time applications and mixed language (AL and HLL) programming	4
8.	Concepts of computer buses (PCI, ISA), Communication ports (RS232, USB) and networking (LAN, WAN, WLAN, industrial networking)	4

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Hall D.V., " Microprocessor and Interfacing –Programming and Hardware", Tata McGraw Hill, New Delhi.	2006
2.	Brey B.B., "The Intel Microprocessors: 8086/8088, 80186, 80286, 80386 & 80486, Architecture, Programming & Interfacing", Prentice Hall of India, New Delhi.	2006
3.	Barney G.C., "Intelligent Instrumentation: Microprocessor Applications in Measurement and Control".	1992
4.	Gilmore, "Microprocessors – Principle and applications", Tata McGraw Hill, New Delhi.	1997

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-540** Course Title: **Advanced Power Electronics**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 0 5 6. Semester √ **Autumn** ☐ **Spring** ☐ **Both**

7. Pre-requisite: **Basic Course on Power Electronics** 8. Subject Area: **PG-13**

9. Objective:

The aim of the course is to teach the students the semiconductor devices such as Power MOSFET, IGBT, GTO, SIT and MCT etc. and their use in applications such as rectification, inversion, frequency conversion etc. The students will be exposed to advanced power electronic converters and harmonic reduction techniques.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of solid-state devices, SCR, MOSFET, IGBT, GTO, Driving circuits, Protection, Heat sink design	3
2.	Three phase converters, Effect of load and source impedances, Dual converter, Twelve step converter, Multi-pulse converters	5
3.	PWM Converter, Power factor improvement techniques	5
4.	Voltage and Current Commutated Choppers, DC-DC Converters: Buck converter, Boost converter, Cuk Converter	4
5.	Three phase ac regulators	3
6.	Single phase and three phase Cyclo-converters	2
7.	Review of line commutated and forced commutated inverters, Three phase Voltage Source Inverters, Voltage and frequency control	2
8.	Harmonic reduction techniques, PWM inverters, Space Vector Modulation	6
9.	Multi-Level Inverters, Diode Clamped, Flying Capacitor and Cascade Multi-Level Inverters.	3
10.	Current Source Inverters, Commutation circuits, Transient voltage suppressing techniques	3
11.	DC link resonant converters	3
12.	MATLAB Simulation of Power Electronic Converters	3
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Dubey G.K., Doradla S.R., Joshi A., Sinha R.M.K., "Thyristorised Power Controllers" Prentice Hall, New Jersey.	2005
2.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
3.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distributors, Delhi.	2001
4.	Lander C. W., "Power Electronics", Prentice Hall of India, New Delhi.	2004
5.	Rashid M., "Power Electronics- Circuits, Devices and Applications", Pearson Education, Delhi.	2006

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-541** Course Title: **Electric Drives-I**

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

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

4. Relative Weightage: **CWS** 1 5 **PRS** 1 5 **MTE** 3 0 **ETE** 4 0 **PRE** 0 0

5. Credits: 0 4 6. Semester √ **Autumn** ☐ **Spring** ☐ **Both**

7. Pre-requisite: **Basic Course on Electric Drives** 8. Subject Area: **PG-13**

9. Objective:

The aim of the course is to discuss in detail the basic concepts of an electric drive, power converters fed dc and ac drives, closed loop control structures and mathematical modeling of these drives.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Definition, Types of load, steady state and transient stability of drives, selection of motor ratings,	2
2.	Review of braking and speed control of dc motor & induction motor, Multi-quadrant operation, loss minimization in adjustable speed drives	3
3.	Phase controlled dc drives, Analysis and performance evaluation, Dual converter fed dc drives;	4
4.	Chopper controlled dc drives, Closed loop control of dc drives; Current control techniques; mathematical model of dc drives, stability analysis	5
5.	Modular control techniques, adaptive control	3
6.	Constant V/f controlled induction motors, Controlled current and controlled slip operations; Frequency controlled induction motor drives, PWM inverter drives, Multi-quadrant operation	5
7.	Slip power controlled induction motor drives; Static rotor resistance control, Static Kramer drive	4
8.	Mathematical modeling of induction motor drives, transient response and stability analysis,	4
9.	Field oriented control of induction motor drives	5
10.	Synchronous motor drives; adjustable frequency operations, voltage fed and current fed self controlled drives.	5
11.	MATLAB Simulation of Converter Fed Drives	3
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Pillai S.K., "A first Course on Electric Drives", Wiley Eastern Limited, New Delhi.	2006
2.	Dubey G.K., "Fundamentals of Electric Drives", Narosa Publishing House, New Delhi.	2005
3.	Murphy J.M.D., Turnbull F.G., "Power Electronics Control of AC Motors", Prergamon Press, New York.	1988
4.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
5.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distributors, Delhi.	2001
6.	Dubey G.K., "Power Semiconductor Controlled Drives" Prentice Hall, New Jersey.	2001
7.	Krishnan R., "Electric Motor Drives – Modeling, Analysis & Control", Prentice Hall of India, New Delhi.	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-542** Course Title: **Analysis of Electrical Machines**

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 5 6. Semester [√] **Autumn** [ ] **Spring** [ ] **Both**

7. Pre-requisite: **Electrical Machines** 8. Subject Area: **PG-13**

9. Objective:

The objective of the course is to present a general theory of rotating electrical machines applicable to all normal types of machines and to all condition of operation. Students will be taught development of mathematical model of the 3-phase balanced induction machine and synchronous machine in arbitrary reference frame and in field oriented reference frame for transient and steady-state performance of ac machines.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Generalized transformations, Physical model, Different reference frame, Primitive machine, dynamic variable, Formulation of dynamic equations of a generalized machine in arbitrary reference frame	10
2.	Analysis of induction machines, Space vector, induction motor modeling in arbitrary reference frame and in field oriented frame, Performance analysis	12
3.	Analysis of synchronous machine, Modeling, Operational impedances, Time constants, torque expression, Asynchronous damping,	8
4.	Steady state and transient performance, Phasor diagram and power angle characteristics,	6
5.	Symmetrical and asymmetrical short circuit analysis, Measurement of reactances and time constants	6
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Concordia, Charles, "Synchronous Machines- Theory and Performance", Wiley, New York.	1989
2.	Kimbark E.W., Power System Stability: Synchronous Machines", Vol.3, Cover Publication, New York.	1976
3.	Adkins B., Harley R.G., "The Generalized Theory of Alternating Current Machines", Chapman & Hall, London.	1979
4.	Leonard W., "Control of Electrical Drives", 3rd Edition. Springer Press, New York.	2002
5.	Murphy J.M.D., Turnbull F.G., "Power Electronics Control of AC Motors", Pergamon Press, New York.	1988

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-543** Course Title: **Electric Drives-II**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 04 6. Semester ☐ **Autumn** ☐ **Spring** ☐ **Both**

7. Pre-requisite: **Electric Drives-I** 8. Subject Area: **PG-13**

9. Objective:

This course deals with the recent ac drives, fed from LCI/VSI/CSI, for both general-purpose and superior high-performance requirements. The emphasis of the course is on state-of-the-art field-orientation control, brushless dc drives, permanent magnet & switched reluctance motor drives.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of power electronic converters for drives control	3
2.	**LCI-IM Drive:** Drive configuration, Commutation at different speeds, Control structure, Resonance Problem, Performance	5
3.	**FOC-IM Drive:** Drive configuration, Mathematical modeling, direct & indirect FOC, Influe3nce of parameters, VSI & CSI fed schemes, adaptive drive control	7
4.	**Brushless DC drives:** Self control, CSI with load commutation, Low speed commutation, Inverter control strategies, Performance	5
5.	**Permanent magnet SM drive:** Control fundamentals, Converter configuration, Synchronization Trapezoidal & sinusoidal drive control structures, Performance	6
6.	**Switched Reluctance Motor Drives:** Principle of operation, Converter circuits, Sensors, Speed control, Performanc	5
7.	**Resonant-Link converter fed Drives:** Principle of soft switching in inverters, converters utilizing resonant circuits, Modulation strategies, Application in IM drives	5
8.	Advanced control techniques, Application of modern & evolutionary techniques in drives	6
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Murphy J.M.D., Turnbull F.G., "Power Electronics Control of AC Motors", Pergamon Press, New York.	1988
2.	Bose B.K., "Modern Power Electronics & AC Drives", Pearson Education Asia, New Dellhi.	2002
3.	Dubey G.K., "Power Semiconductor Controlled Drives" Prentice Hall, New Jersey.	2001
4.	Krishnan R., "Electric Motor Drives – Modeling, Analysis & Control", Prentice Hall of India, New Delhi.	2000
5.	Leonard W., "Control of Electric Drives", Springer Press, New York.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-544** Course Title: **Microprocessor Controlled Electric Drives**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 0 4 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Microprocessors, Power Electronics Electric Drives** 8. Subject Area: **PG-13**

9. Objective:

The objective of the course is to discuss microprocessor-based control system for electrical drives. The emphasis of the course is on use of microprocessors for generation of firing signals for power electronic converters, speed and current error processing & protection of power converters.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of microprocessors & support devices	3
2.	Review of power converters: Phase angle control, Chopper, Quasi- square and PWM Inverters	3
3.	Overview of microcomputer control of Power Electronic Systems	2
4.	Microprocessor controlled single-phase and three phase converters, single-quadrant and multi-quadrant choppers	10
5.	Feed back signal processing, Measurement of electrical variables, Speed & position control of motor, signal conditioning	4
6.	Closed loop drive, Control philosophy, Closed loop dc drive fed from dual converter and chopper	3
7.	VSI, CSI and PWM inverter fed drives	7
8.	Simulation of Drives, Mathematical modeling and stability studies	5
9.	Modern control theory application	5
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Dubey G.K., "Power Semiconductor Controlled Drives" Prentice Hall, New Jersey.	2001
2.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distributors, Delhi.	2001
3.	Bose B.K., "Microcomputer Control of Power Electronics & Drives", IEEE Press, NewYork	1999
4.	Toliyat H.A., Campbell S., "DSP Based Electromechanical Motion Control", CRC Press, New York	2004
5.	Kenjo T., "Power Electronics for the Microprocessor Age", Oxford University Press	1994

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-545** Course Title: **Embedded Controller & Its Applications**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 04 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Microprocessors** 8. Subject Area: **PG-13**

9. Objective:

The aim of the present course is to teach students in detail the Intel 8051 family microcontroller, their architecture, operation, instruction set, programming and interfacing. Few case studies will also be discussed.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of 8-bit and 16-bit microprocessors, State transition diagram, Interrupt structure, Input/Output Techniques	3
2.	Review of Intel 8255 PPI, Intel 8253 PIT, Intel 8259 PIC, Intel 8279 Keyboard and Display Interface, Intel 8251 USART. ADC and DAC chips and their interfacing	5
3.	Intel 8051/8052 Microcontroller, Introduction, Architecture, Functional diagram, Pin description, CMOS and HMOS microcontrollers and their difference, Oscillator, CPU Timing	4
4.	Memory organization, Accessing external program and data memory, Internal data memory, Special function registers	4
5.	I/O ports, Internal structure of all ports	2
6.	Timer/Counter, Modes of operation	2
7.	Interrupts	2
8.	Serial Interface, Single-step operation	3
9.	Addressing modes, Instruction set and programming, Boolean processing capability	5
10.	Hardware Interfacing, I/O expansion, Programming & Erasing EPROM	3
11.	Application of microcontroller for drive applications	4
12.	PIC controllers	5
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Intel Manual	--
2.	Ayala Kenneth J.," The 8051 Microcontroller- Architecture, Programming & Applications", 2nd Edition, Perram International Publishers (India).	1996
3.	Hall D.V., " Microprocessor and Interfacing –Programming and Hardware", Tata McGraw Hill, New Delhi.	2006
4.	Predko M., "Programming & Customizing the 8051 Microcontroller", Tata McGraw Hill, New Delhi	1999
5.	Gilmore, "Microprocessors – Principle and applications", Tata McGraw Hill, New Delhi.	1997
6.	Deshmukh A.V., "Microcontroller: Theory & Applications", Tata Mc Graw Hill, New Delhi.	2005
7.	Peatman J.B., "Design with PIC Microcontrollers", Pearson Education, New Delhi.	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-547** Course Title: **Instrumentation in Electric Drive**

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: 04 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Basic Course on Electric Drives** 8. Subject Area: **PG-13**

9. Objective:

The course is designed to impart knowledge of instrumentation related to electric drive parameters such as speed, torque, current, temperature etc. The signal conditioning circuits using linear/analog and digital integrated circuits are also included. The concept of data acquisition is emphasized and typical drive related instrumentation examples and problems are also incorporated.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Transducers & sensors: Definitions, Classification of errors, Characteristics and parameters	8
2.	Devices for Instrumentation: Amplifiers, Multipliers & dividers, Timers, Multiplexes	8
3.	Sample and Hold, Isolators, Signal converters, ADC & DAC	6
4.	Instrumentation & signal processing	5
5.	Drive related signals and their instrumentation and conditioning	8
6.	Data acquisition system: Basic structure, Data acquisition of drive related variables	7
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Cerni, R.H., Foster, L.E., "Instrumentation for Engineering Measurement", John Wiley & Sons, New York.	1966
2.	Coughlin, R.F., Driscoll, F.F., "Operational Amplifier & Linear Integrated Circuits", Prentice Hall, Gale.	2003
3.	Norton, N., "Handbook of Transducers", Prentice Hall, New Jersey.	2004
4.	Hamilton, "Handbook of Linear Integrated Electronics", McGraw Hill, New York.	1977

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-548** Course Title: **Drive System in Electric Traction**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Electric Machines**
Power Electronics

8. Subject Area: **PG-13**

9. Objective:

The objective is to educate on application of Electric Drives in Electric Trains, Trams, Electric Buses and to give knowledge on modern practice in application of AC and DC Drives in these services. The course is aimed at discussing different configurations of power electronic converters. Adequate analytical study of the drive system is also included to estimate the power rating of drive motors.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	General features of electric traction	6
2.	Mechanism of train movement	5
3.	Calculation of tractive effort	5
4.	Electrical motors for traction	5
5.	Power electronic converters in modern traction practice	12
6.	Diesel electric traction	5
7.	AC drives in Electric Traction	4
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Dubey G.K., "Fundamental of Electrical Drives" Narosa Publishing House, New Delhi.	2005
2.	Shepherd W., Halley L.N., Liang D.T.W., "Power Electronics and Motor Control", Cambridge Printing Press, UK.	1990
3.	Andrews H.I., "Railway Traction-The Principles of Mechanical and Electrical Railway Traction", Elsevier, Prentice Hall.	2004
4.	Bose B.K., "Power Electronics & Variable Frequency Drives -- Technology & Applications", IEEE Press, Standard Publisher Distributors, Delhi.	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-549** Course Title: **Control Techniques in Power Electronics For AC Drives**

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

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

4. Relative Weightage: **CWS** 1 5 **PRS** 1 5 **MTE** 3 0 **ETE** 4 0 **PRE** 0 0

5. Credits: 0 4 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics and Electric Drives** 8. Subject Area: **PG-14**

9. Objective:

The aim of the course is to discuss in depth the various control techniques such as Field Oriented Control, Direct torque control and Energy efficient control used in AC drives. The course also includes the use of advanced control techniques such as Fuzzy control and Neural Network control used in power electronics. The mathematical model of AC machines for different control techniques will also be discussed.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of Pulse Width Modulation Techniques for Voltage Source Inverters	3
2.	Matrix Converter, Advanced Current Controllers	5
3.	Control and Modeling of PWM Inverter-Fed Induction Motors, Vector Control, Direct and Indirect Field Oriented Control	6
4.	Control Techniques for PMSM Drives, Flux Weakening Control, Constant Power Loss Controller.	6
5.	Control and Modeling of Synchronous Reluctance Machines	5
6.	Direct Torque and Flux Control of AC Drives	5
7.	Neural Network and Fuzzy Logic Control in Power Electronics	6
8.	Control and Modeling of Three-phase PWM Rectifiers	6
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Dubey G.K., "Power Semiconductor Controlled Drives" Prentice Hall, New Jersey.	1989
2.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
3.	Kazmierkpwski Marian P., Krishnan R., Blaabjerg F., "Control in Power Electronics – Selected – Selected Problems", Academic Press, New York.	2002
4.	Krishnan R., "Electric Motor Drives – Modeling, Analysis & Control", Prentice Hall of India, New Delhi.	2001
5.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distributors, Delhi.	2001
6.	Vas Peter, "Electrical Machines & Drives – A Space Vector Theory Approach", Oxford Science Publications.	1992

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-550** Course Title: **Pulse Width Modulation for Power Converters**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics and Electric Drives.** 8. Subject Area: **PG-14**

9. Objective:

The objective of the course is to discuss in depth the various advanced PWM control techniques including Space Vector Modulation for 1-phase and 3-phase voltage source inverters, current source inverters and multi-level inverters.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of Voltage Source Inverters, Voltage Control (V/f, phase shift modulation)	3
2.	Harmonic Distortion: Voltage and Current Distortion Factors, Weighted THD	2
3.	Modulation Techniques for One-Inverter Phase Leg, Frequency ratios, Effect of Minimum Pulse Width, PWM Dead-Time Compensation	5
4.	Modulation Techniques of Single-Phase and Three-Phase VSI	6
5.	Space Vector Modulation Strategies	4
6.	Over-modulation of an Inverter.	3
7.	Programmed Modulation Strategies.	5
8.	Modulation of Multi-Level Converters	4
9.	Carrier Based and Space Vector PWM of MLI	6
10.	Implementation Techniques for a Modulation Controller	4
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
2.	Kazmierkpwski Marian P., Krishnan R., Blaabjerg F., "Control in Power Electronics – Selected – Selected Problems", Academic Press, New York.	2002
3.	Bose B.K., "Power Electronics & AC Drives", Prentice Hall, New Jersey.	2002
4.	Murphy J.M.D., Turnbull F.G., "Power Electronic Control of AC Motors", Pergaman Press, New York.	1988
5.	Holmes D.G., Lipo T.A., "Pulse Width Modulator For Power Converters – Principles and Practice", IEEE Press, John Wiley & Sons, Inc., USA.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-551** Course Title: **Topologies of Enhanced Power Quality AC/DC Converters**

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

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

4. Relative Weightage: **CWS** 1 5 **PRS** 1 5 **MTE** 3 0 **ETE** 4 0 **PRE** 0 0

5. Credits: 0 4 6. Semester , [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics** 8. Subject Area: **PG-14**

9. Objective:

The objective of the course is to discuss the harmonics generated by different conventional phase controlled converters and their input power factors. Various methods of improving the input performance of the converters will be dealt which includes multi-phase converter, high power factor converters and multi-level converters.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of 2-pulse and 6-pulse converters and their performance with inductive and capacitive loads.	3
2.	Harmonic analysis of phase controlled converters, IEEE standards.	5
3.	Conventional methods of power factor improvement techniques.	3
4.	Multi-pulse converters using delta/zigzag/Fork/Polygon transformers, Analysis and harmonic calculations.	5
5.	Passive filters: configurations and their design.	3
6.	Active Filters: Shunt, Series and Hybrid Active Filters, Topologies and their control strategies.	6
7.	High quality single-phase and three-phase converters: Control techniques, Buck, Boost control, Power flow control, Hysteresis and carrier wave control, Space vector control.	10
8.	Multi-level converters: Topologies and control techniques.	5
9.	Snubber circuits and their design.	2
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Rashid Muhammad H.," Power Electronics - Circuits, Devices, and Applications", 3rd Edition, Pearson Education, Delhi.	2004
2.	Dubey G.K., Doradla S.R., Joshi A., Sinha R.M.K., "Thyristorised Power Controllers" Wiley Eastern, Limited, New Delhi.	2005
3.	Lander Cyril W., "Power Electronics", Prentice Hall of India, New Delhi.	2004
4.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
5.	Paice Derek A., "Power Electronic Converter Harmonics – Multipulse methods for clean power:, IEEE press, New York.	1995
6.	Kazmierkpwski Marian P., Krishnan R., Blaabjerg F., "Control in Power Electronics – Selected Problems", Academic Press, New York.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-552** Course Title: **Switch Mode Power Supply**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics and Electric Drives.** 8. Subject Area: **PG-14**

9. Objective:

The objective of the course is to make familiar the students with the concept, control techniques, protection and design of different configurations SMPS. The concept of zero voltage switching and zero current switching to reduce switching losses will be discussed in detail.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Overview of Linear Voltage Regulators: Shunt and series regulators.	2
2.	Switching Concepts, Ideal switch, practical switch, switching functions.	4
3.	Switching Circuits, Harmonic concepts, Power Computations.	3
4.	Non-isolated Switch-mode dc-dc Converters: Buck, Boost, Buck-Boost converters.	6
5.	Isolated Switch-Mode dc-dc Converters.	8
6.	Soft switching dc-dc converters: Series and Parallel resonant circuits, ZCS and ZVS switching topologies.	10
7.	Simulation of Switching Converters.	4
8.	Switching Converter Design: Choke and transformer design, Driver circuits, Snubber circuits, EMI suppression, Input rectifiers with unity input power factor, Reliability, Case Studies.	5
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Rashid Muhammad H.," Power Electronics - Circuits, Devices, and Applications", 3rd Edition, Pearson Education, Delhi.	2004
2.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
3.	Whittington H.W., Aflynn B.W., Macpherson D.E., "Switch Mode Power Supplies – Design and Construction", John Wiley & Songs Inc., New York.	1997
4.	Hart Daniel W., "Introduction to Power Electronics", Prentice Hall, New York.	1996
5.	Ang Simon S., "Power Switching Converter", Marcel Dekker Inc., New York.	1995
6.	Luo Fang Lin, Ye Hong, "Advanced DC/DC Converters", CRC Press, New York.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-553** Course Title: **Power Quality Improvement Techniques**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00

5. Credits: 04 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics** 8. Subject Area: **PG-13**

9. Objective:

The aim of this course is to discuss the reasons of various load generated harmonics present in the supply and the methods to suppress or eliminate these harmonics using transformer connection and solid-state converters such as active power filter. Various configurations of active filter & their control will be discussed.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Concept of Power Quality: Frequency and voltage variations, Waveform distortion, Measures of harmonic distortions	3
2.	Causes of harmonics: Converter, AC regulator, Integral cycle control, Cycloconverter, Input current waveforms and their harmonic spectrum.	5
3.	Causes of Harmonics: Transformer, Rotating machines, ARC furnace, TV and Battery charger.	4
4.	Current and Voltage limits of Harmonic Distortions: IEEE, IEC, EN, NORSOK	2
5.	Effect of Harmonics on static power plant, Harmonic Interference	2
6.	Elimination/ suppression of harmonics, High power factor converter, Multi-pulse converters	4
7.	Passive filters, Filter design criteria	3
8.	Active filters: Compensation principle, Classification of active filters by Objective, System configuration, Control strategy.	2
9.	Review of Current controlled PWM Converter.	2
10.	Single-phase shunt active filter, Compensating principle and design	4

11.	Three-phase shunt active filter, Compensating principle and design, Instantaneous reactive power theory.	4
12.	Series active filter, Compensating principle and design	3
13.	Unified Power Quality Conditioner, Compensating principle and design	2
14.	Simulation of Active Power Filters	2
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Derek A Paice, "Power Electronic Converter Harmonics", IEEE Press, New York.	1989
2.	Arrillaga J., Smith B.C., Watson N.R., Wood A.R., " Power System Harmonic Analysis", John Wiley and Sons, New York	1997
3.	Arthur R.Bergen , Power System Analysis",Prentice-Hall, New York.	1986
4.	Arrillaga J., Braedlley D.A., Bodger P.S., "Power System Harmonis", John Wiley and Sons, New York.	1985
5.	Dugan R.C., McGranaghan M.F., Beaty H.W., Electrical Power System Quality", McGraw Hill, New York.	1996
6.	Sankaran C., "Power Quality", CRC Press, New York.	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-554** Course Title: **FACTS Devices**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics and Power Systems** 8. Subject Area: **PG-14**

9. Objective:

The aim of the course is to familiarize the students with the concept of FACTS, shunt and series compensators, Unified Power Flow Controller (UPFC), control techniques, application of FACTS in HVDC and enhancement of system dynamic and Transient stability.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	FACTS: Concept, Power flow and Stability, Basic Theory of Line Compensation	4
2.	Review of PWM Voltage Source Inverters, Classifications of FACTS controllers	4
3.	Static shunt compensators: SVC and STATCOM- TCR, TSC, System Stability.	6
4.	Static Series compensators: GCSC, TSSC, TCSC and SSSC, Control Techniques.	6
5.	Static voltage and phase angle regulators: Power flow control, TCVR and TCPAR.	4
6.	The Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC)	4
7.	Modeling of FACTS Devices	4
8.	Co-ordination of FACTS devices with HVDC links	3
9.	FACTS optimization, Transients and Dynamic Stability Enhancement	4
10.	Advanced FACTS devices, case studies and other applications of FACTS controllers.	3
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Miller T.J.E., "Reactive Power Control in Electric Systems," Wiley-Interscience.	1982
2.	Mathur R.M., "Static Compensators for Reactive Power Control," Cantext Publications, Winnipeg, Canada.	1984
3.	Song Y.H., Johns A.T., "Flexible AC Transmission Systems (FACTS)", IEE Press.	1999
4.	Hingorani N.G., Gyugyi L., "Understanding FACTS", IEEE Press, Delhi.	2001
5.	Ghosh A., Ledwich G., "Power Quality Enhancement Using Custom Power Devices," Kluwer Academic Publishers, London.	2002
6.	Mathur R.M., Varma R.K., "Thyristor – Based FACTS Controllers For Electrical Transmission Systems," John Wiley & Sons, New York.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-555** Course Title: **CAD of Power Apparatus**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Electrical Machines** 8. Subject Area: **PG-13**

9. Objective:

To familiarize the design procedure and performance evaluation of rotating machine and transformer with sinusoidal and non-sinusoidal supply system. It also includes utility of computer in designing the machine with analysis and synthesis methods for optimum design.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of design of Transformer and rotating machine	5
2.	Calculation of reactance parameters, losses, temperature rise and performance	3
3.	Application of Finite Element Method in thermal and field analysis of electrical machines	5
4.	Design consideration for rotating machines fed from non-sinusoidal supply	5
5.	Computer aided design, Philosophy and economics, Selection of input data and design variables, Flow chart for design of transformer and rotating machine	12
6.	Review of optimization techniques-objectives and constraint functions, constrained and unconstrained minimization	4
7.	Flow chart development for design optimization of power apparatus, converter fed drives and energy efficient machines	8
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Say M.G., "The Performance & Design of AC Machines", CBS Publishers & Distributors, New Delhi.	2002
2.	Veinott C.G., "Computer Aided Design of Electrical Machinery", MIT Press.	1987
3.	Sen S.K., "Principle of Electrical Machine Design with Computer Programs", Oxford & IBH Company Pvt. Ltd., New Delhi.	2001
4.	Ramamoorthy M., "Computer Aided Design of Electrical Equipment", East West Press, New Delhi.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-556** Course Title: **Selected Topics in Machines & Transformers**

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

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

4. Relative Weightage: **CWS** 1 5 **PRS** 1 5 **MTE** 3 0 **ETE** 4 0 **PRE** 0 0

5. Credits: 0 4 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Electrical Machines** 8. Subject Area: **PG-13**

9. Objective:

The objective of the course is to discuss behavior of induction machine under abnormal conditions and effect of space and time harmonics on the performance of machine The operation of multiwinding transformers, linear induction machine, angled field motors, axial field motors and stepper motors will also be covered in the course.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Multi winding transformers: Equivalent circuit, regulation, efficiency and parallel operation.	4
2.	Inrush current phenomenon in transformers: Causes, problems and methods of prevention	2
3.	Sequence impedances of two-winding and three-winding transformers, single-phase loading of three-phase transformer,	2
4.	Parallel operation of transformers with optimum losses	2
5.	Effect of space harmonics, crawling, cogging, voltage ripples and magnetic noise.	4
6.	High starting torque motors, Energy efficient motors	3
7.	Abnormal operation of induction motor operation on non-sinusoidal supply	5
8.	Two- phase induction motor, Servomotor, Tachogenerator	4
9.	Linear induction motors: principle, construction and application.	5
10.	Angled field motors, Motors using phase shift control, log motor	4
11.	Axial field motors, tubular and arc motors	3
12.	Permanent magnet motors, Stepper motors	4
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Vickers, "The Induction Motors: The Theory, Design and Application of Alternating Current Machines including Fractional hp Motors", Pitman, London.	1989
2.	Alger P.L., "Induction Machines – Their Behavior and Use", Routledge.	1995
3.	M.I.T. Staff, "Magnetic Circuit & Transformer"	1961
4.	Laithwate E.R., "Induction Machine for special purpose"	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-557** Course Title: **Synchronous Machines & System Stability**

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 5 6. Semester [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Electrical Machines** 8. Subject Area: **PG-13**

9. Objective:

This course aims at analyzing the system behavior under small and large disturbances. The effect of excitation and governing is studied for improved system performance. The course also introduces application of recent technique in power system control.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Mathematical modeling of synchronous machine & load, Operational impedances, machine impedances, time constants, torque expression	4
2.	Steady state and transient performance, Phasor diagrams, Power angle characteristics for one and multi machine systems	3
3.	Short circuit analysis, Symmetrical and asymmetrical short circuits, measurement of reactances and time constants	5
4.	Concept & types of stability, Transient stability, Direct and indirect method, critical fault clearing and CB reclosing times.	5
5.	Effect of exciter and governor, state modeling	3
6.	Steady state and dynamic stability, Perturbation equation, Parameter synthesis, Long distance power transmission, compensations, Sub-synchronous and Self excited oscillations	10
7.	DC systems terminal equipment, control characteristics, stabilization	6
5.	Application of modern techniques for power system control.	6
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Concordia, Charles, "Synchronous Machines – Theory and Performance", Wiley, New York.	1989
2.	Kimbark E.W., "Power System Stability: Synchronous Machines", Vol.3, Dover Publication.	1976
3.	Adkins B., Harley R.G., "The Generalized Theory of Alternating Current Machines"	1979
4.	Machowski J., Bialak J.W., Bumby J.R., "Power System Dynamics & Stability", John Wiley & Sons, New York.	1998

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE-558** Course Title: **Special Machines**

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** [√] **Spring** [ ] **Both**

7. Pre-requisite: **Power Electronics**
Electrical Machines

8. Subject Area: **PG-13**

9. Objective:

The objective of the course is to discuss the advancement in drives such as permanent magnet brushless motor drive, switched reluctance motor, linear induction motors and stepper motors.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Review of adjustable speed drives, permanent- magnet materials and circuits	8
2.	Principle, construction, operation of a) square- wave and sine wave P.M. brushless motor drives b) P.M. and synchronous reluctance based drives c) switched reluctance motors d) linear induction motors e) stepper motors	 10 5 5 5 2
3.	Energy efficient motors	7
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	Murphy J.M.D., Turnbull F.G., "Power Electronics Control of AC Motors", Pergamon Press, New York.	1988
2.	Miller T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", Oxford Clarender Press.	1982
3.	Bose B.K., "Power Electronics & Variable Frequency Drives – Technology & Applications", IEEE Press, Standard Publisher Distribution.	2001
4.	Nasar S.A., "Linear Induction Machine"	2002
5.	Andreas J.C., "Energy Efficient Electric Motors", Springer.	1982

Appendix 'L'
Item No. Senate/18.2.11

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE Signature.....
OFFICE OF DEAN OF FACULTY AFFAIRS

Report of the committee constituted vide O.M. No. F&A/MHRD/Assistantship/06 dated 7 November, 2006, to consider the award of MHRD assistantship to Final Year students of three year M.Tech. (Applied Geology/Geophysics).

The committee observed that final year students of the three year M.Tech. (Applied Geology/Applied Geophysics) programmes were getting scholarship of Rs.600/- p.m. for ten months in the University of Roorkee. It was stopped after University of Roorkee was converted into IIT Roorkee, with effect from 2004-05 as there was no provision in the IIT system.

Consequent upon the request of GATE qualified final year students of M.Tech. (Applied Geology/Applied Geophysics), a committee of the undersigned was constituted too look into the request for assistantship/scholarship recommended by the Department of Earth Sciences.

The committee observed that the students admitted to five year IDD programme of IIT, are eligible to get MHRD assistantship in the final year ~~i.e. fifth~~ i.e. four years after completing 10+2 course. Further, two year M.Sc. students are not eligible for assistantship.

In view of the above final year students of three year M.Tech. programmes may be considered at par with the final year students of five year IDD in respect of MHRD assistantship. The committee, therefore, recommends necessary procedural action for award of assistantship to the final year students of three year post B.Sc. M.Tech. students.

Dean, SRIC

Dean, UGS

Dean, PGS&R

Dean, Finance & Planning

Dean of Faculty Affairs

Appendix 'M'
Item No. Senate/18.2.13

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: **IPH-01** Course Title: **Quantum Devices**

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 ( ) Spring ( ) Both (Yes)

7. Pre-requisite: None 8. Subject Area: IE

9. **Objective of Course:** The course aims to familiarize students with the basic principles of quantum mechanics and to expose them to some applications.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	Basics of quantum mechanics, probability and the uncertainty principle.	3
	The Schroedinger wave equation, some potential well problems, tunneling.	5
	Particles in periodic potentials, energy bands, transport in quantum structures (perpendicular and parallel)	6
2.	Electronic quantum devices, Field effect transistor, hetrostructure field effect transistor, bipolar hetrostructure transistors.	6
	Resonant tunneling oscillators, diodes and transistors, multipeak current voltage characteristics and multivalued logic applications.	6
3.	Optical quantum devices, Optics of quantum structure, optical resonators.	3
	Interaction of light with matter, optical properties of bulk semiconductors, optical properties of quantum structures, intraband transitions.	5
	Light amplification in semiconductors, light emitting diodes, amplification feedback and laser oscillations, modulation of laser output, quantum well lasers, surface emitting lasers, blue quantum well lasers.	7
	Photoconductive detectors.	1

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	Quantum hetrostructures by V.V. Mitin, V.A. Kochelap and M.A. Stroscio	1999
2.	Physics of Semiconductor devices by S.M. Sze	1981
3.	Physics of Semiconductor Devices by D.K. Roy	1992
4.	Semiconductor Physics by J. Singh	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF THE DEPTT./CENTRE: PHYSICS DEPARTMENT

1. Subject Code: IPH- 02 Course Title: NANOMATERIALS
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 MTE 2 5 ETE 5 0
5. Credits: 0 4 6. Semester Autumn [ ] Spring [√] Both [ ]
7. Pre-requisite: None 8. Subject Area:
9. Objective of Course:

The course is to acquaint the students with the basic principles and concepts of nanosolid and surface science, and frontier progress. The course on Nanomaterials is designed to introduce advanced undergraduates to the emerging area of nanotechnology that has the potential to revolutionize techniques by which materials and products will be created in the future with new and superior properties and functionalities. The students will be able to get a good understanding of fundamental knowledge and analytical skills towards designing new functional nanomaterials and solid-state devices

10. Details of Course:

Sl. No.	Particulars	Contact Hours
1	**Introduction:** Definitions and course organization, Classification of functional nanomaterials, Historical development	2
2	**Fundamental Principles:** Size & Scale, Units, Scaling Laws, Atoms, Molecules & Clusters, Supramolecules, Nanoscale Phenomena: Tunneling, Chemical Bonds (types and strength), Intermolecular Forces, Molecular and Crystalline Structures, Hierarchical Structures and Functionality, Surfaces and Interfaces, Bulk to Surface transition, Self-Assembly and surface reconstruction	8
3	**Properties of NanoMaterials:** Size dependence of properties, Phenomena and Properties at Nanoscale, Mechanical / Frictional, Optical, Electrical Transport, Magnetic properties	9
4	**Nanomaterial characterization:** Electron Microscopy, Scanning Probe Microscopes, Near field microscopy, Micro- and near field Raman spectroscopy, Surface-enhanced Raman spectroscopy, X-ray photoelectron spectroscopy	10
5	**Synthesis of Nanomaterials:** Fabrication techniques: Self-Assembly, Self-Replication, Sol-Gels, Langmuir-Blodgett thin films, Nanolithography, Bio-inspired syntheses, Microfluidic processes, Chemical Vapor Deposition, Semiconductors Cadmium Sulfide, silicon, Fullerenes / Carbon nanotubes, Nano-composites, Nanoporous Materials, Biological Materials	10
6	**Applications of Nanomaterials:** Nanoelectronics, Nanosensors, Environmental, Biological, Energy storage and fuel cells	3

11. Suggested Books:

S. No	Name of Book/Authors	Year of Publication
1	*Nanomaterials- Synthesis, Properties and Applications*, Edited by A.S. Edelstein and R.C. Cammarata, **Institute of Physics Publishing, London**	1998
2	*Handbook of Nanostructured Materials and Nanotechnology*, Edited by H.S. Nalwa Vols. 1-5, **Academic Press, San Diego**	2000
3	*Nanostructured Carbon for Advanced Applications*, edited by G. Benedek, P. Milani, and V. G. Ralchenko, Vol. 24 of NATO Science Series II: Mathematics, Physics and Chemistry **(Kluwer Academic Publishers, Dordrecht)**	2001
4	*Science of Fullerenes and Nanotubes*, by M.S. Dresselhaus, G. Dresselhaus and P. Eklund, **Academic Press ISBN 0-12-221820-5**	1996

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: PH-03 Course Title: **Fibre Optics**

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 ____ Spring ____ YES Both

7. Pre-requisite: PH-101 or any basic course on electromagnetism. 8. Subject Area: IE

9. **Objective of Course:** The course provides an understanding of the physical principles of optical fibers and the engineering aspects of their use in optical telecommunication systems and sensor technology.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Basic characteristics of the optical fiber:** Light guidance, numerical aperture, Coherent bundle, attenuation, Pulse dispersion, loss mechanisms.	02
2.	**Pulse Dispersion in optical waveguides:** Ray paths, transit time calculations, parabolic index medium, step-index planar waveguide, power law profile, pulse dispersion in graded index optical fibers, material dispersion, group velocity, pulse broadening.	04
3.	**Electromagnetic analysis of plannar waveguides and optical fibers:** Review of maxwell's equations and the wave equation in a dielectric. TE and TM guided modes of a plannar waveguide, power associated with a mode, radiation modes, modal analysis of a step-index fiber, fractional modal power in the core, Gaussian approximation, splice loss Petrermann-2 spot size the far- field pattern.	12
4.	**Sources and detectors for optical fiber communication:** Laser diode characteristics, LED characteristics, PIN photodetector, avalanche photodiode.	04
5.	**Design considerations for a fiber optic communication system:** Group delay and waveguide dispersion, empirical formula for step-index fibers, dispersion-shifted fibers, single-mode operation, splice loss, bending loss, analog and digital modulation, signal to noise ratio, bit error rate, power budgeting, rise time budgeting, attenuation limited system, dispersion limited system.	07
6.	**Fiber-optic components and sensors:** Optical fiber amplifier, dispersion compensating fiber, optical fiber directional coupler, polarization controller, fiber Bragg gratings, long period fiber gratings, fiber optic interferometric sensors, current sensors, gyroscope, pH-sensor, gas sensors, temperature, strain and pressure sensors, liquid lever sensor, displacement sensor, civil structure monitoring, smart structure.	10
7.	**Fiber fabrication:** Fabrication techniques, outside vapour-phase oxidation, vapour-phase axial deposition, modified chemical vapour depositions, plasma-activated chemical vapour deposition, double-crucible method, mechanical properties of fibers, fiber-optic cables..	03

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	Optical Fiber Communications by G. Keiser, McGraw Hill, New York.	2000
2.	Introduction to Fiber Optics by A. Ghatak and K. Thyagarajan, Cambridge University Press.	1998
3.	Fiber-optic Communication Systems by G. P. Agrawal, John Wiley Singapore.	2002
4.	Science of Fullerenes and nanotubes by M.S. Dresselhaus, G. Dresselhaus and P. Eklund, Academic Press	1991
5.	Optical fiber sensors by J. Dakin and B. Culshaw	1997

COMMENTS ON PH-03 FIBRE OPTICS

1. This course content does not require any knowledge of transmission line. The electromagnetic theory studied by all students in PH-101 course is sufficient, which we have added in S. No. 3 of the modified syllabus. In view of this, we have also changed Pre-requisite to 'PH-101' or any basic course on electromagnetism

2. The course in the present form is useful not only for Electrical and electric branch but also for the students of civil and chemical engineering.

In particular please note the following:-

a) Course contents of S. No. 4 & 5 are useful for Electronics & Communications Engineering students.

b) Course contents of S. No. 6 are useful for Electrical Engineering and Civil Engineering students.

25.8.06

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE : PHYSICS DEPARTMENT

1. Subject Code: IPH-4 Course Title: **Space Science and Technology**

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 ( ) Spring ( ) Both (YES)

7. Pre-requisite: None 8. Subject Area: IE

9. **Objective of Course:** The course aims to familiarize students with the basics of space science and technology and it's applications.

10. Details of Course:

S.No.	Particulars	Contact Hours
1.	**Earth and orbiting satellites:** Basic principles, Keplerian orbits and Kepler equations, orbital elements, from velocity and position information, Perturbation theory and applications, Data receiving and handling.	08
2.	**Rockets and Rocket Propulsion:** Rockets and rocket propulsion, liquid fuels, solid fuels, Electromagnetic propulsion, Ion propulsion, Important satellite launching stations, Facilities at ISRO, NASA and ESRO Russian and Chinese facilities.	08
3.	**Global Positioning Systems:** Global navigation satellite systems, Historical background, GPS signal structure, Application of GPS systems.	06
4.	**Satellite Communications:** Earth to satellite communication, Laser communication, Satellite to satellite communication.	06
5.	**Some Important Applications of Space Technology:** Physics of the earth's space, Solar observations in infrared, visible and X-rays, Communication satellite and applications, Earth resource monitoring, Remote sensing and others, Hubble space telescope, Military applications, Weather satellite and applications.	10
6.	**Manned Flights:** Manned flights to moon, Manned orbiting space crafts, NASA Space shuttles, Immunology and infection in space, The ISS and application, Russian space crafts, Skylab.	04

11. Suggested Books:

S.No.	Names of Books/Authors	Year of Publication
1.	Space Science and Technology by Hans Mark, John Wiley and Sons	2003
2.	The Cambridge enclyopedia of Space, missions, applications and exploration by Verger et at, Cambridge University Press	2003
3.	Space environment and it's interaction with spacecraft by C. Uberoi and S.C. Chakravorty, IISc – ISRO Educational Program	2000
4.	Encyclopedia of Space Science and Technology by Mark, Hans, Silveira, Milton. Yarymovych Michael I, Hoboken, Wiley-Interscience	2003
5.	Satellite operations, systems approach to design and control by Garner, John T., Gones, Macolam, New York, Ellis Horwood	1990
6.	Theory of Satellite geodesy applications of satellite geodesy by Kaula, William M, Mineola Dover Publications	2000
7.	Introduction to GPS the global positioning system by El-Rabbany, Ahmed, London: Artech house	2002
8.	Understanding GPS: principles and applications by Kaplan, Elliott D., Boston: Artech House	1996
9.	GPS: Theory, algorithms and applications by Xu, Guochang, Berlin: Springer	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE : **Electrical Engineering Department**

1. Subject Code: **EE - 426** Course Title: **Digital Control Systems**
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 [0] MTE [25] ETE [50] PRE [0]
5. Credits: [0 | 4] 6. Semester [ ] Autumn [ ] Spring [Both] Both
7. Pre-requisite : Knowledge of control System and Microprocessors
8. Subject area : **Control System**
9. **Objective of Course:** Apart from the analog control systems, discrete-time or digital control schemes are increasingly being used for industrial control schemes. This course is aimed to make the students conversant with the techniques of discrete-time control system.

10. Details of the course:

S. No.	Particulars	Contact Hours
1.	Review of z-transform and stability analysis	[6]
2.	z-transform design of digital control systems	[6]
3.	State-space analysis of sampled data systems	[6]
4.	Design of digital control using state-space techniques	[6]
5.	System identification techniques	[6]
6.	Model reference and self tuning control	[8]
7.	Application and block diagram	[4]

11. Suggested Books:

S. No.	Name of Books/ Authors	Year of Publication
1.	J. R. Leigh, "Applied digital control – theory, design and implementation", Prentice-Hall international, 1985, 2nd edition.	1993
2.	G. F. Franklin, J. D. Powell and M. L. Workman, "Digital control of dynamic systems", Addison Wesley, 3rd edition.	1997
3.	Rolf Iserman, "Digital Control System", Springer-Verlag, 2nd edition.	1996
4.	V. Strjec, "State-space theory of discrete linear control", John Wiley and sons, first edition	1981
5.	M. Gopal, "Digital control and state variable methods", Tata-McGraw Hill, First edition.	1997
6.	B. C. Kuo, "Digital Control Systems", CBS publishing, Japan	2006
7.	M. Gopal, "Digital Control Engineering", Wiley Eastern Limited, First edition	1988

Appendix-3

The following are the

(i) Postgraduate courses which are being added in the undergraduate programme:

B.Tech. (CSE)
Department Elective IV.5 EC-523 Advanced Computer Networks
B.Tech. (E&C)
Department Elective IV.4 EC-612 Wireless Networks
Department Elective V.5 EC-641 RF/Microwave Design for Wireless Applications
Department Elective V.6 EC-557 Digital VLSI Circuit Design
Department Elective V.7 EC-518 Speech and Image Processing
Department Elective V.8 EC-614 Adaptive Signal Processing Techniques
IDD (CSE/IT)
Department Elective IV.5 EC-523 Advanced Computer Networks
IDDCSE/IT) *Programme Electives*
EC-524 Advanced Computer Architecture
IDD B.Tech.(E&C/Wireless Communication)
Department Elective IV.4 EC-557 Digital VLSI Circuit Design

(ii) Postgraduate courses which are replacing the corresponding undergraduate courses with the same title:

B.Tech. (CSE)
Department Elective IV.2 EC-623 Management Information Systems **(U.G. EC-424)**
Department Elective IV.3 EC-621 Mobile Computing **(U.G. EC-428)**
B.Tech. (E&C)
Department Elective IV.1 EC-533 Digital Control Systems **(U.G. EC-432)**
Department Elective IV.2 EC-546 Radar Systems **(U.G. EC-442)**
Department Elective V.2 EC-534 Fuzzy Control **(U.G. EC-434)**
Department Elective V.3 EC-548 Wireless Communication Links & Antennas **(U.G. EC-444)**

Serial No.040033

Modified Format

भारतीय प्रौद्योगिकी संस्थान रुड़की

अभिषद् की अनुशंसा पर

सिविल इंजीनियरी में प्रौद्योगिकी स्नातक

की उपाधि

ऐश्वर्य प्रताप सिंह

को, जिन्होंने इस उपाधि की अवाप्ति हेतु विनियम विहित अपेक्षाओं को सन् 2004 में सफलतापूर्वक पूरा कर लिया है, एतद्द्वारा प्रदान करता है।

10 अंकीय मापक्रम में इनका संचित कोटि अंक माध्य **6.73** है।

भारतीय गणराज्य के अन्तर्गत रुड़की में आज, दिनांक 29 सितम्बर 2004, संस्थान की मुद्रा अंकित यह उपाधि दी गई।

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

On the recommendation of the Senate hereby confers the degree of

Bachelor of Technology in Civil Engineering

upon

AISHWARYA PRATAP SINGH

who has successfully completed in the year 2004 the requirements prescribed under the regulations for the award of this degree with a Cumulative Grade Point Average of 6.73 on a 10 point scale.

Given this day, the 29th of September 2004, under the seal of the Institute at Roorkee in the Republic of India.

अध्यक्ष, अभिशासक परिषद्
Chairman, Board of Governors

निदेशक एवं अध्यक्ष, अभिषद्
Director & Chairman, Senate

कुलसचिव
Registrar

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Appendix 'P'
Item No. Senate/18.2.21

Minutes of the Award Committee Meeting held on 23.1.2007 at 3.30 PM for awarding of Scholarships/ Prizes

The following were present:

Prof. G.S.Srivastava, Dean, UGS
Prof Surender Kumaar, Dean Planning & Finance
Prof. V.K.Gupta, Dean of Students Welfare

The committee considered the request of Prof. M.N.Saxena, Prof. & Head(Retd) Met. Engg. Deptt. University of Roorkee,now residing at C-12-B Mahanagar, Lucknow. The Committee resolved as follows.

1. The committees expressed its gratitude to Prof. M.N.Saxena for considering IIT. Roorkee for instituting of this scholarship to be awarded to the best student of B.Tech. IV Yr. class of the Metallurgical & Material Engineering Deptt.

2. As Scholarship is given from the interest accrued on the Endowment fund donated by the individual, therefore it is not possible to institute the scholarship w.e.f. Annual Convocation 2007, because the endowment is proposed to be given in two installments. However if the endowment is made in a single installment, the institute will be in a position to grant and give the scholarship w.e.f. Annual Convocation of 2007.

3. The committee feels that most of the Scholarships are of the order of Rs.10, 000.00 per year. Therefore it is suggested that Dean, UGS may request to Prof. M.N.Saxena to take into consideration this aspect also while instituting the prize. It may also be made known to Prof. Saxena about the institute policy that any student can receive only one scholarship.

The meeting ended with thanks to the chair.

(Prof. V.K.Gupta) (Prof. Surendra Kumar) 23.1.07 (Prof. G.S.Srivasatava) 23/1/07

Course Structure for IDD 1st Year
B.Tech. (Elect. Engg.) and M.Tech. (Power Electronics)

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

Course Structure for IDD 2nd Year
B.Tech. (Elect. Engg.) and M.Tech. (Power Electronics)

Teaching Scheme					Contact Hours/Week			Exam Duration		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	-	15	-	35	50	-
2.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4.	MT-201A	Material Science	ESC	4	3	1	0	3	-	25	-	25	50	-
5.	EE-201	Network Theory	DCC	4	3	1	0	3	-	25	-	25	50	-
6.	EE-203	Electrical Measurements and Measuring Instruments	DCC	4	3	0	2	3	2	15	15	15	40	15
7.		Institute Elective-I (Basic Science)	BGSEC	3	2	1	0	2	-	25	-	25	50	-
		Total		23	17	4	4							
Semester-IV (Spring)														
1.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2.	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	-	15	-	35	50	-
3.	EE-202	Electrical Machines –I	DCC	5	3	1	2	3	3	15	15	15	40	15
4.	EE-204	Electro Magnetic Field Theory	DCC	3	2	1	0	2	-	25	-	25	50	-
5.	EE-206	Power Electronics	DCC	4	3	1	2/2	3	2	15	15	15	40	15
6.	EE-208	Digital Electronic Circuits and Systems	DCC	4	3	1	2/2	3	3	15	15	15	40	15
7.		Institute Elective-II (Basic Science)	BGSEC	3	2	1	0	2	-	25	-	25	50	-
		Total		24	17	6	4							

Course Structure for IDD 3rd Year

B.Tech. (Elect. Engg.) and M.Tech. (Power Electronics)

Teaching Scheme					Contact Hours/Week			Exam Duration		Relative Weightage (%)				
S. No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Semester- V (Autumn)														
1.	EE-301	Power System Engineering	DCC	4	3	1	2/2	3		15	15	30	40	-
2.	EE-303	Electrical Machines-II	DCC	5	3	1	2	3	3	15	15	15	40	15
3.	EE-305	System Engineering	DCC	3	2	1	0	2	-	25	-	25	50	-
4.	EE-307	Microprocessors	DCC	5	3	1	2	3	3	15	15	15	40	15
5.	EE-309	Applied Instrumentation	DCC	3	2	1	2/2	2	-	15	15	30	40	-
6.		Institute Elective-III (Engineering Science)	ESEC	4	3	1	0	3	-	25	-	25	50	-
		Total		24	16	6	6							
Semester-VI (Spring)														
1.	EE-302	Power System Analysis & Control	DCC	3	2	1	0	2	-	25	-	25	50	-
2.	EE-306	Control Systems	DCC	5	3	1	2	3	3	15	15	15	40	15
3.	EE-308	Electronic Instrumentation	DCC	3	2	1	2/2	2	-	15	15	30	40	-
4.	EE-567	HVDC Systems	MSC	4	3	1	0	3	-	25	-	25	50	-
5.	EE-310	Communication Skills	DCC	2	0	0	2	-	-	100	-	-	-	-
6.		Institute Elective-IV (Engineering Science)	ESEC	4	3	1	0	3	-	25	-	25	50	-
		Total		21	13	5	5							

Course Structure for IDD 4th Year

B.Tech. (Elect. Engg.) and M.Tech. (Power Electronics)

Teaching Scheme					Contact Hours/Week			Exam Duration		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.	EE-401	Power System Protection	DCC	4	3	0	2	3	3	15	15	15	40	15
2.	EE-540	Advanced Power Electronics	MSC	5	3	1	2	3	-	15	15	30	40	-
3.	EE-541	Electric Drives-I	MSC	4	3	1	2/2	3	-	15	15	30	40	
4.		Departmental Elective-I	DEC	4	3	1	0	3	-	25	-	25	50	-
5.	EE-405	Field Training	DCC	2	0	0	2	-	-	100	-	-	-	-
6.		Institute Elective-V (Social Science)	HSSMEC	3	2	1	0	2	-	25	-	25	50	-
		Total		22	14	4	5							
Semester-VIII (Spring)														
1.	EE-554	FACTS Devices	MSC	4	3	1	0	3	-	25	-	25	50	-
2.	EE-543	Electric Drives-II	MSC	4	3	1	0	3	-	25	-	25	50	-
3.	EE-503	Modeling, Simulation & Evolutionary Techniques	MSC	4	3	0	2	3	-	15	15	30	40	-
4.		Departmental Elective-II	DEC	4	3	1	0	3	-	25	-	25	50	-
5.		Departmental Elective-III	DEC	4	3	1	0	3	-	25	-	25	50	-
		Total		20	15	4	2							

Course Structure for IDD 5th Year

B.Tech. (Elect. Engg.) and M.Tech. (Power Electronics)

Teaching Scheme					Contact Hours/Week			Exam Duration		Relative Weightage (%)				
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Semester- IX (Autumn)														
1.		Seminar	DCC	2	-	-	-	-	-	-	-	-	-	-
2.		Research Project	RP	4										
3.		Dissertation (to be continued next semester but evaluated in this semester also)	DCC	-	-	-	-	-	-	-	-	-	-	-
		Total		6										
Semester-X (Spring)														
1.		Dissertation (contd. From IX semester)	DCC	24	-	-	-	-	-	-	-	-	-	-
		Total		24	8	3	8							

Proposed credits for B.Tech. Programme

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

Proposed Credits and Curricular Structure of the 5 year Integrated Dual Degree (IDD) (B.Tech. & M.Tech.) Programmes

Curricular Components	Credits
(a) Institute core (IC) Courses	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	21
III. General Sciences (GSC)	06
IV. Engineering Sciences (ESC)	28
Total	**65**
(b) Department Core Courses (DCC)	
I. Class Contact-Core Courses including Modeling and Simulation	62-65
II. Communication Skills	02
III. Field Training	02
Total	**66-69**
(c) Departmental Elective/Courses (DEC)	**12**
(d) Institute Elective Courses (IEC)	**15-18**
(e) M.Tech. Specialization Courses (MSC)	**18-21**
(f) Research Project (RP)	**04**
(g) Seminar	**02**
(h) Dissertation	**20-24**
(i) Extra-Curricular Activities (ECA)	**06**
I. Discipline (2 Credits/year for 3 years)	
II. NCC/NSS/NSO (First year)	**02**
III. NSO/Proficiency (Second year to fourth years)	**03**
Total	**11**
Grand Total	**213-219**

INSTITUTE CORE COURSES FOR B.TECH. & IDD PROGRAMMES

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

Proposed Credits and Curricular Structure of the 5 year Integrated Dual Degree (IDD) (B.Tech. + M.B.A.) Programme

Curricular Components	Credits
(a) Institute core (IC) Courses	
I. Humanities, Social Sciences and Management (HSSMC)	10
II. Basic Sciences (BSC)	21
III. General Sciences (GSC)	06
V. Engineering Sciences (ESC)	28
Total	**65**
(b) Department Core Courses (DCC)	
I. Class Contact-Core Courses	60-63
II. Modeling, Simulation and Computer Application	03
III. Communication Skills	02
IV. Major Project	04
IV. Project Field Training	02
Total	**71-74**
(c) Departmental Electives (DC)	**6-9**
(d) Management Core Courses (MCC) (including projects and presentation)	**26-29**
(e) Management Elective Courses (MEC) in specialization groups	**12-15**
(f) Institute Elective Courses (IEC)	**24-30**
(g) Extra-Curricular Activities (ECA)	
I. Discipline (2 Credits/year for 3 years)	06
II. NCC/NSS/NSO (First year)	02
III. NSO/Proficiency (Second year to fourth years)	03
Total	**11**
Grand Total	**215-225**

Credits and Curricular Components of Institute Elective for B.Tech., B.Arch., IDD (B.Tech. +M.Tech) and IDD (B.Tech.+MBA) Programme

Curricular Components	Credits		
	B.Tech./B.Arch.	B.Tech.+M.Tech.	B.Tech.+MBA
(i) Humanities, Social Sciences and Management (HSSMEC)	6	3-6	9-12
(ii) Basic and General Sciences (BGSEC)	6	6-9	6-9
(iii) Engineering Sciences (ESEC)	8-12	6-9	6-9
Total	**20-24**	**18-21**	**24-30**

Course Structure for B.Tech. and IDD First Year

Structure-A

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

Course Structure for B.Tech. and IDD Second Year

Structure-A

Teaching Scheme					Contact Hours/Week			Exam Duration		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	-	15	-	35	50	-
2.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4.	MT-201A	Material Science	ESC	4	3	1	0	3	-	25	-	25	50	-
	MI-201	Solid Mechanics		4	3	1	0	3	-	25	-	25	50	-
		Total		12	9	2	2							
Semester-IV (Spring)														
1.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2.	ES-201	Introduction to Geo-Science	GSC	2	2	0	0	2	-	15	-	35	50	-
	CH-201	Energy Resources and Conservation		2	2	0	0	2	-	15	-	35	50	-
		Total		5	4	1	0							

Course Structure for B.Tech. and IDD First Year

Structure-B

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

Course Structure for B.Tech. and IDD Second Year

Structure-B

Teaching Scheme					Contact Hours/Week			Exam Duration		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	-	15	-	35	50	-
2.	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3.	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4.	MT-201A	Material Science	ESC	4	3	1	0	3	-	25	-	25	50	-
	MI-201	Solid Mechanics		4	3	1	0	3	-	25	-	25	50	-
		Total		12	9	2	2							
Semester-IV (Spring)														
1.	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2.	ES-201	Introduction to Geo-Science	GSC	2	2	0	0	2	-	15	-	35	50	-
	CH-201	Energy Resources and Conservation		2	2	0	0	2	-	15	-	35	50	-
		Total		5	4	1	0							

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT / CENTRE: Department of Paper Technology

1. Subject Code: **PP-241** Course Title: **Introduction to Polymer Materials & Technology**

2. Contact Hours L; **02** T; **01** P; **03**

3. Examination Duration (Hrs): Theory [02] Practical [03]

4. Relative Weightage: CWS [15] PRS [15] MTE [15] ETE [40] PRE [15]

5. Credits: [03] 6. Semester: [√] Autumn [ ] Spring [ ] Both

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

9. Objective of Course:

The course is intended to provide a general understanding about Polymer Materials & technology.

10. Details of Course:

S. No.	Particulars	Contact Hours
1.	Amorphous polymer: Glass transition, flexible polymers, copolymers, rigid rod polymers and rubbers	3
2.	Crystalline polymers : crystallization of polymers, semi-crystalline polymers	2
3.	Polymer degradation : stability and dehydration of polymers, various modes of degradation	2
4.	Properties of Polymers : Mechanical, Optical, surface, electrical and others	5
5.	Materials :Thermoplastics, thermosets and elastomers,	4
5.	Polymer processing : Principles and related equipments	3
6.	Plastic products and introduction to their processing	3
7.	Polymeric materials : blends, composites, fibers, rubbers, liquid crystalline polymers, conducting & electronic polymers	6
		Total = 28 hours

11. Suggested Books

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Cowie J.M.G., "Polymers; Chemistry and Physics of Modern Materials", Blackie & Sons, UK	2001
2.	Elias, H.G, "An Introduction to Polymer Science", Wiley	1997

List of Practicals : (Each of 3 hour duration)

1. Determination of melt flow index
2. Identification of polymers
3. Determination of molecular weight
4. Synthesis of polymers.
5. Chemical analysis of polymers.
6. Determination of carbon black content
7. End group analysis of plastic.
8. Determination of heat deflection temperature of plastic.
9. Study of a single screw extruder
10. Study of injecton molding machine.
11. Determination of Burst strength

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT / CENTRE: Department of Paper Technology

1. Subject Code: **PP- 242** Course Title: **Polymer Chemistry**

2. Contact Hours L; **02** T; **01** P; **00**

3. Examination Duration (Hrs): Theory [02] Practical [00]

4. Relative Weightage: CWS [30] PRS [ ] MTE [30] ETE [40] PRE [ ]

5. Credits: [03] 6. Semester: [ ] Autumn [√] Spring [ ] Both

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

9. Objective of Course:

The course is intended to provide an introductory basic concept of Polymer Chemistry. General understanding of the polymer chemistry will enhance their aptitude for interdisciplinary nature of the subject.

10. Details of Course:

S. No.	Particulars	Contact Hours
1.	Introduction : basic concept, definition, classification, nomenclature	3
2.	Average molar mass and distributions, size and shape, elastomers, fibers and plastics	3
3.	Step growth polymerization	3
4.	Free radical addition polymerization, emulsion polymerization	3
5.	Ring opening polymerization, Ionic polymerization	3
6.	Copolymerization	3
7.	Polymer stereochemistry, Reaction of polymers	3
8.	Polymeization reactions initiated by metal catalysts and transfer reactions	4
9.	Polymer liquid crystals	3
		Total = 28 hours

11. Suggested Books:

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Seymour, R.B., "Introduction to Polymer Chemistry", McGraw Hill, New York.	2000
2.	Billmeyer, F.W., "Text Book of Polymer Science", Wiley	2002
3.	Seymore, R.B. and Carraher, C.E., "Polymer Chemistry : An Introduction", Marcel Dekker, New York	2000
4.	Odian, G., "Principles of Polymerization", Wiley	2000

PROPOSED SCHEME OF TEACHING AND EXAMINATION FOR

IDD B. TECH. (Process Engineering) and MBA FIRST YEAR

Structure-A

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 I (Autumn)														
1	MA-101	Mathematics-I	BSC	4	3	1	0	3	-	25	-	25	50	-
2	PH-101	Physics-I	BSC	5	3	1	2	3	3	15	15	15	40	15
3	EE-101	Electrical Science	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4	EC-101A	Computer Systems and Programming	ESC	4	3	0	2	3	-	15	15	30	40	-
	EC-101B	Fundamentals of Object Oriented programming		4	3	0	2	3	-	15	15	30	40	-
5	MI-102	Manufacturing Techniques	ESC	3	2	0	2	2	-	15	15	30	40	-
6	BT-101	Fundamentals of Biotechnology	GSC	2	2	0	0	2	-	15	-	35	50	-
7	HS-101	Technical Communication	HSSMC	2	1	0	2	2	-	25	-	25	50	-
		Total		24										
Semester II (Spring)														
1	MA-102	Mathematics-II	BSC	4	3	1	0	3	-	25	-	25	50	-
2	CY-101	Chemistry	BSC	5	3	1	2	3	3	15	15	15	40	15
3	EC-102	Fundamentals of Electronics	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4	CE-101	Engineering Graphics	ESC	4	2	0	4	3	-	-	25	25	50	-
5	MI-101	Thermodynamics	ESC	3	2	1	0	2	-	25	-	25	50	-
6	CE-102	Environmental Studies	GSC	2	2	0	0	2	-	15	-	35	50	-
7	HS-102	Behavioral Science	HSSMC	2	2	0	0	2	-	15	-	35	50	-
		Total		24										

IDD B. TECH. (Process Engineering) and MBA FIRST YEAR

Structure-B

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 I (Autumn)														
1	MA-101	Mathematics-I	BSC	4	3	1	0	3	-	25	-	25	50	-
2	CY-101	Chemistry	BSC	5	3	1	2	3	3	15	15	15	40	15
3	EC-102	Fundamentals of Electronics	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4	CE-101	Engineering Graphics	ESC	4	2	0	4	3	-	-	25	25	50	-
5	MI-101	Thermodynamics	ESC	3	2	1	0	2	-	25	-	25	50	-
6	CE-102	Environmental Studies	GSC	2	2	0	0	2	-	15	-	35	50	-
7	HS-102	Behavioral Science	HSSMC	2	2	0	0	2	-	15	-	35	50	-
		Total		24										
Semester II (Spring)														
1	MA-102	Mathematics-II	BSC	4	3	1	0	3	-	25	-	25	50	-
2	PH-101	Physics-I	BSC	5	3	1	2	3	3	15	15	15	40	15
3	EE-101	Electrical Science	ESC	4	3	1	2/2	3	-	15	15	30	40	-
4	EC-101A	Computer Systems and Programming	ESC	4	3	0	2	3	-	15	15	30	40	-
	EC-101B	Fundamentals of Object Oriented programming		4	3	0	2	3	-	15	15	30	40	-
5	MI-102	Manufacturing Techniques	ESC	3	2	0	2	2	-	15	15	30	40	-
6	BT-101	Fundamentals of Biotechnology	GSC	2	2	0	0	2	-	15	-	35	50	-
7	HS-101	Technical Communication	HSSMC	2	1	0	2	2	-	25	-	25	50	-
		Total		24										

IDD B. TECH. (Process Engineering) and MBA SECOND YEAR
Structure A

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	-	15	-	35	50	-
2	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4	MT-201	Material Science	ESC	4	3	1	0	3	-	25	-	25	50	-
5	PP-211	Material and Energy Balance	DCC	4	3	0	2	3	-	-	25	25	50	-
6	PP-213	Fluid Mechanics	DCC	4	3	1	2/2	3	3	15	15	15	40	15
7		Institute Elective-I	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		24										
Semester IV (Spring)														
1	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	-	15	-	35	50	-
3	PP-212	Fluid Particle Mechanics	DCC	4	3	1	2/2	3	3	15	15	15	40	15
4	PP-214	Heat Transfer	DCC	4	3	1	2/2	3	3	15	15	15	40	15
5	PP-216	Chemical Engg. Thermodynamics	DCC	3	2	1	0	2	-	25	-	25	50	-
6	PP-218	Process Technology	DCC	3	3	0	0	3	-	15	-	35	50	-
7		Institute Elective-II	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		23										

IDD B. TECH. (Process Engineering) and MBA SECOND YEAR
Structure B

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	-	15	-	35	50	-
2	CE-201	Computer Aided Graphics	ESC	2	1	0	2	2	-	-	25	25	50	-
3	BM-201	Management Concepts and Practices	HSSMC	3	2	1	0	2	-	25	-	25	50	-
4	MT-201	Material Science	ESC	4	3	1	0	3	-	25	-	25	50	-
5	PP-211	Material and Energy Balance	DCC	4	3	0	2	3	-	-	25	25	50	-
6	PP-213	Fluid Mechanics	DCC	4	3	1	2/2	3	3	15	15	15	40	15
7		Institute Elective-I	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		24										
Semester IV (Spring)														
1	HS-201	Economics	HSSMC	3	2	1	0	2	-	25	-	25	50	-
2	CH-201	Energy Resources and Conservation	GSC	2	2	0	0	2	-	15	-	35	50	-
3	PP-212	Fluid Particle Mechanics	DCC	4	3	1	2/2	3	3	15	15	15	40	15
4	PP-214	Heat Transfer	DCC	4	3	1	2/2	3	3	15	15	15	40	15
5	PP-216	Chemical Engg. Thermodynamics	DCC	3	2	1	0	2	-	25	-	25	50	-
6	PP-218	Process Technology	DCC	3	3	0	0	3	-	15	-	35	50	-
7		Institute Elective-II	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		23										

IDD B. TECH. (Process Engineering) and MBA THIRD YEAR

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)														
1	PP-311	Mass Transfer	DCC	4	3	1	2/2	3	3	15	15	15	40	15
2	PP-313	Chemical Reaction Engineering	DCC	4	3	1	0	3	-	25	-	25	50	-
3	PP-315	Process Optimization	DCC	3	2	1	0	2	-	25	-	25	50	-
4	PP-317	Bioprocess Technology	DCC	3	3	0	0	3	-	15	-	35	50	-
5	PP-319	Managerial Economics	MCC	3	3	0	0	3	-	15	-	35	50	-
6		Institute Elective III	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		**21**										
Semester VI (Spring)														
1	PP-312	Modeling and Simulation	DCC	3	2	1	0	2	-	25	-	25	50	-
2	PP-314	Operations Research	DCC	3	2	1	0	2	-	25	-	25	50	-
3	PP-316	Bioprocess Engineering	DCC	3	2	1	0	2	-	25	-	25	50	-
4	PP-318	Process Instrumentation	DCC	2	2	0	0	2	-	15	-	35	50	-
5	PP-320	Environmental Management	DCC	4	3	1	2/2	3	3	15	15	15	40	15
6	PP-322	Communication Skills	DCC	2	0	2	0	-	-	100	-	-	-	-
7		Institute Elective-IV	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		21										

IDD B. TECH. (Process Engineering) and MBA FOURTH YEAR

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	PP-411	Process Systems Analysis and Control	DCC	4	3	1	2/2	3	3	15	15	15	40	15
2	PP-413	Process Engineering Design	DCC	4	3	1	0	3	-	25	-	25	50	-
3	PP-415	Industrial Hazards Management	DCC	3	2	1	0	2	-	25	-	25	50	-
4	PP-417	Summer Training	DCC	2	0	0	3	-	-	100	-	-	-	-
5		Departmental Elective I	DEC	3	2	1	0	2	-	25	-	25	50	-
6		Institute Elective V	IEC	4	3	1	0	3	-	25	-	25	50	-
		Total		**20**										
Semester VIII (Spring)														
1	PP-412	Business Environment	MCC	2	2	0	0	2	-	25	-	25	50	-
2	PP-414	Strategy of Process Engineering	DCC	4	3	1	0	3	-	25	-	25	50	-
3	PP-416	Human Resource Management and Organizational Behavior	MCC	3	3	0	0	3	-	15	-	35	50	-
4	PP-418	Business Communication	MCC	2	1	2	0	2		25	-	25	50	-
5	PP-420	Major Project	DCC	4	0	0	8	-	-	-	25	25	-	50
6		Institute Elective VI	IEC	4	3	1	0	3	-	25	-	25	50	-
7		Departmental Elective-II	DEC	3	2	1	0	2	-	25	-	25	50	-
		Total		22										

IDD B. TECH. (Process Engineering) and MBA FIFTH YEAR

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 IX (Autumn)														
1	PP-511	Financial and Management Accounting	MCC	4	3	1	0	3	-	15	-	35	50	-
2	PP-513	Financial Management	MCC	3	3	0	0	3	-	25	-	25	50	-
3	PP-515	Marketing Management	MCC	4	3	1	0	3	-	25	-	25	50	-
4	PP-517	Operations Management	MCC	3	3	0	0	3	-	25	-	25	50	-
5	PP-519	Management Training	MCC	2	0	0	3	-	-	100	-	-	-	-
6		Open Elective	MEC	3	2	1	0	2	-	25	-	25	50	-
		Total		19										
Semester X (Spring)														
1	PP-512	Business Law	MCC	3	3	0	0	3	-	15	-	35	50	-
2		Specialization Elective-I	MEC	3	2	1	0	2	-	25	-	25	50	-
3		Specialization Elective-II	MEC	3	2	1	0	2	-	25	-	25	50	-
4		Specialization Elective-III	MEC	3	2	1	0	2	-	25	-	25	50	-
5		Specialization Elective-IV	MEC	3	2	1	0	2	-	25	-	25	50	-
		Total		15										

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Mathematics**

1. Subject Code: **MA-101** Course Title : **Mathematics I**
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** ☐ **Spring** ☐ **Both**
7. Pre – requisite: **NIL**
8. Subject Area: **BSC**
9. Objective of the Course:

The aim of the course is to provide essential knowledge of basic tools of Differentia Calculus, Differential Equations and Matrix Algebra for degree students.

11. Details of the Course:

S. No.	Topics	No. of Lectures
1	**Functions of Several Variables:** Limit, continuity and differentiability of functions of two variables. Euler's Theorem, tangent plane and normal, change of variables, chain rule. Jacobians, Taylor's Theorem for two variables. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers.	12
2	**Ordinary Differential Equations:** Solution of linear differential equations with constant coefficients, Euler-Cauchy Equations, Solution of second order differential equations by change of dependent and independent variables. Method of variation of parameters for second order differential equations. Numerical solution of ODE by Picard's method, Taylor's series, Euler method & Modified Euler method.	8
3	**Infinite Series:** Convergence of infinite series, Comparison test, Ratio test, Root test, Raabe's test, Logarithmic test, Demorgan's test, Cauchy Integral test.	4
4	**Solution in Series:** Solution in series of second order linear differential equations with polynomial coefficients. Bessel and Legendre equations and their series solutions. Properties of Bessel functions and Legendre polynomials.	9
5	**Matrix Algebra:** Rank of a matrix , inverse of a matrix by elementary operations, Solution of linear simultaneous equations and their numerical solutions by Gauss Elimination and Gauss Seidel methods , eigen values and eigen vectors , Cayley-Hamilton theorem, diagonalization of matrices .Orthogonal , Hermetian, Skew-Hermetian, Normal and Unitary matrices and their elementary properties, quadratic forms	9
	Total	42

12. Suggested Books

S. No.	Name of book/ Author/ Publication	Year of publication
1	Thomas, G. and Finney R.L "Calculus and Analytical Geometry", Addision Wesley, Ninth Edition	1996
2	Kreyszig E., Wiley Eastern, "Advanced Engineering Mathematics", Nineth	2005
3	Grewal B.S , "Engineering Mathematics", Khanna Publishers	2004
4	Piaggio H.T.H., "An Elementary Treatise on Differential Equations and their Applications", G. Bells & Sons Ltd.	1970
5	Simmons G.F., "Differential Equations", TMH Edition	1981
6	Prasad C., "Mathematics For Engineers", Prasad Mudralaya, Allahabad, XIX Edition.	1989
7	Gerald, C.F. & Wheatley P.O. , "Applied Numerical Analysis", 6th Edition, Wesley.	2002
8	Krishnamurthy E.V. and Sen S.K. , "Applied Numerical Analysis, East West Publication	1982

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Mathematics**

1. Subject Code: **MA-102** Course Title: **Mathematics II**
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 [ ] Spring [√] Both [ ]
7. Pre-requisite: **NIL**
8. Subject Area: **BSC**
9. Objective of the Course:

   The aim is to provide tools of Calculus & transform methods to the students.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Integral Calculus:** Double and triple integrals, change of order of integration, change of variables. Gamma, Beta functions, Dirichlet's integral. Applications (Evaluation of surface area, volume, center of gravity, moment of inertia).	08
2.	**Vector Calculus**: Differentiation of vectors, gradient, divergence, curl and their physical meaning. Differential operators and their identities. Line and surface integrals. Green's Theorem in a plane. Gauss Divergence and Stokes's theorems and their applications.	10
3.	**Laplace Transform**: Definition, shifting theorems, transform of derivatives. Differentiation and Integration of Transforms, Haviside unit step and Dirac delta functions. Solution of ordinary differential equations in mechanics, electric circuits and bending of beams using Laplace Transform	09
4.	**Z-Transform:** Definition, Z-transform of elementary functions, shifting theorems, convolution theorem, initial and final value theorems. Inverse of Z- transform. Application to solution of difference equations.	05
5.	**Fourier Series**: Trigonometric Fourier Series, half range series, harmonic analysis.	04
6.	**Fourier Transform:** Definition, Fourier Sine and Cosine transforms, Fourier Integral Formula and Applications.	06
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Kreyszig John, "Advanced Engineering Mathematics", Wiley & Sons	2000
2.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publishing House, Second Edition	2005
3.	Hilderbrandt , "Advanced Calculus For Applications", Prentice Hall, India	1977
4.	Prasad C., "Advanced Mathematics For Engineers", Prasad Mudralaya, Allahabad, XIII Edition	1989

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Physics Department**

1. Subject Code: **PH-101** Course Title: **Physics I**
2. Contact Hours: L: **3** T: **1** P: **2**
3. Examination Duration (Hrs.): **Theory** 0 | 3 **Practical** 0 | 3
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 15 **ETE** 40 **PRE** 15
5. Credits: 0 | 5 6. Semester: Autumn [ ] Spring [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **BSC**
9. Objective of the Course:

   To expose students to the basic aspects of vector fields to help them get familiarized with fundamentals of Electricity and Magnetism and with Maxwell's equations and their applications. Next they would be introduced to the special theory of relativity and how it acts as bridge between Electricity and Magnetism.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Vector Fields :** Vector transformation, Vector calculus, Divergence and curl in curvilinear coordinates. Divergence and curl of electrostatic fields, Electric potential, Laplace's and Poisson's equation, Divergence and curl of magnetic field, Magnetic vector potential.	12
2.	**Electromagnetic Waves :** Maxwell's equations. Conservation of charge and energy, Electromagnetic waves in vacuum and in matter, Polarized and unpolarized electromagnetic waves. Absorption and dispersion.	10
3.	**Special Relativity:** Postulates of special relativity, Lorentz transformation, Introduction to four-vectors, Time dilation, Doppler effect, Length contraction, Twin paradox, Relativistic momentum, Mass and energy , energy and momentum, Relativity as bridge between electricity and magnetism, Magnetism as relative phenomenon (Qualitative discussion)	10
4.	**Wave Particle Duality an Quantizators:** Blackbody radiation, photoelectric effect, Compton effect, DeBrogtie waves, Electron Diffraction, Davission –Germer experiment, Uncertainty principle. Bohr atom model and Sommerfeld corrections. Franck-hertz experiment.	10
5.	**List of Experiments:**	
	(i) Measurement of magnetic susceptibility by Quinck's method.	

	(ii) Determination of Planck's constant by photoelectric effect. (iii) Franck-Hertz Experiment. (iv) Single-slit, double slits and multiple slits diffraction by Laser. (v) Determination of Planck's constant by radiation method. (vi) Stefen's constant. (vii) Magnetic field of paired coils in Helmholtz arrangement (viii) Davisson – Germer Experiment.	
	Total	**42**

11. Suggested Books:

S. No.	Name of Books/Authors/Publisher	Year of Publication
1.	David J. Griffabs, "Introduction to Electrodynamics" Prentice Hall of India (3rd Edition)	1999
2.	Arthur Beiser, "Concepts of Modern Physics" Tata McGraw-Hill (6th Edition)	2003
3.	Mathew N.O. Sadikh, "Elements of Electromagnetic", Oxford University Press (3rd Edition)	2003
4.	Feymman R.P., Leighton R.B. and Sands M., "The Feymman Lectures on Physics", Volume 1 & II, Narosa Publishing House.	2003

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Physics Department**

1. Subject Code: **PH-201** Course Title: **Physics II**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs.): **Theory** **0** **3** **Practical** **0** **0**
4. Relative Weightage: **CWS** **15** **PRS** **00** **MTE** **35** **ETE** **50** **PRE** **00**
5. Credits: **0** **3** 6. Semester: √ **Autumn** ☐ **Spring** ☐ **Both**
7. Pre-requisite: **Physics I**
8. Subject Area: **BSC**
9. Objective of the Course:

   The course would familiarize students with the basic principles of quantum mechanics and its applications in the areas of Atomic, Solid State and Nuclear Physics.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Elements of Quantum Mechanics:** Basic postulates of quantum mechanics and meaning of measurement, Schrodinger wave equation, idea of wave function, expectation values, stationery states, particle in a box, finite potential well, potential barrier and tunneling one dimensional harmonic oscillator	12
2.	**Atomic Structure:** Hydrogen atom (qualitative), angular momentum quantization, space quantization, electron spin, Stern –Gerlach experiment, vector atom model, fine structure of Hz line.	06
3.	**Photonics:** Distribution function of classical and quantum particles, Elements of classical and quantum statistics, Basic ideas of laser and its properties, Einstein's A and B coefficients, ruby laser, He-Ne laser, basic idea of holography, optical fiber for telecommunication.	07
4.	**Solid State physics:** Crystal structure, Free electron theory of metals, electron in a periodic potential, Kronig-Penny Model, effective mass, origin of the energy gap, band theory of solids, classification solids into metal, semiconductor and insulators, magnetic properties of solids. Concepts of electrons confinement in low dimensions, quantum wells and superlatices leading to nanodevices. Essential properties of superconductors, zero resistivity, Meissner effect, isotope effect, heat capacity, Energy gap, Type-I & II superconductors, Levitation.	12

5.	**Nuclear Structure:** Binding energy and stability of nuclei, Liquid drop model and shell model, applications in nuclear energy.	05
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Beiser, "Concepts of Modern Physics", Tata McGraw-Hill	2003
2.	Laud B.B., "Lasers and Nonlinears Optics" Wiley Eastern	2000
3.	Kittel, "Introduction to Solid State Physics", John Wiley	2004
4.	Lilley, "Nuclear Physics – Principles and Applications", John Wiley	2001
5.	Mani and Mehta, "Introduction to Modern Physics" Affiliated East West Press	1991
6.	Feynman R.P., Leighton R.B. and Sands M., "The Feynman Lectures on Physics Volume III", Narosa Publishing House.	2003
7.	Thornton S.T. & Rex,Modern A. "Physics for Scientists & Engineers" Sanders College, Pub. 2nd Edition.	2000

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemistry Department**

1. Subject Code: **CY-101** Course Title: **Chemistry**
2. Contact Hours: L: **3** T: **1** P: **2**
3. Examination Duration (Hrs.): **Theory** 0 3 **Practical** 0 3
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 15 **ETE** 40 **PRE** 15
5. Credits: 0 5 6. Semester:

Autumn	Spring	Both
		√

7. Pre-requisite: **NIL**
8. Subject Area: **BSC**
9. Objective of the Course:

   To provide a theoretical and experimental knowledge of basic/fundamental chemistry and to make the scientific background stronger for engineering discipline students.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Thermodynamics :** Free energy, Partial Molar quantities, Chemical potential, Gibb's-Duhem equation and their applications to physical and chemical equilibria	6
2.	**Kinetics and Catalysis :** Theories of chemical reactions, Adsorpption-Langmuir adsorption isotherm, Surface activity – Gibb's adsorption isotherm, Homogeneous and Heterogeneous catalysis – Enzyme catalysed reactions, Langmuir-Hinselwood mechanism	6
3.	**Electrochemical cells :** Electrochemical corrosion and fuel cells	2
4.	Stereoisomerism :Configuration, Fischer projections, R.S nomenclature, geometrical isomerism in compounds containing two C=C double bonds (E&Z), and simple cyclic systems. Elementary idea of conformation, Newman projection (ethane & substituted ethane). Optical isomerism of compounds without asymmetric carbon atom (allenes, spiro compounds, etc.) chirality involving atoms other than carbon.	5
5.	**Reaction Mechanism and Sterochemistry in Organic Synthesis :** (a) Carbocations, carboanion and free radicals : their generation and stability (b) Addition of Br_2, $KMnO_4$, OsO_4 on cis-, and trans-2-butene (c) Diels-Alder reaction : (4+2) cycloaddition MO treatment (d) Aromatic nucleophilic substitution mechanism (SNAr, SN1, Arynes) reactivity and reactions (e) Novel Polymers : Stereo chemical control of synthesis, Ziegler-Natta catalyst, Polyurerthanes, conducting polymers	3 2 2
6.	**Introduction to NMR and MS**	2

7.	**Coordination compounds** : Crystal field theory of octahedral and tetrahedral complexes colour and magnetic properties, John-Teller distortion with specific reference to d^9 case.	4
8.	**Organometalics** (i) Metal carbonyls : synthesis, structure and bonding (ii) Metal alkene complexes : Bonding in Metal alkene complexes , role of metal alkene complexes in hydrogenation and hydro-formylation	4
9.	**Instrumental Techniques :** UV-visible , and IR : Elementary idea and application to simple compounds/coordination complexes	4
10.	**Metal ions in biological system** Role of trace metals in biological systems with special reference to transition metals (Cu, Fe, Zn), toxic effect of Cd and Hg.	2
	Practicals 1. Determination of iron in iron ore using potassium dichromate (Internal indicator method) 2. Determination of sodium carbonate in baking/washing soda 3. Determination of hardness of water by EDTA-complexometry titrations 4. Heat of neutralization of a strong base by a strong acid 5. Surface excess of 1-butanol iin aqueous solution 6. Order of reaction 7. Percentage of ammonia in an ammonium salt 8. Identification of functional groups in organic compounds 9. blue printing 10. 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+} 13. Spectrophotometry : Determination of Fe(III) by colorimetry; 14. Determination of water of crystallation by microwave irradiation	
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Lee (JD), "Concise Inorganic Chemistry", Fifth Edn. Chapman & Hall.	2002
2.	Malik (T), Madan, "Selected Topics in Inorganic Chemistry", 5th Ed., S. Chand & Company.	2003
3.	Peter Sykes, "A guide book to Mechanism in Organic Chemistry, 6th Ed., Orient Longman.	2002
4.	Morrison (RT). Boyd (RN), "Organic Chemistry", Sixth Ed., Printice Hall of India.	2001
5.	Mahan (BH), "University Chemistry", 3rd Ed., Narosa Publishing House, New Delhi.	1980
6.	Atkins (PW), "Physical Chemistry", Vth Ed. ELBS, Oxford Univ. Press, Oxford.	1994

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Humanities and Social Sciences**

1. Subject Code: **HS-101** Course Title: **Technical Communication**
2. Contact Hours: L: **1** T: 0 P: **2**
3. Examination Duration (Hrs.): **Theory** 0 2 **Practical** 0 0
4. Relative Weightage: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 00
5. Credits: 0 2 6. Semester: **Autumn** [ ] **Spring** [ ] **Both** [√]
7. Pre-requisite: **NIL**
8. Subject Area: **HSSMC**
9. Objective of the Course:

   To sharpen the communication skills of students, both written and spoken, and to prepare them for meeting the challenge of communicating in national and international professional environment in the most relevant, correct and effective way.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Communication Basics :** scope, process, barriers, Non-verbal Communication, tools for Effective Communication	03
2.	**A. Writing Skills : Technical Reports** : Definition ; Types ; Planning and Prepration ; Structure; Writing of Technical Reports – Technical Style B. Writing Skills : Writing Resume / Job Application Letter /CVs	06
3.	**Oral Skills :** Pre-placement Group Discussion ; Interview Techniques : Effective Strategies for Oral Presentations. Listening	04
4.	Variations of English Language in the Global Scenario.	01
	Total	**14**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Guffey, Mary Ellen, "Essentials of Business Communication", 5 Edition, South-Western College Publishing	2001
2.	Bovee, Courland L. & John Thill, "Business Communication Today" (8th Edition), Pearson	2003
3.	Stevenson, Susan & Whitmore, Steve, "Strategies for Engineering Communication", John Willey and Sons, New York,	2002
4.	Sharma R.C. and Mohan, Krishna, "Business Correspondence and Report Writing " (3rd Edition), Tata McGraw Hills	2002
5.	Raman, Minakshi and Sharma , Sangeeta, "Technical Communication : Principles and Practice", OUP	2004

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Humanities and Social Sciences**

1. Subject Code: **HS-102** Course Title: **Behavioral Science**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs.): **Theory** 0 2 **Practical** 0 0
4. Relative Weightage: **CWS** 15 **PRS** 00 **MTE** 35 **ETE** 50 **PRE** 00
5. Credits: 0 2 6. Semester: Autumn [ ] Spring [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **HSSMC**
9. Objective of the Course:

   To expose the students to the concepts of behavioral science for better societal awareness and interpersonal interaction.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Introduction to behavioral Science:** The core disciplines contributing to behavioral Science and its importance.	02
2.	**Society and Culture:** Social structures (micro and macro level), attitudes, values, traditions, stereotypes and prejudices and their influence in behaviour. Ethnocentrism and culture relativism.	05
3.	**Personality and Socialization:** Role of biological and cultural factors in its development. Agents of socialization: family, school media and peers. Socialization and identify. Rikson's Eight Stages of Man.	07
4.	**Social groups and leadership :** Group structure, Boundaries : In-group and out-group, Group size, dyads and triads, primary and secondary groups, reference groups and leadership	05
5.	**Motivation:** Theories of Motivation. Two-Factor Theory, ERG Theory, and McCleland's Theory of Needs	05
6.	**Perception and individual decision making:** Perception and its relevance in behaviour, factors influencing perception, Person-perception: making judgements about others. Attribution theory, fundamental attribution errors. Cultural differences in it.	04
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Donald Light Jr. & Suzzane E. Keller "Sociology" (2nd Ed.) McGraw-Hill, Inc.	1977

2.	Fred Luthans "Organizational Behavior" (10th Ed.) McGraw-Hill Companies.	2004
3.	Joseph Curran Jr., "Introductory Sociology" McGraw-Hill, Inc.	1977
4.	Morgan, King, Weisz, & Schopter " introduction to Psychology" 7th Tata McGraw-Hill Edition.	2004
5.	Denisoff R. Serge, & Ralph Wahrman. A"An Introduction to Sociology " (3rd Ed) Macmillan Publishing Co. Inc.	1983
6.	Robert a. Baron & Donn Byrne. Social Psychology" (10th Ed Pearson Education, Inc.	2004
7.	Stephen P. Robins. "Organizational Behaviour" (9th Ed.) Prentice Hall of India, Pvt. Ltd.	2002

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Humanities and Social Sciences**

1. Subject Code: **HS-201** Course Title: **Economics**
2. Contact Hours: L: **2** T: **1** P: **0**
3. Examination Duration (Hrs.): **Theory** 0 2 **Practical** 0 0
4. Relative Weightage: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 00
5. Credits: 0 3 6. Semester: Autumn ☐ Spring ☐ Both √
7. Pre-requisite: **NIL**
8. Subject Area: **HSSMC**
9. Objective of the Course:

   To acquaint the students with the basic concepts of economics with emphasis on thei application.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Basic Concepts :** micro and macro economics, static and dynamic economics, equilibrium, utility, stock and flow, national income concepts, Indian Union Budget.	3
2.	**Consumer Behaviour :** demand, law of demand, elasticity of demand, consumer's equilibrium	4
3.	**Production and Cost Analysis:** production functions, laws of returns and returns to scale, Isoquants – producer's equilibrium ; cost theory and functions, break-even analysis	6
4.	**Pricing of Final Products :** marginal analysis approach – price and output determination under perfect and imperfect market conditions	4
5.	Money and Capital markets	2
6.	Inflation and Stabilization Policies	3
7.	Balance of Payments and Foreign Exchange Market	3
8.	WTO and Intellectual Property Rights	3
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Koutsoyiannis A., "Modern Microeconomics" Macmillan Publishers	2004
2.	Ahuja H.L., "Principles of Microeconomics", S. Chand Publishers	2004
3.	Brian Atkinson, "Applied Economics (Ed.)", Macmillan Publishers	1998

4.	Evans J. Douglas, "Managerial Economics : Theory, Practice and Problems" Prentice hall	2004
5.	Dutt R. & Sundharam K.P.M., "Indian Economy", (S. Chand)	2006
6.	Mukerjee Sampat, "Modern Economic Theory", New Age International Publishers	2005
7.	Vasudeva P.K., "World Trade Organization : Implications for Indian Economy", Pearson Education (Singapore) Pvt. Ltd.	2005

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Management Studies**

1. Subject Code: **BM-201** Course Title: **Management Concepts & Practices**
2. Contact Hours: L: **2** T: **1** P: **0**
3. Examination Duration (Hrs.): **Theory** | 0 | 2 | **Practical** | 0 | 0 |
4. Relative Weightage: **CWS** | 25 | **PRS** | 00 | **MTE** | 25 | **ETE** | 50 | **PRE** | 00 |
5. Credits: | 0 | 3 | 6. Semester: | | **Autumn** | | **Spring** | √ | **Both**
7. Pre-requisite: **NIL**
8. Subject Area: **HSSMC**
9. Objective of the Course:

   To provide basic knowledge on the different Managerial Roles, Skills and Function: required for effective Managerial Performance at work place.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Introduction to Management :** Evolution of Management Thought; Management Processes and Functions, Roles and Skills ; Understanding Organizational design and structure	3
2.	**Marketing :** The concept of Marketing Mix of Product Policy and design, Pricing and Promotion	6
3.	**Finance :** Finance function, Concept, Scope and its relationship with other Disciplines; Financial Statements, Financial Analysis, Management of Working Capital	5
4.	**Human Resource Management :** Introduction ; Recruitment & Selection, Performance appraisal, Career Development	5
5.	Operations, Manufacturing, Operations Planning and Control, Management of Supply Chain, Introduction to Materials Management, Systems and procedures for inventory Management	6
6.	**Strategy :** Firm and its environment : Strategies for growth and diversification process of strategic planning Current and Emerging Trends	3
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Kotler P, "Principles of Marketing," , Pearson Education, 2005	2005
2.	Robbins S P, "Organizational Behaviour : Concept Controversies and Applications", PHI, 2005	2005

3.	Thomas S, Bateman & Scott A. Snell, "Management : Competing in the new era,. Tata McGraw Hill, 2005	2005
4.	Bhattacharyya Ashish K., "Financial Accounting for business managersm Prentice Hall India", Prentice Hall of India, 2005	2005
5.	How to read a Balance Sheet, An ILO Programme Bookl, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi,1989.	1989

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Electrical Engineering Department**

1. Subject Code: **EE-101** Course Title: **Electrical Science**
2. Contact Hours: L: **3** T: **1** P: **2/2**
3. Examination Duration (Hrs.): **Theory** 0 | 3 **Practical** 0 | 0
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00
5. Credits: 0 | 4 6. Semester: Autumn [ ] Spring [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   To introduce the students to the fundamentals of Electrical Engineering concepts o network analysis, principles of electrical machines, basics of electrical measurement anc measuring instruments.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Network Fundamentals:** Types of Sources and Elements, Kirchoff's Laws, Mesh and Node Analysis of D.C. Networks.	4
2.	**Transient Analysis :** RL & RC circuits	3
3.	**Network Theorems:** Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Theorem, Star-Delta Transformation	3
4.	**A.C. Fundamentals** : Concept of Phasor, Impedance and Admittance , Mesh and Node analysis of Single Phase AC Networks, Network Theorems in AC Networks, Active and Reactive Power in AC Circuits, Resonance in Series AC Circuits	4
5.	**Introduction to 3-phase A.C. Circuits:** Analysis of 3-phase balanced start-delta circuits, Power in 3-phase Circuits.	3
6.	**Magnetic Circuit Concepts :** Analogy with Electrical Circuits, Calculation for series, parallel and series parallel magnetic circuits, Eddy current and Hysteresis losses	4
7.	**Single Phase Transformer:** Basic constructional features, Operating principle, Phasor diagram, Equivalent Circuit, Voltage regulation, Efficiency, Open circuit and Short Circuit tests.	6
8.	**D.C. Machines :** Principle of operation, Basic constructional features, Emf and torques equation, Armature reaction, Types of Excitation and Generator characteristics , Types of D.C. motors, Starting and speed control of D.C. motors.	7
9.	**AC Machines :** Three phase Induction Motor : Operating principle,	4

	Constructional features, Equivalent circuits, Torque-speed characteristics, Starting and speed control. Synchronous Generator : Basic principle of operation, Emf equation, Constructional features	
10.	**Measurement of Electrical Quantities:** Measurement of Voltage, Current, Power and Energy, Moving Iron Instruments, Measurement of 3 phase power, Accuracy class of meters.	4
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Mukhopadhyaya P., Pant A.K., Kumar V. and Chittore D.S., "Elements of Electrical Science", M/s Nem Chand & Brothers.	1997
2.	Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall of India.	2002
3.	Kothari D.P., Nagrath I.J., "Theory and Problems of Basic Electrical Engineering", Prentice Hall of India.	2003
4.	Hayt William H., Kemmerly Jack E. and Durbin Steven M., "Engineering Circuit Analysis", Tata McGraw –Hill Publishing Company Limited, India	2002
5.	Chapman, Stephen, J., "Electric Machinery Fundamentals", MCGraw Hill Book Company, New Delhi	1985
6.	Hughes Edward, "Electrical & Electronic Technology", Pearson Publishing, 8th edition	2002

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Electronics and Computer Engineering**

1. Subject Code: **EC-102** Course Title: **Fundamentals of Electronics**
2. Contact Hours: L: **3** T: **1** P: **2/2**
3. Examination Duration (Hrs.): **Theory** | **0** | **3** | **Practical** | **0** | **0** |
4. Relative Weightage: **CWS** | **15** | **PRS** | **15** | **MTE** | **30** | **ETE** | **40** | **PRE** | **00** |
5. Credits: | **0** | **4** | 6. Semester:

	Autumn	Spring	Both
			√

7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   To introduce to the students the fundamental concepts of electronic devices and circuits for engineering applications.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Review of conductors, semiconductors, and insulators; Drift and diffusion currents ;** p-n junction ; junction under forward and reverse bias ; circuit models ; diode applications : rectifier, clipper, clamper ; Zener diode regulator ; simple power supply with capacitor filter and zener regulator.	9
2.	**Bipolar Junction Transistor :** structure and operation, various configurations, input and output characteristics, BJT as amplifier, DC analysis of various biasing circuits, biasing stability.	8
3.	**Field Effect Transistors :** JFET, depletion-mode and enhancement-mode MOSFETs, FET biasing, FET as an amplifier	4
4.	**Small-signal analysis of BJTs and FETs:** h-parameter model of BJT, small-signal analysis of BJT amplifier circuits, frequency response of RC-coupled BJT and FET amplifiers.	4
5.	**Amplifiers :** cascade connection, current mirror, differential amplifier, operational amplifier, op-amp applications, power amplifiers, feedback in amplifiers.	8
6.	**Oscillators :** Barkhausen criterion, damped oscillations in LC circuits, audio and rf oscillators.	4
7.	**Digital Electronics :** Combinational Circuits – adder, decoder, encoder, multiplexer, demultiplexer ; Sequential Circuits – flip-flops, counters, and shift registers ; ADC an DAC.	5
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Boylestad R.L. and Nashelsky L., "Electronic Devices and Circuit Theory", 9th edition –Pearson Education. Asia.	2006
2.	Millman J. and Halkias C.C., "Electronic Devices and Circuit" –Mc Graw-Hill.	2000
3.	Millmanand J., Halkias C.C., "Integrated Electronics "–Tata McGraw-Hill.	2001
4.	Nagrath, I.J. ",Electronics – Analog and Digital" –PHI.	2000
5.	Santiram Kal, "Basic Electronics" –PHI.	2002

Experiments

1. Study of basic components and measuring instruments – Resistors, Capacitors, Inductors, CRO, multimeter, and function generator.
2. Study of diode circuits – rectifiers with filter and zener regulator, clippers and clampers
3. Design of CE amplifier.
4. Study of oscillator circuits.
5. Study of operational amplifier and its applications
6. Studies on Flip-flops and Counters
7. Study of ADC and DAC.

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Mechanical & Industrial Engineering**

1. Subject Code: **MI-101** Course Title: **Thermodynamics**
2. Contact Hours: L: **2** T: **1** P: **0**
3. Examination Duration (Hrs.): **Theory** **0 2** **Practical** **0 0**
4. Relative Weightage: **CWS** **25** **PRS** **00** **MTE** **25** **ETE** **50** **PRE** **00**
5. Credits: **0 3** 6. Semester: [ ] [ ] [√]

Autumn **Spring** **Both**

7. Pre-requisite: **NIL**
8. Subject Area: ESC
9. Objective of the Course:

   To introduce the basic principles of thermodynamics and their application.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Introduction :** Introduction to thermodynamic system, surrounding, state, process, properties, equilibrium, heat and work, Zeroth Law of Thermodynamics	04
2.	**Properties of Pure Simple Compressible Substance:** PvT surface, Pv, Tv, TP diagrams. Equation of state for ideal and real gases. Virial equation of state, Van-der waal, Redlich-Kwong,Peng Robinson equation of state etc. use of steam tables and Mollier diagram.	06
3.	**First Law of Thermodynamics:** First law application to non-flow processes such as isochoric, isobaric, isothermal, adiabatic and polytropic processes. Steady flow energy equation, flow work. Application to various practical systems viz nozzles, diffuser, turbines, heat exchangers etc. Application of energy equation to transient flow problems.	07
4.	**Second Law of Thermodynamics:** Second law, reversible and irreversible processes, Clausius and Kelvin Planck statements, Carnot cycle, corollaries of second law: thermodynamic temperature scale, Clausius inequality, entropy as a property, principle of increase of entropy. Calculation of entropy change.	06
5.	**Thermodynamic Cycles:** Otto, Diesel, Rankine cycles and their applications. Vapour compression refrigeration cycle.	05
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Van Wylen & Sonntag, "Fundamentals of Thermodynamics", John Wiley.	2003
2.	Roger GFC & Mayhew, "Engineering Thermodynamics Work and Heat Transfer", Longman.	1996
3.	Smith J.M., Van Ness H.C. and Abbott, "Introduction to Chemical Engineering Thermodynamics", M.M. Tata McGraw Hill.	2003
4.	Version SI, Moran MJ & Shapiro HM, "Fundamentals of Engineering Thermodynamics", John Wiley.	2006

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Mechanical & Industrial Engineering**

1. Subject Code: **MI-102** Course Title: **Manufacturing Techniques**
2. Contact Hours: L: **2** T: **0** P: **2**
3. Examination Duration (Hrs.): **Theory** 0 2 **Practical** 0 0
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00
5. Credits: 0 3 6. Semester: Autumn [ ] Spring [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   The course aims as imparting the basic knowledge about the fundamental manufacturin techniques employed to convert a raw material into final product.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Introduction :** Engineering materials, their manufacturability and applications	2
2.	**Casting :** Pattern materials, pattern types, allowances, molding sand, composition and properties, cores, casting defects and their remedies, plastic parts molding	5
3.	**Machining:** Lathe, drilling, milling and grinding machines and their operations, cutting tools used.	5
4.	**Joining :** Welding fundamentals, types of welded joints, types of welding processes, gas welding process, manual metal arc welding, welding defects and remedies, Soldering and brazing, their applications in electronics industry	6
5.	**Forming:** Forging, rolling, extrusion, wire drawing and tube drawing, sheet metal operations, forging defects and remedies.	6
6.	**Advance Manufacturing Process:** Introduction to advanced manufacturing technique and their application.	4
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Paul E. DeGarmo, J.T. Black, Ronald A. Kohser, "Materials and Processes in Manufacturing": Prentice Hall of India Pvt. Limited – Delhi	1997
2.	S. Kalpakjian, S.R. Schmid, "Manufacturing Engineering and Technology": Pearson Education, Delhi	2000
3.	Groover Mikell P. , "Fundamentals of Modern Manufacturing": John Wiley and Sons Inc.	2002
4.	Lindberg R.A., "Processes and Materials of Manufacture": Prentice Hall India Limited	1990

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Mechanical & Industrial Engineering**

1. Subject Code: **MI-201** Course Title: **Solid Mechanics**
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	Spring	Both
√		

7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   This course introduces the study of equilibrium and displacement system in engineering components and structures to enable designs to be effected in terms of stress and strains and the selection of materials.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**CONCEPT OF STRESS & STRAIN:** Concept of stress ; normal stress and shear stress : nine Cartesian components of stress at a point, sign convention and notation, equality of shear stresses on mutually perpendicular planes and their planes of action, stress circle. Concept of strain, normal and shear strain, two dimensional state of principlal strains, Poisson's ratio, volumetric strain, strain circle.	5
2.	**Stress-Strain Relationship:** Hooke's law and its application to isotropic materials, elastic constant and their relationships, plane stress and conditions.	3
3.	**Mechanical Properties:** Uniaxial tension test to determine yield and ultimate strength of materials, uniaxial stress-strain diagram, proof stress, ductile and brittle materials, hardness and impact strength Conditions affecting mechanical behaviour of engineering materials.	3
4.	**Members inUniaxial State of Stress:** Uniform cross section and tapered bars subjected to uniaxial tension and compression, composite bars and statically indeterminate bars, thermal stresses, introduction to plasticity concepts.	5
5.	**Members Subjected to Axi-Symmetric Loads:** Stresses and strains in the cylindrical shells and spheres under internal pressure stresses in thin rotating rings.	3
6.	**Materials Subjected to Torsional Loads:** Tursion of solid and hollow circular shafts, stepped and composite shafts, close-coiled helical springs subjected to axial loads.	3

7.	**Members Subjected to Flexural Loads:** Statically determinate beams, support reactions, relationship between load, shear forces and bending moment, shear force and bending moment diagrams. Theory of flexure for initially straight beams, distribution of bending, normal and shearing stresses across the beam cross-section ; principal stresses in beams stress in composite and built-up beams. Equation of elastic curve for the loaded beam, relationship between bending moment, slope and deflection. Calculation of deflection by integration moment area, and unit-load methods.	6 6 6
	Total	**40**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Gere J.M., "Mechanics of Materials", Nelson Thornes Ltd., London, UK, 5th Edition	2002
2.	Crandall S.H., Dahl N.C. and Lardner T.J., "A Introduction to the Mechanics of Solid", McGraw Hill Kogakusha Ltd., 2nd Edition	1978
3.	Beer F.P. and Johnston E.R., "Mechanics of Materials", Tata McGraw Hill Book Company, New Delhi, 3rd Edition	2004
4.	Nagarajan Popov E.P., "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi,	1996

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Civil Engineering**

1. Subject Code: **CE-101** Course Title: **Engineering Graphics**
2. Contact Hours: L: **2** T: **0** P: **4**
3. Examination Duration (Hrs.): **Theory** **0** **3** **Practical** **0** **0**
4. Relative Weightage: **CWS** **00** **PRS** **25** **MTE** **25** **ETE** **50** **PRE** **00**
5. Credits: **0** **4** 6. Semester: Autumn [ ] Spring [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   The objective of the course is to teach the basic concepts of Engineering Drawing to th students. The emphasis of the course is to improve their power of imagination.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	Types of Projection, Reference Planes and Quadrants. Projection of point keeping it in different quadrants.	2
2.	Auxiliary planes, projection of points on auxiliary planes	1
3.	Projection of lines	2
4.	Oblique planes – determination of VTH when inclination are given and vice versa, conversion	2
5.	Projection of plane figures.	2
6.	Plane figure in OP and one edge inclined to HP or VP	
7.	Types of solids and their projections in their initial positions	3
8.	Section of solid and development	2
9.	**General:** Sheet Layout, Line Symbols, Line Groups, Preferred Scales, Theory of Orthographic Projection, Technical Sketching	2
10.	**Shape Description (External):** Multiplaner Representation Systems of Projection, Sketching of Orthographic Views from Pictorial Views, Conventional Practices, Precedence of Views, Precedence of Lines.	2
11.	**Uniplaner Representation:** Sketching of Pictorial Views(Isometric and Oblique) from Multiplaner Orthographic Views	3
12.	**Shape Description (Internal):** Sectioning as an Aid to understand internal features, Principles of Sectioning, Types of Sections, Section Lines, Cutting Plane Lines and Conventional Practices.	3
13.	**Size Description:** Dimensioning, Tools of Dimensioning, Size and position Dimensions, Unidirectional and Aligned Systems, Principle and Practices, of Dimensioning, Tolerance Dimensioning	3
14.	**Conventional Representation:** Representation and Identification of Common Machine Elements and Features	1

S.No.	Topics	Practice Classes of Two Hour Duration
1.	Projection of Points	**02**
2.	Projection of lines	**03**
3.	Oblique planes	**02**
4.	Projection of Plane Figures	**02**
5.	Projection of Solids	**02**
6.	Section and Development	**02**
7.	Sketching of Orthographic Views from Pictorial Views	**04**
8.	Sketching of Pictorial Views (isometric and Oblique) from Multiplaner Orthographic Views, Missing Lines Exercise, Missing View Exercise.	**05**
9.	Sectioning Exercise	**02**
10.	Dimensioning Exercise	**02**
11.	Identification Exercise	**01**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Giesecke, Mitchell, Spencer, Hill, Dygdon and Novak, "Technical Drawing", Macmillan Publishing Company	2003
2.	French T.E., Vierck C.J. and Foster R.J., "Engineering Drawing and Graphics Technology", McGraw-Hill Inc	1993
3.	Luzadder W.J., Warren J. and Duff J.M., "Fundamentals of Engineering Drawing ", Prentice Hall international Editions	1989
4.	Sp 46:1988 Engineering Drawing Practice for Schools and Colleges, Bureau of Indian Standards	----
5.	Chandra A.M. and Chandra S., "Engineering Graphics", Narosa Publishing House, New Delhi	2003

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: Civil Engineering

1. Subject Code: **CE-102** Course Title: **Environmental Studies**

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

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

4. Relative Weightage: **CWS** 15 **PRS** 00 **MTE** 35 **ETE** 50 **PRE** 00

5. Credits 0 2 6. Semester ☐ **Autumn** ☐ **Spring** √ **Both**

7. Pre-requisite: **NIL**

8. Subject Area: **GSC**

9. Objective of the Course

This preliminary course in environmental studies aims at creating among students awareness related to emerging environmental challenges.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	Introduction and scope	1
2.	Earth's natural environment, human population and Ecosystems	3
3.	Environmental Pollution Air pollution-sources, effects and control, Distribution of pollutants in atmosphere, Air quality standards Water pollution-sources, effects and control, Distribution of pollutants in water, Water quality standards Land pollution – sources, effects and control Thermal and noise pollution	10
4.	Basic principles of waste management, including industrial wastes Hazardous wastes and risk management	3
5.	Environmental impact assessment Life cycle assessment Sustainable development Conservation of natural resources Trade, environment and development	7
6.	Environmental management systems and ISO certification Control policies, legislations and acts	4
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Davis M.L. and Cornwell D.A., "Introduction to Environmental Engineering," McGraw Hill. New York 3/e	1998
2.	Masters G.M., "Introduction to Environmental Engineering and Science", Prentice Hall of India. New Delhi. 2/e	1998
3.	Peavy H.S., Rowe D.R. and Tchobanoglous G., "Environmental Engineering", McGraw Hill. New York	1986

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Civil Engineering**

1. Subject Code: **CE-201** Course Title: **Computer Aided Graphics**
2. Contact Hours: L: **1** T: **0** P: **2**
3. Examination Duration (Hrs.): **Theory** **0 2** **Practical** **0 0**
4. Relative Weightage: **CWS** **00** **PRS** **25** **MTE** **25** **ETE** **50** **PRE** **00**
5. Credits: **0 2** 6. Semester:

Autumn	Spring	Both
√		

7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course:

   The course objective is to provide basic knowledge of computer sciences its engineering Applications. The emphasis will be on the practical through the use of software such as AUTOCAD or MICROSTATION, MS OFFICE etc.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Computer Aided Graphics :** Introduction and Applications	2
2.	Graphic Data file formats	1
3.	Point and Line Generation Algorithms	3
4.	Two Dimensional Coordinate Systems, Coordinate transformations	3
5.	Two dimensional windowing and clipping	2
6.	**Graphics Software :** Auto CAD, Microstation, MS Excel Spread Sheet Digitisation, Scanning and Animation	3
7.	**Practical exercises on generation of simple 2 dimensional drawings:** plans, sections etc. charts and other figures. Digitisation and scanning exercises. Editing and cleaning of drawings. Presentation of drawings.	15x2

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Foley, James, Andries van Dam, Steven Feiner, John Hughes, "Computer Graphics: Principles and Practice", 2nd ed., Addition – Wesley, NY	2000
2.	Hearn D. and Baker M.P, "Computer Graphics", Prentice Hall of India, New Delhi, 2nd ed.	1977
3.	Daniel B. Olfe, Daniel B., "Computer Graphics for Design From Algorithms to Autocad", Prentice Hall of India, USA.	1995
4.	Xiang, Z. and Roy Plastock, "Computer Graphics", Schaum's Outline Series, McGraw Hill Book Co., NY	2000
5.	User Mannual, AutoCAD	
6.	User Manual, MS Excel	

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Biotechnology**

1. Subject Code: **BT-101** Course Title: **Fundamentals of Biotechnology**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs.): **Theory** **0 2** **Practical** **0 0**
4. Relative Weightage: **CWS** **15** **PRS** **00** **MTE** **35** **ETE** **50** **PRE** **00**
5. Credits: **0 2** 6. Semester: **Autumn** ( ) **Spring** ( ) **Both** (√)
7. Pre-requisite: **NIL**
8. Subject Area: **GSC**
9. Objective of the Course:

   This course provides a comprehensive and up-to-date review of the various concepts of modern biology. Particularly emphasis is placed upon the biological functions, which facilitates a greater appreciation of their potential applications.

10. Details of the Course

S.No.	Particulars	Contact Hours
1.	Introduction, structural and chemical components of cell	5
2.	**Molecular mechanism and engineering:** DNA replication, RNA and protein synthesis, mutation and genetic recombination, Protoplast and cell fusion technology, Genetic engineering and PCR	7
3.	**Microbes & fermentation:** Bacteria, fungi, viruses, microbial growth and bioprocess technology, Enzyme kinetics and bioconversion, Immobilization of enzymes, cell and application	6
4.	**Plant and animal biotechnology and safety issues:** Biodiversity, transgenic plants and animals, Biosafety and bioethics	4
5.	**Applications:** Biofuels, Bioremediation, bio-medical applications	6
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Smith JE, "Biotechnology", Cambridge University Press, UK(3rd Edition)	1996
2.	Walker JM and Gingold EB, "Molecular Biology and Biotechnology", The Royal Society of Chemistry , UK/Panima Publishing Corporation, New Delhi India (Indian Edn)	1999
3.	Auderisk G and Auderisk T, "Biology life on Earth", Macmillan Publishing Company, USA	1989

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Earth Sciences**

1. Subject Code: **ES-201** Course Title: **Introduction to Geo-Science**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs.): **Theory** **0 2** **Practical** **0 0**
4. Relative Weightage: **CWS** **15** **PRS** **00** **MTE** **35** **ETE** **50** **PRE** **00**
5. Credits: **0 2** 6. Semester: **Autumn** [ ] **Spring** [√] **Both** [ ]
7. Pre-requisite: **NIL**
8. Subject Area: **GSC**
9. Objective of the Course:

   To provide an overview of the field of earth science including earth processes, resource and geohazards.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	Earth, its place in Solar system, physical features of its surface, other basic features (mass, shape, size, density, etc.) and Earth's interior.	4
2.	Rocks and Minerals, gems and gemstones.	3
3.	Volcanoes, earthquakes and tsunami, glaciers, landslides, mudflow and avalanches	4
4.	Evolution of the Earth through Ages	2
5.	Remote Sensing, GIS and GPS	3
6.	Mineral Exploration and Geophysical Exploration	3
7.	Groundwater, Hydrocarbons and coal	3
8.	Rock Deformation, Mining and Tunneling	4
9.	Geological Divisions of India, Plate Tectonics and the Himalayas	2
	Total	**28**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	F. Press F. and R. Siever, "Earth"	2001
2.	Gass I.G., Smith P.J. and Wilson R.C.L., "Understanding the Earth"	1977
3.	Moore J.S. and Wicander R., " Physical Geology "	2001
4.	:Willam Lowrie, " Fundamentals of Geophysics"	1997

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Metallurgical & Material Engineering**

1. Subject Code: **MT-201A** Course Title: **Material Science**
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 **Spring** **Both**

7. Pre-requisite: **PH-101**
8. Subject Area: **ESC**
9. Objective of the Course:

   To expose the students to the fundamentals of Electrical, Electronics and magnetic properties and their applications.

10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Crystal and Crystalline defects:** Point line and planer defects, surfaces and properties, stoichiometry, non- stoichiometry and defects structures.	5
2.	**Solid solutions and two-phase solids:** Isomorphous alloys, phase diagrams and binary eutectic phase diagram of Pb-Sn alloys.	2
3.	**Electrical and Thermal conduction in solids:** Drude Model, Temperature dependence of resistivity of metals, Mathiessen's rule, Resistivity of two phase Ag-Ni alloy and electrical contacts, Electrical conductivity of semi-conductors, ionic crystals and glasses.	7
4.	**Semi-conductors:** Energy band and intrinsic semi-conductors, electrons and holes, extrinsic semi-conductors, temperature dependence of conductivity, Recombination and minority carrier injection, diffusion and conduction equations, continuity equation, optical absorption, luminescence, Schottky junctions, Ohmic contacts and thermo-electric coolers.	10
5.	**Dielectric Materials and insulation:** Matter polarization and relative permittivity, electronic polarization, polarization mechanisms, Dielectric constant and dielectric loss, Dielectric strength and insulation breakdown, capacitor dielectric materials, piezoelectricity, ferroelectricity and pyroelectricty.	8
6.	**Magnetic Properties:** Magnetization of matter and classification of magnetic Materials, Origin of ferromagnetism and exchange interaction, saturation magnetization and curie temperature, magnetic domains in ferromagnetic materials, soft and hard magnetic materials.	10
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Kasap S.O., "Principles of Electronic Materials and Devices" Second Edition, Tata McGraw-Hill	2002
2.	Callister W.D., "Materials Science and Engineering – an Introduction, Fifth Edition, Jr., John Wiley & Sons Inc.	2000
3.	Askeland D.R., "The Science and Engineering of Materials", Third Edition, PWS Publishing Co.	1994

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Chemical Engineering**

1. Subject Code: **CH-201** Course Title: **Energy Resources & Conservation**
2. Contact Hours: **L: 2 T: 0 P: 0**
3. Examination Duration (Hrs.): **Theory** [02] **Practical** [00]
4. Relative Weightage: **CWS** [15] **PRS** [00] **MTE** [35] **ETE** [50] **PRE** [00]
5. Credits: [02] 6. Semester: [ ] **Autumn** [√] **Spring** [ ] **Both**
7. Pre-requisite: **NIL**
8. Subject Area: **GSC**
9. Objective of the Course:
   To provide a comprehensive coverage of energy resources and conservation measures.
10. Details of the Course:

Sl. No.	Particulars	Contact Hours
1	**Introduction**: Energy resources spectrum, Renewable and non Renewable energy Sources, consumption pattern in various sectors, Efficiency of energy resources, load demand, and economics	3
2	**Coal**: Classification, properties, combustion, carbonization, liquefiction and gasification, Electricity generation from coal	3
3.	**Liquid fuels:** various type of fuels, properties and handling	2
4.	**Gaseous fuel:** CNG, LNG, and LPG	1
5.	**Nuclear Energy**: Potential, Fusion and fission processes and nuclear reactor	2
6.	**Wind Energy:** potential and utilisation	1
7.	**Solar Energy:** Solar radiation measurements, **Solar Thermal**: Flat plate and focusing collectors, solar space heating and cooling, solar pond, **Solar Photovoltaic**: Solar cells and storage	3
6	**Hydropower**: Classification, components of hydropower generation systems,	3
7	**Biomass Energy**: Biomass Types, characterization, conversion routes, biochemical	3
8	**Other Energy Resources**: Hydrogen, Fuel Cells, and other energy sources	3
9.	**Energy Conservation:** Waste heat recovery, use of low grade hot streams, concept of vapour recompression, flash vaporization, heat pipe, energy targeting by pinch method.	4
	Total	**28**

11. Suggested Books and References:

Sl. No.	Name of Books/ Authors/ Publisher	Year of Publication
1.	"World Energy Outlook 2006", International Energy Agency, France	2006
2.	Electricity in India International Energy Agency, France	2002
3.	Twidel, J. and Tonyweir, "Renewable Energy Resources", Second Edition, Taylor & Francis.	2006
4.	Manwell, JF et.al., Wiley ,"Wind Energy Explained – Theory, Design & Application"	2002
5.	Sukhatme, S P, "Solar Energy: Principles of Thermal Collection and Storage", Second Edition, Tata McGraw-Hill Publishing Company Ltd	1999
6.	Takahashi, Peytrick & Trenka, Andrew; Wiley "Ocean Thermal Energy Conservation",	1996
7.	Teddy, DIRECTORY, TERI, New Delhi	2006

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Electronics & Computer Engineering**

1. Subject Code: **EC-101A** Course Title: **Computer Systems & Programming**
2. Contact Hours: L: **3** T: **0** P: **2**
3. Examination Duration (Hrs.): **Theory** | **0** | **3** | **Practical** | **0** | **0** |
4. Relative Weightage: **CWS** | **15** | **PRS** | **15** | **MTE** | **30** | **ETE** | **40** | **PRE** | **00** |
5. Credits: | **0** | **4** | 6. Semester: | | **Autumn** | | **Spring** | √ | **Both**
7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course: To introduce the fundamental concepts of Computer Systems hardware and software and to develop basic skills in programming, to prepare for the use of Information Technology tools and techniques.
10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Basic Computer Fundamentals:** Introduction to computer systems ; number system integer,m signed integer, fixed and floating point representations . IEEE standards integer and floating point arithmetic ; CPU organization ALU, registers, memory, the idea of program execution at micro level: concept of flow chart and algorithm, algorithms to programs Concept of strain, normal and shear strain, two dimensional state of principlal strains, Poisson's ratio, volumetric strain, strain circle.	7
2.	**Basic Programming elements in C++: Input/Output:** Constants, variables expressions and operations: Naming conventions and styles: Conditions and selection statements; Looping and control structures; File I/O header files, string processing; Pre-processor directives such as include, #define, #ifdef, #ifndef, Compiling and linking.	8
3.	**Programming through functional decomposition:** Functions (void and value returning) parameters, scope and lifetime of variables, passing by value, passing by reference passing by constant reference : Design of functions and their interfaces (concept of functional decomposition), recursive functions, function overloading and default arguments ; Library functions	8
4.	**Aggregate data-types: Arrays and pointers: Structures :** Dynamic data and pointers, dynamics arrays ; Introduction to data structures, use of pointers in linked structures.	7
5.	**Object Oriented Programming Concepts:** Data hiding, abstract data types, classes, access control : Class implementation – default constructor, constructors, copy constructor, destructor, operator overloading, friend functions ; Object oriented design, inheritance and composition :	12

	Dynamic binding and virtual functions ; Polymorphism ; Dynamic data in classes.	
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
1.	Dietel H.M. & Dietel P.J., "C ++ How to Program" Prentice Hall Publications.	2004
2.	Nell Date, Chip Weems, Mark Headington, "Programming and Problem Solving with C++", CBS Publishers and Distribution New Delhi.	2000
3.	Cohoon J.P. & Davidson J.W., "C++ Program Design" Tata McGraw Hill.	2005

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT: **Electronics & Computer Engineering**

1. Subject Code: **EC-101B** Course Title: **Fundamentals of Object Oriented Programming**
2. Contact Hours: L: **3** T: **0** P: **2**
3. Examination Duration (Hrs.): **Theory** 0 3 **Practical** 0 0
4. Relative Weightage: **CWS** 15 **PRS** 15 **MTE** 30 **ETE** 40 **PRE** 00
5. Credits: 0 4 6. Semester: **Autumn** [ ] **Spring** [ ] Both [√]
7. Pre-requisite: **NIL**
8. Subject Area: **ESC**
9. Objective of the Course: To introduce the concepts of Java programming, Classes in Jav Inheritance, Applets
10. Details of the Course:

S.No.	Particulars	Contact Hours
1.	**Basic Computer Fundamentals:** Introduction to computer systems, computer as a programmed machine: CPU organization, ALU, registers, memory: machine language, assembly language, idea of program execution at micro level, high – level languages: concept of flow chart and algorithm algorithms to programs, efficiency of algorithms, big-O notation; object oriented programming concept difference in approach from procedural programming.	**8**
2.	**Introduction to linux and Java programming environment, Java compiler and virtual machine:** structure of a Java program, stand-alone programs and applets: concepts of portability.	**3**
3.	**Basic Programming elements in Java :** data types, variables and array's operators, assignment and selection statements iterative structures, nested loops	**6**
4.	**Classes in Java:** general form of a class, creating objects, access control in classes. Constructors, methods, finalization, parameters, method overloading, recursive methods, returning objects, static members final, qualifier, nested and inner classes, string handling in Java, I/O mechanism, command line arguments.	**10**
5.	**Inheritance:** basics super classes and subclasses, multilevel hierarchy, method overriding: run time polymorphism, abstract classes, final in inheritance, and the object class.	**5**
6.	**Packages and Interfaces :** defining package, access protection, importing classes and packages, defining and implementing interfaces, nested interfaces, use of interfaces, variables in interfaces, the keyword extends	**3**

7.	**Exception handling :** fundamentals , types of exceptions catching exceptions, multiple catching nested try statements, uncaught exceptions, throw and throws, finally mechanism, built-in exceptions, creating exception subclasses, using exceptions	4
8.	**Applets :** applet fundamentals, native methods, static import, the applet class, applet display method, requesting repaining, a banner applet, passing parameters to applets, uses of applets	3
	Total	42

11. Suggested Books:

S.No.	Name of Books/Authors/Publisher	Year of Publication
	Text Books:	
1.	Dietel and Associates, "Java How to Program", 7th edition, Prentice-Hall, December 2006	2006
2.	David Flanagan, "Java in a Nutshell, 5th edition, O'Reilly Media, Inc.,	2005
	Reference Books:	
3.	Bruce Eckel, "Thinking in Java", Prentice Hall	1998
4.	The Java Language Specification 2nd Ed. By James Goslimg, Bill Joy, Guy Steele, Gilad Bracha	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

ACADEMIC CALENDAR FOR THE AUTUMN SEMESTER SESSION 2007-2008

1.	Joint Entrance Examination Counselling for B.Tech. / B.Arch./ IDD / Integrated M.Sc. & M.Tech. Programmes	June 19 -22, 2007	Tues.- Fri.
2.	Joint Entrance Examination Architecture Aptitude Test	June 22, 2007	Friday
3.	Last date for submission of M.Tech. / M.Arch./ MURP / M.Phil / M.Sc. & M.Tech.(ES) dissertation.	June 29, 2007	Friday
4.	Joint Entrance Examination Counselling for Preparatory Courses	July 06, 2007	Friday
5.	Examinations for Summer Term	July 06-08, 2007	Fri. - Sun.
6.	Declaration of Results for Summer Term Examination	July 10, 2007	Tuesday
7.	Final Evaluation of M.Tech. Dissertation of IV semester	July 10, 2007	Tuesday
8.	Institute reopens for the session 2007-2008	July 16, 2007	Monday
9.	Registration for all PG and Ph.D Students (New Entrants)	July 25, 2007	Wednesda
10.	Registration for all UG/PG/Ph.D. students (other than new entrants) in respective departments)	July 25, 2007 (10 A.M. onwards)	Wednesda
11.	Classes begin for all UG/PG courses (other than new entrants) and Ph.D. programmes.	July 26, 2007	Thursday
12.	Registration for all UG courses (New Entrants)	July 26, 2007	Thursday
13.	Orientation for UG/PG students (New Entrants)	July 27, 2007	Friday
14.	Counselling/Registration for PG students against vacant seats only (except for **MBA** programme)	July 27, 2007	Friday
15.	Classes begin for all courses (New Entrants)	July 30, 2007	Monday
16.	Enrolment of N.C.C. / N.S.S. cadets at N.C.C. Parade Grounds of 3 UA CTR NCC	August 01 & 02, 2007 (at 8.00 A.M.)	Wednesda & Thursda
17.	Assignment of UG Projects	August 03, 2007	Friday
18.	Closing of UG/PG/Ph.D. admissions	August 06, 2007	Monday
19.	Last date for subject registration of UG/PG/Ph.D students (New Entrants)	August 06, 2007	Monday
20.	Departments to send the lists of Institute Elective to UG section to be run in Spring Semester – 2007-08	August 17, 2007	Friday
21.	Last date of submission of Seminar (PG students)	August 31, 2007	Friday
22.	UG & PG sections to send to Deptts/Centres final lists of Registered Students	August 31, 2007	Friday
23.	Mid Term Exam. - I for all UG/PG students	September 05 - 06, 2007	Wed.- Thu.
24.	Last date for withdrawal from a course (s)	September 14, 2007	Friday

25.	Last date of display of attendance record of students falling short of minimum attendance requirements during the middle of semester (by departments / centres)	September 20, 2007	Thursday
26.	Intimation to parents/guardians of students having "short attendance" by academic Sections (UGS and PGS&R)	September 27, 2007	Thursday
27.	Intimation to the students (UGS) about the Institute Electives to be run during spring semester 2007-08 by the Academic Section	September 27, 2007	Thursday
28.	Last date for submission of Project (PG studies)	October 01, 2007	Monday
29.	Last date of submission of remaining document(s) by all new entrants	October 01, 2007	Monday
30.	Mid Term Exam.- II for all UG/PG students	Oct. 12 & 15. 2007	Fri. & Mon.
31.	Thomso – 2007 & Rave-2007 (Saharanpur Campus)	To be decided	
32.	Semester break (for students only)	Oct. 16 to 22, 2007	Tue. - Mon.
33.	Issue of blank progress forms for Ph.D. students by the PG section to respective Deptts./Centres	November 01, 2007	Thursday
34.	Last date for finalization of time tables of spring semester -2007-08 session by all departments / centres	November 01, 2007	Thursday
35.	Notification of seating plan Autumn Semester Exam,	November 05, 2007	Monday
36.	Filling of response forms by UG/PG students in the respective Departments /Centres	Nov. 05-08, 2007	Mon.- Thu
37.	Pre subject registration for spring semester for the session 2007-08 for UG students	Nov. 06 – 07 ,2007	Tue. – Wed.
38.	Pre subject registration for spring semester for the session 2007-08 for PG students	Nov. 08 – 09 ,2007	Thu. – Fri.
39.	Notification of dates of Exam. for common subjects.	November 08, 2007	Thursday
40.	Annual Convocation	To be decided	
41.	Information regarding short attendance cases to Academic Sections UGS and PGS&R by Departments/Centres	November 13, 2007	Tuesday
42.	Last date of Teaching for all UG/PG classes	November 21, 2007	Wednesday
43.	Display of course work evaluation	November 22, 2007	Thursday
44.	Notices to students' Notice Boards regarding shortage of attendance (by Departments/Centres)	November 23, 2007	Friday
45.	Action by Academic sections UGS/PGS&R to ascertain that the detained students do not appear in Exam.	November 23, 2007	Friday
46.	Last day of evaluation of M.Tech. Dissertation for 3rd Semester & sending of satisfactory/unsatisfactory report to A.R. (PGS&R) by departments/centres	November 23, 2007	Friday
47.	Practical Examination, if any	Nov.23 to 25, 2007	Fri-Sun
48.	End Term Exam. for all UG/PG/Ph.D. classes including Preparatory course	Nov.26 to Dec. 04, 2007	Mon.-Tue.
49.	NCC Camp	To be decided by DOSW	
50.	J.M.E.T.-2007 Examination	To be decided	
51.	Last date to show the answer scripts of End Term Examination to the students	December 10, 2007	Monday

52.	Finalization of grades by the grade Moderation Committees	December 11, 2007	Tuesday
53.	Display of grades for all classes on Department Notice Board	December 11, 2007	Tuesday
54.	Last date for sending of grades to Academic Section UGS & PGS&R after scrutiny	December 12, 2007	Wednesc
55.	Submission of progress reports of the Ph.D. students by the Departments/Centres	December 14, 2007	Friday
56.	Last date for declaration of Autumn Semester results	December 15, 2007	Saturday
57.	Winter vacation for Teaching Staff	Dec. 17 - 31, 2007	Mon. - M
58.	Spring Semester 2007-2008 begins	January 01, 2008	Tuesday
59.	Registration for all courses in respective Departments/Centres	January 01, 2008	Tuesday
60.	Classes begin for all courses	January 02, 2008	Thursday

Note: - 1. Heads of Department are requested to please plan the functions / Seminars on Saturdays and Sundays so that the Institute is able to maintain the minimum teaching days required in a semester.
2. Kabad day (Shiv Ratri) is on 11.8.2007.