# सीनेट की 43<sup>वीं</sup> बैठक का कार्यवृत्त MINUTES OF THE 43<sup>RD</sup> MEETING OF THE SENATE

22<sup>वीं</sup> तथा 29<sup>वीं</sup> फरवरी 2012 22<sup>№</sup> AND 29<sup>™</sup> FEBRUARY 2012



भारतीय प्रौद्योगिकी संस्थान रूड़की रूड़की – 247 667 (भारत) INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE – 247 667 (INDIA)

### बैठक अनुभाग MEETING SECTION भारतीय प्रौद्योगिकी संस्थान रूड़की INDIAN INSTITUTE OF TECHNOLOGY ROORKEE



संस्थान के सीनेट हॉल में दिनांक 22 व 29 फरवरी 2012 को आहुत सीनेट की 43वीं बैठक का कार्यवृत्त Minutes of the 43<sup>rd</sup> Meeting of the Senate held on 22<sup>nd</sup> & 29<sup>th</sup> February 2012 in the Senate Hall of the Institute.

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The following were present:-

1. Prof. Pradipta Banerji 2. Prof. D.K. Paul 3. Prof. R. Shankar 4. Prof. S.Y. Kulkarni 5. Prof. R.P. Singh Prof. I.M. Mishra 6. 7. Prof. Surendra Kumar 8. Prof. Bikash Mohanty 9. Prof. Shri Chand 10. Prof. I.D. Mall 11. Prof. Vijay Kumar Agarwal Prof. Ravi Bhushan 12. 13. Prof. V.K. Gupta 14. Prof. Anil Kumar 15. Prof. (Mrs.) Mala Nath 16. Prof. A.K. Singh 17. Prof. S.M. Sondhi 18. Prof. U.P. Singh 19. Prof. M.R. Maurya 20. Prof. A.K. Jain 21. Prof. S.S. Jain 22. Prof. M.N. Viladkar 23. Prof. (Mrs.) Renu Bhargava Prof. U.C. Kothyari 24. 25. Prof. P.K. Garg Prof. Pradeep Bhargava 26. 27.Prof. Satish Chandra Prof. S.K. Ghosh 28.

-Director & Chairman Dy. Director (Architecture & Planning) (Architecture & Planning) (Biotechnology) (Chemical Engineering) (Chemical Engineering) (Chemical Engineering) (Chemical Engineering) (Chemical Engineering) (Chemical Engineering) (Chemistry) (Chemistry) (Chemistry) (Chemistry) (Chemistry) (Chemistry) (Chemistry) (Chemistry) (Civil Engineering) (Civil Engineering)

| 29.                | Prof. Mahendra Singh       |
|--------------------|----------------------------|
| 30.                | Prof. Manoj K. Arora       |
| 31.                | Prof. Manoranian Parida    |
| 32.                | Prof. Praveen Kumar        |
| 33.                | Prof. Ashwani Kumar        |
| 34                 | Prof. H.R. Wason           |
| 35.                | Prof. M.L. Sharma          |
| 36.                | Prof. Ashok Kumar          |
| 37                 | Prof. (Mrs.) Amita Sinvhal |
| 38.                | Prof. H. Sinvhal           |
| 39                 | Prof R P Gupta             |
| 40                 | Prof D K Mukhopadhyay      |
| 41                 | Prof A K Saraf             |
| 42                 | Pro R Anbalagan            |
| 12.<br>12          | Prof R G S Sostry          |
| т <u>э</u> .<br>11 | Prof Mohd Jergil           |
| 44.                | Prof. Supil Poinci         |
| 43.                | Prof. Sumi Dajpai          |
| 40.                | Prof. Sandeep Singh        |
| 47.                | Prof. S.P. Gupta           |
| 48.                | Prof. Vinod Kumar          |
| 49.                | Prof. Pramod Agarwal       |
| 50.                | Prof. Grish Kumar Singh    |
| 51.                | Prof. S. Mukherjee         |
| 52.                | Prof. S.P. Singh           |
| 53.                | Prof. R.P. Maheshwari      |
| 54.                | Prof. S.P. Srivastava      |
| 55.                | Prof. Rajendra Prasad      |
| 56.                | Prof. R.S. Anand           |
| 57.                | Prof. Biswarup Das         |
| 58.                | Prof. A.K. Sarje           |
| 59.                | Prof. S.N. Sinha           |
| 60.                | Prof. Padam Kumar          |
| 61.                | Prof. Manoj Mishra         |
| 62.                | Prof. M.J. Nigam           |
| 63.                | Prof. N.K. Goel            |
| 64.                | Prof. Himanshu Joshi       |
| 65.                | Prof. M. Perumal           |
| 66.                | Prof. Pashupati Jha        |
| 67.                | Prof. D.K. Nauriyal        |
| 68.                | Prof. (Mrs.) Rashmi Gaur   |
| 69.                | Prof. V.K. Nangia          |
| 70.                | Prof. G.S. Srivastava      |
| 71.                | Prof. S.P. Sharma          |
| 72                 | Prof. T.R. Gulati          |
| 73                 | Prof. (Mrs.) Rama Bhargava |
| 74.                | Prof. R.C. Mittal          |

(Civil Engineering) (Civil Engineering) (Civil Engineering) (Civil Engineering) (Earthquake Engineering) (Earthquake Engineering) (Earthquake Engineering) (Earthquake Engineering) (Earthquake Engineering) (Earth Sciences) (Electrical Engineering) (Electronics & Computer Engg.) (Hydrology) (Hvdrology) (Hydrology) (Humanities & Social Sciences) (Humanities & Social Sciences) (Humanities & Social Sciences) (Management Studies) (Mathematics) (Mathematics) (Mathematics) (Mathematics) (Mathematics)

- 75. Prof. V.K. Kativar (Mathematics) 76. Prof. Y.K. Gupta (Mathematics) (Mechanical & Industrial Engg.) 77. Prof. Pradeep Kumar 78. Prof. Satish C. Sharma (Mechanical & Industrial Engg.) 79 Prof. P.K. Jain (Mechanical & Industrial Engg.) 80. Prof. Dinesh Kumar (Mechanical & Industrial Engg.) 81. Prof. B.K. Gandhi (Mechanical & Industrial Engg.) 82. Prof. Ravi Kumar (Mechanical & Industrial Engg.) 83. Prof. S. Ray (Metallurgical & Materials Engg.) 84. Prof. P.K. Ghosh (Metallurgical & Materials Engg.) 85. Prof. S.K. Nath (Metallurgical & Materials Engg.) Prof. Surendra Singh (Metallurgical & Materials Engg.) 86. 87. Prof. Anjan Sil (Metallurgical & Materials Engg.) 88. Prof. A.K. Ray (Paper Technology) 89. Prof. A.K. Singh (Paper Technology) 90. Prof. J.S. Upadhyay (Paper Technology) 91. Prof. Satish Kumar (Paper Technology) 92. Prof. A.K. Jain (Physics) 93. (Physics) Prof. Rajesh Srivastava 94. Prof. Vir Singh (Physics) 95. Prof. Navan Sharma (WRD&M) 96. Prof. M.L. Kansal (WRD&M) 97. Prof. Deepak Khare (WRD&M) 98. Prof. Karmeshu, School of Computers & Systems Sciences, JNU, Delhi 99. Dr. R.P. Saini, Head, Alternate Hydro Energy Centre (AHEC)
- 100. Dr. Ramasre Prasad, Head, Department of Biotechnology
- 101. Dr. S.N. Rangnekar, Head, Department of Management Studies
- 102. Dr. Ajai Gairola, Head, Centre of Excellence in Disaster Mitigation & Management
- 103. Dr. C.B. Majumdar, Associate Dean (SRIC)
- 104. Mr. Yogendra Singh, Librarian
- 105. Dr. Shishir Sinha, Chief Warden, Govind Bhawan
- 106. Dr. D.K. Dwivedi, Associate Professor, MIED
- 107. Dr. Dharam Dutt, Associate Professor, Department of Paper Technology
- 108. Dr. (Ms.) Kusum Deep, Associate Professor, Department of Mathematics
- 109. Dr. Vikas Pruthi, Associate Professor, Department of Biotechnology
- 110. Mr. Prashant Garg, Offtg. Registrar & Secretary, Senate (22.02.2012)
- 111. Lt.Col.(Retd.) A.K. Srivastava, Registrar & Secretary, Senate (29.02.2012)

The Chairman (Director) welcomed the members to the 43<sup>rd</sup> Meeting of the Senate.

The Chairman extended warm and cordial welcome of the undermentioned new members to the Senate and solicited their valuable contribution and active participation in its functioning:

- 1. Dr. R.P. Saini, Head, Alternate Hydro Energy Centre
- 2. Dr. Ramasre Prasad, Head, Department of Biotechnology
- 3. Dr. S.N. Rangnekar, Head, Department of Management Studies
- 4. Dr. Ajai Gairola, Head, Centre of Excellence in Disaster Mitigation and Management
- 5. Dr. (Ms) Bina Gupta, Associate. Professor, Department of Chemistry
- 6. Dr. D.K. Dwivedi, Associate Professor, Department of Mechanical & Industrial Engineering.
- 7. Dr. Dharam Dutt, Associate Professor, Department of Paper Technology.
- 8. Dr. (Ms.) Kusum Deep, Associate Professor, Department of Mathematics
- 9. Dr. Vikas Pruthi, Associate Professor, Department of Biotechnology

Chairman thanked the under-mentioned outgoing members and recorded the Senate's appreciation for their valuable contribution in the meetings of the Senate.

- 1. Prof. Ishwar Singh, Department of Physics
- 2. Dr. Arun Kumar, Ex-Head, AHEC
- 3. Dr. K.L. Yadav, Associate Professor, Department of Physics
- 4. Dr. Dharmendra Singh, Associate Professor, Department of E&C Engg.
- 5. Dr. Yogendra Singh, Associate Professor, Department of Earthquake Engg.
- 6. Dr. R. Krishnamurthy, Associate Professor, Department of Earth Sciences
- 7. Dr. (Ms) Babita Sinha, Assistant Professor, Department of Hum. & Social Sciences

The Senate noted the communication received from Prof. B.K. Gandhi, Department of Mechanical & Industrial Engineering and Prof. N.K. Samadhiya, Department of Civil Engineering for not attending the current meeting.

The Agenda was then taken up:

Item No. 43.1.1 To confirm the minutes of the 41<sup>st</sup> and 42<sup>nd</sup> meeting of the Senate held on 04.11.2011 and 09.12.2011, respectively.

The minutes of the  $41^{st}$  and  $42^{nd}$  meeting of the Senate held on 04.11.2011 and 09.12.2011, respectively were confirmed.

#### Item No. 43.1.2: To receive a report on the actions taken to implement the decisions taken by the Senate in its 41<sup>st</sup> and 42<sup>nd</sup> meeting held on 4.11.2011 and 9.12.2011, respectively.

The Senate noted the actions taken on the decisions taken by the Senate in its 41<sup>st</sup> Meeting held on 4.11.2011 and the 42<sup>nd</sup> meetings held on 9.12.2011, respectively.

#### **ITEMS FOR CONSIDERATION:**

#### Item No. 43.2.1: To consider the request of Head, Department of Electrical Engineering regarding:-

- i) Change of number of credits of Departmental Elective–I for B.Tech. students from 3 credits to 4 credits.
- ii) Revision in the syllabi for the subjects EE-601, 602, 603, 604, 605 & 613 for 4 credits and
- iii) Allowing the Institute Elective IE-01: Advanced Microprocessor and Interfacing as Departmental Elective.

As considered and recommended by the Board of Studies, the Senate decided as under:

- (i) The change of credits of Department Electives-I from 3 credits to 4 credits be accepted. The scheme of IV year B. Tech. (Electrical Engg.) as given in Appendix 'A' be approved.
- (ii) Institute Elective IE-01: Advanced Microprocessor and Interfacing to run as Departmental Elective with the new name as EE-613 Advanced Microprocessor and Interfacing be accepted. However, IE-01 shall continue to run as Institute Elective course of 4 credits for other branches as well.
- (iii) The syllabi of the courses EE-601, 602, 603, 604, 605 and 613 to be offered as Departmental Elective for 4 credits as given in **Appendix 'B'** be approved.

The above will be effective from the next Autumn Semester.

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#### Item No.43.2.2: To consider the various issues as requested by the Head, Department of Mathematic vide letter No.M/C-3/ 333/ SR-4 dated 7.6.2011.

As considered and recommended by the Board of Studies, the Senate decided as under:

- Total credits required for the 2<sup>nd</sup> year M.Sc. (Industrial Mathematics and Informatics) be changed from 95-97 to 91-93.
- (ii) The scheme of M.Sc (Industrial Mathematics and Informatics) as given at **Appendix 'C'** be approved.
- (iii) The load of the core courses, namely, MA-601, MA-603, and MA-605 running in the 5<sup>th</sup> year Integrated M.Sc. Programme with details of syllabi be modified as 3+0 instead of earlier 2+1.
- Item No.43.2.3: To consider the syllabi of the courses for II and III years of revised MCA programme (for the students admitted

The Committee will also suggest the utilisation of expertise of the faculty involved in this programme.

Item No.43.2.4: To consider the request of Head, Department of Electrical Engineering vide letter No. EED/DFB/1142, dated 11.11.11, for the change of Title of course EE-611 from "Embedded Controller" to "Single Chip Microcontroller and Applications".

> As recommended by the Board of Studies, the Senate decided that the change in the Title of course EE-611 from "Embedded Controller" to "Single Chip Microcontroller and Applications" be accepted.

The above will be applicable from the session 2012-13.

#### Item No. 43.2.5: To consider the request from Head, Department of Civil Engineering vide letter No. CED/DFB/1/JULY/2011-12/ 1431 dated 1.8.2011.

As recommended by the Board of Studies, the Senate decided that the amendment in course contents of the subject "Advanced Steel Design" for the Integrated Dual Degree B.Tech. (Civil Engg.) and M.Tech (Structural Engineering) as given at **Appendix 'E'** be approved.

# Item No.43.2.6: To consider the constitution of the Board of Research for a period 2 years (sessions 2011-12 and 2012-13).

The Senate authorise the Director, (Chairman, Senate) to nominate the two Senate nominees on the Board of Research. Further, The Senate decided that members from the Centres of Excellence be also included on the Board of Research.

#### Item No. 43.2.7: To consider the difficulties faced by some Departments in their inability to provide teachers for EC-101A course.

After in depth deliberations, the Senate decided that the following committee be constituted to examine this issue and suggest solution:

- 1. Dean Academic Studies Chairman
- 2. Heads of the concerned Departments Member

The committee shall submit its report within 45 days. The report, so submitted, will be placed before the Director (Chairman, Senate) for approval. The action, taken by the Director (Chairman, Senate), will be reported to the Senate.

Item No.43.2.8: To consider the letter No. ECE/Acd-7/4036 dated 6.1.2012 received from Dr. Padam Kumar, Prof. & Head, Deptt. of Electronics & Computer Engineering regarding not to take the responsibility of teaching EC-101A unless there is significant addition of faculty in the department.

This letter was related to item No. 43.2.7

#### Item No.43.2.9: To consider the renaming of "Board of Studies" as "Academic Programme Committee".

The Senate decided that the title of all the internal Boards, other than the Statutory Board of Governors be changed to Committees and the Senate Manual be amended accordingly. The changes are as under:

| Sl.No. | Existing Name  | Proposed name   |
|--------|--|---|
| 1.     | Board of Sponsored<br>Research and Industrial<br>Consultancy (BSRIC) | Sponsored Research<br>and Industrial<br>Consultancy Advisory<br>Committee (SRIC-AC) |
| 2.     | Board of Studies (BOS)   | Institute Academic<br>Programme Committee<br>(IAPC)                                 |
| 3.     | Board of Research (BOR)  | Institute Academic<br>Research Committee<br>(IARC)                                  |
| 4.     | Departmental/Centre's<br>Faculty Board(FDB/CFB)                      | Departmental/Centres<br>Faculty Committee<br>(DFC/CFC)                              |

An agenda item in this regard be placed before the Board of Governors for approval.

# Item No.43.2.10: To consider the revision of rates of fellowships for the Post Doctoral Fellows.

The Senate decided that the rates of fellowship for the post of Doctoral Fellows be enhanced as given below:

| Qualifications / Experience       | Amount of Fellowship |
|-----------------------------------|----------------------|
| 1. Ph.D. with two year experience | Rs.40,000/-p.m.      |
| 2. Recent Ph.D. Degree holder     | Rs.35,000/-p.m.      |

The existing guidelines for award of Post Doctoral Fellowship will have the provision of teaching assistance from Post Doctoral Fellows.

#### Item No.43.2.11: To consider the period of absence that can be allowed to a Research Scholar for visits in India or abroad in connection with their research work etc.

As considered and recommended by the Board of Research, the Senate decided that a Research Scholar be ordinarily allowed an absence from the Institute normally upto 03 months in an year for field work/research work in other Institute in India or abroad during first 03 years of his/her studies at IIT Roorkee but in no case his/her absence be more than 50% of the total duration of Ph.D. on the recommendations of his Ph.D. Supervisor(s) with details of contact person to the Dean (Academic Research) in the Institute.

Further decided that the research scholar will only be entitled for institute assistantship or scholarship provided he/she does not receive any stipend/scholarship from sponsoring institution or organization.

Further decided that the research scholars attending Institutes/ Organisation under exchange programmes or MoU be solely governed by the terms of the MoU or Exchange Programme.

# Item No.43.2.12: To consider the quantum of leave that can be allowed to the Research Scholars.

As considered and recommended by the Board of Research, the Senate decided the under-mentioned quantum of leave that can be allowed to the Research Scholars:

A full-time research student/candidate, during his/ her stay at the Institute will be entitled to leave for 30 days per academic year including leave on medical grounds, in addition to Public Holidays. He/she will not be entitled to mid-semester breaks, summer and winter vacations.

- a) A proper leave account of each research student/ candidate shall be maintained by the Department/ Centre concerned.
- b) Women scholars are entitled for maternity leave with full fellowship/assistantship as applicable, for a period not exceeding 135 days, once during the tenure of their award. The application for maternity leave should be supported by medical certificate.
- c) Male Scholars are entitled for 15 days paternity leave once during the tenure of their award. The application for paternity leave should be supported by medical certificate.
- d) Participation in Seminars/ Conferences in India /abroad by research scholars to present paper will be treated on duty. However, permission from Dean Academic Research be obtained prior to proceeding for conference etc.
- e) Research student/candidate supported by a Govt./ semi-Govt. agencies may be governed by their own rules, if applicable.

#### Item No.43.2.13: To consider the question of admission of candidates with M.Tech. degrees from IITs/IISc. to the Ph.D. Programmes on priority basis.

As considered and recommended by the Board of Research, the Senate decided that the admission of candidates with M.Sc./M.Tech. Degrees from IITs/IISc. to the Ph.D. Programmes on priority basis be approved as follows:

- a. Candidates with M.Tech. degree in Engg. or M.Arch. having a CGPA of 7.50 or more from IITs/IISc. be called for interview and recommendations for their admission will be sent separately by the departments without taking into account their merit with candidates from other institutions.
- b. Candidates with M.Sc./M.Tech. degree in Sciences having a CGPA of 8.00 or more be called for interview and recommendations for their admission will be sent separately by the departments without taking into account their merit with other candidates.

Selection of these candidates will only be based upon their merit in written test and/or interview (100% weightage) as the case may be.

#### Item No.43.2.14: To consider the GATE as a requirement for M.Tech./ M.Arch. candidates for admission to Ph.D. Programmes.

The Senate decided that the issue be re-considered by the Board of Research for more clarification.

#### Item No.43.2.15: To consider requirement of TOEFL/IELTS for Foreign Nationals seeking admission to Ph.D. Programmes at this Institute.

As considered and recommended by the Board of Research, the Senate decided that the requirement of TOEFL/ IELTS for Foreign Nationals seeking admission to Ph.D. Programmes at this Institute be made compulsory with the following minimum scores

- TOEFL Average of 70 out of 120
- IELTS 6 on 9 point scale

#### Item No.43.2.16: To consider certain changes/modifications in existing Tables - 1, 2 & 6 and to include the new specialization i.e. Seismic Vulnerability and Risk Assessment in Earthquake Engineering Department for the PG Information Brochure 2012.

As considered and recommended by the PG Admission Committee, the Senate decided as under:

- 1. The proposed number of seats in programme and their minimum qualifications/eligibility criteria for admission to PG programmes as given in **(Table-1)** be approved.
- 2. The proposed GATE disciplines and maximum/ minimum numbers of seats to be filled GATE discipline wise as given in **(Table-2)** be approved.
- 3. The admission criteria for preparing the merit list for admission to PG programmes 2012 of Hydrology and Physics Departments as given in **(Table-6)** be approved.

#### TABLE -1

#### **ESSENTIAL QUALIFICATION / ELIGIBILITY**

| Programme Name                    | Code<br>No. | Approved Qualification/Eligibility          |  |
|-----------------------------------|-------------|---|--|
| <b>Chemistry</b> Departme         | nt          |   |  |
| Advanced Chemical                 | 49          | B.Tech. (Chemical Engg.)/M.Sc. (Chemistry)/ |  |
| Analysis                          |             | M.Sc. (Environmental Science)with           |  |
|                                   |             | Mathematics atleast 10+2 level.             |  |
| Mechanical & Indust               | rial Er     | gineering Department                        |  |
| CAD, CAM &                        | 38          | Bachelor's degree in                        |  |
| Robotics.                         |             | Mechanical/Industrial/Production            |  |
|                                   |             | Engg./Mechatronics or equivalent.           |  |
| Machine Design                    | 39          | Bachelor's degree in                        |  |
| Engg.                             |             | Mechanical/Industrial/Production            |  |
|                                   |             | /Automobile Engg. or equivalent.            |  |
| Earthquake Engineering Department |             |   |  |
| Seismic Vulnerability             |             | 15 seats (New Programme)                    |  |
| and Risk Assessment               |             |   |  |

#### TABLE-2

#### GATE DISCIPLINE

| Department                   | Programme Name                         | Code No. | Approved G                 | ATE Discipline             |
|------------------------------|--|----------|----------------------------|----------------------------|
|                              |  |          | Minimum<br>Number of seats | Maximum Number<br>of Seats |
| Chemistry                    | Advanced Chemical<br>Analysis          | 49       | CY/CH (15)                 | -                          |
| Mech. & Indl.<br>Engineering | M.Tech Machine<br>Design               | 39       | ME/PI (18)                 | -                          |
| Physics                      | Solid State<br>Electronics Materials   | 50       | PH(12)                     | <b>EE/EC</b> /MT (6)       |
| Met. & Mat.<br>Engineering   | Corrosion Engg                         | 43       | MT(3)                      | ME/PI/CH/<br>PH/CY/XE (15) |
|                              | Industrial Metallurgy                  | 44       | MT(3)                      | ME/PI/ <b>XE</b> (15)      |
|                              | Physical<br>Metallurgy                 | 45       | MT(3)                      | ME/PI/PH/ XE<br>(15)       |
| Electrical<br>Engineering    | Instrumentation &<br>Signal Processing | 28       | EE(12)                     | EC/IN(11)                  |
|                              | Systems & Control                      | 30       | EE[16]                     | EC/IN(7)                   |
| Nano-<br>technology          | Nanotechnology                         | 15       | MT/ME/EC/<br>CH(6)         | CY/PH(6)<br>BT/XL(3)       |

#### Table – 6

#### ADMISSION CRITERIA FOR NEW PROGRAMME

| Department                           | Admission Criteria                             |
|--------------------------------------|--|
| Physics                              | 70% Normalized GATE marks and 30% Written Test |
| Hydrology Only Normalized GATE marks |  |

#### Item No.43.2.17: To consider the request of Head, Department of Civil Engineering vide letter No. CED/DFB/2/NOV/2011-12/156 dated 05.12.2011 regarding change in the course structure of Transportation Engineering-I, CE-362 as (3L-1T-2/2P) with the distribution of marks as CWS:15, PRS:15, MTE 30 and ETE:40.

As considered and recommended by the Board of Studies, the Senate decided that proposed changes suggested by the Department of Civil Engineering regarding change in the course structure of Transportation Engineering-I, CE-362 as (3L-1T-2/2P) with the distribution of marks as CWS:15, PRS:15, MTE 30 and ETE:40 be approved.

#### Item No.43.2.18: To consider the proposal received vide letter No. EQD/ DFB-2011/194 dated 3.12.2011 from Prof. & Head, Department of Earthquake Engineering to start a new two year Full Time M.Tech. Programme "Seismic Vulnerability and Risk Assessment".

After discussion, the Senate approved the proposal for starting a new two Year Full time M.Tech. Programme "Seismic Vulnerability and Risk Assessment" in the Department of Earthquake Engineering with intake of 15 students as given at **Appendix 'F'**. The said course will start with effect from the Academic Session 2012-13.

#### Item No.43.2.19: To consider the proposal for New M.Tech. Programme in "Disaster Mitigation and Management".

As considered and recommended by the Faculty Board of the Centre of Excellence in Disaster Mitigation & Management, the Senate decided that the proposal to start a new M.Tech. Programme on "Disaster Mitigation and Management" as given at **Appendix 'G'** be approved. The said course will start from the Academic Session 2012-13.

The Senate further decided that the Ph.D. Research Scholars be registered in all the Centres of Excellence.

#### Item No.43.2.20: To consider the enhancement of amount of "Jaiprakash Sewa Sansthan Scholarship" from Rs.12,000/- to Rs.20,000/- without any change in number of scholarships and eligibility conditions.

The Senate discussed and accepted the proposal for enhancing the amount of the Jaiprakash Sewa Sansthan Scholarship from Rs.12,000/- to Rs.20,000/- w.e.f. the Academic Session 2012-2013, without any changes in the number of scholarship and eligibility conditions.

#### Item No.43.2.21: To consider the following two proposals received from the Head, Centre of Nanotechnology vide letter dated 07.02.2012:

# 1. Bionanomaterials- Institute elective course (under the category BGSEC).

#### 2. Nanomedicine- Department elective course

The Senate considered the recommendations of the Board of Studies and decided to accept the two proposals one for Institute Elective under the category of BGSEC and another for Department Elective for P.G. courses as submitted by the Centre of Nanotechnology as given at **Appendix 'H'**.

#### Item No.43.2.22: To consider the proposal received from the Head, Department of Earth Sciences vide letter No. ES/S-30/ 3549 dated 9.2.2012 regarding syllabi (under the BGSEC category) of the following courses.

- 1. IES-01: Fractals and Applications
- 2. IES-02: Global Climate
- 3. IES-03: Fundamentals of Petroleum Geology
- 4. IES-04: Planetary Geosciences
- 5. IES-05: Glaciology

As considered and recommended by the Board of Studies, the Senate approved the syllabi (Under the BGSEC category) of the under-mentioned five courses submitted by the Department of Earth Sciences as given at **Appendix 'I'**:

1. IES-01: Fractals and Applications

2. IES-02: Global Climate

3. IES-03: Fundamentals of Petroleum Geology

4. IES-04: Planetary Geosciences

5. IES-05: Glaciology

#### Item No.43.2.23: To consider the renaming of "Board of Research" as "Institute Research Advisory Committee".

Refer to item No. 43.2.9.

#### Item No.43.2.24: To consider the modifications in the teaching scheme of the Department of Electronics and Computer Engineering and the inclusion of two new courses.

Senate considered the recommendations of the Board of Studies and approved the modifications in the teaching schemes of B.Tech./IDD programmes, as suggested by the Department of Electronics & Computer Engineering in view of the new teaching scheme for the M.Tech. programmes of the Department. The modification be implemented from the Session 2010-11 as given in the **Appendix 'J'**.

#### Item No.43.2.25: To consider the recommendations of DFB of the Department of Electronics & Computer Engineering for discontinuation of IDD (CSE) and M.Tech. (IT) programmes in the department.

The Senate considered the recommendation of the Faculty Board of the Department of Electronics & Computer Engineering and decided as under:

- 1. M.Tech. (Information Technology) Programme of the Department of Electronics & Computer Engineering be discontinued from the academic session 2012-13.
- 2. Students intake (23 Nos.) of M.Tech. (Information Technology) Programme of the Department of Electronics & Computer Engineering be transferred to the M.Tech. (Computer Science & Engineering) Programme from the session 2012-13.
- 3. IDD (Computer Science & Information Technology) programme of the Department of Electronics & Computer Engineering be discontinued from the academic session 2012-13.

4. 25 seats of IDD (Computer Science & Information Technology) be merged in the B.Tech. (Computer Science & Engineering) w.e.f. session 2012-13.

#### Item No.43.2.26: To consider the Academic restructuring of Saharanpur Campus

The Senate decided that the Saharanpur Campus be re-structured as stated below with effect from 1<sup>st</sup> March 2012. A detailed agenda note in this regard be prepared for obtaining the approval of the Board of Governors for the proposed re-structuring:

| S1.<br>No. | Name of the proposed Department                 | Proposed Academic Programmes   |
|------------|---|--|
| 1.         | Department of Paper<br>Technology               | • B. Tech. (Pulp & Paper)<br>• M. Tech. (Pulp & Paper)                         |
| 2.         | Department of Polymer &<br>Process Engineering  | <ul> <li>Integrated M. Tech. (Polymer<br/>Science &amp; Technology)</li> </ul> |
|            |   | • IDD B. Tech. (Process Engg.)+<br>MBA   |
|            |   | <ul> <li>3-year post B.Sc. M.Tech.<br/>(Packaging Technolog)</li> </ul>        |
| 3.         | Department of Applied<br>Science & Engineering. | •Interdisciplinary Programmes.   |

The Senate further decided that the under-mentioned committee be constituted for exploring and suggesting the possibilities of starting new academic programmes of National Interest at the Saharanpur Campus, so as to make the Saharanpur Campus a Centre of Excellence:

Dean, Academic Studies- ChairmanHead, Department of Paper Technology- MemberHead, Department of Civil Engineering- MemberHead, Mechanical & Industrial Engineering- MemberHead, Chemical Engineering- Member

The Committee will submit its report by 6<sup>th</sup> of March 2012.

#### Item No.43.2.27: To consider the proposal for restructuring and renaming the Integrated Master of Technology (Polymer Science Technology) programme of 05 years duration to B.Tech (Polymer Science & Technology) programme of four years duration at Saharanpur Campus.

The Senate decided that the proposal for restructuring and renaming the 05 years Integrated Master of Technology (Polymer Science & Technology) programme to 04 years B.Tech (Polymer Science & Technology) to be run at Saharanpur Campus be accepted.

Item No.43.2.28: To consider the proposal received from the Department of Metallurgical and Materials Engineering for revamping the B.Tech. (Metallurgical and Materials Engineering) programme and to introduce Integrated Dual Degree (IDD) programme with Materials Engineering specialization.

The Senate decided that the proposal for introduction

of new IDD programme **[B.Tech. (Metallurgical and Materials Engineering) and M.Tech. (Materials Engineering)]** with new curriculum structure and syllabi as given at **Appendix 'K'** be approved. The said course will be started from the session 2012-13.

The Senate further decided the reallocation of seats as under:

| B.Tec | ch. Programme | 90 seats |
|-------|---------------|----------|
| IDD   | Programme     | 20 seats |

#### Item No. 43.3.1: To report the institution of "Vinay K. and Sunita Jain Award' for Excellence in Information and Communication Technologies (ICT).

The Senate noted that the Director has approved the proposal to institute "Vinay K. and Sunita Jain Award' for Excellence in Information and Communication Technologies (ICT) of Rs.5,000/- p.a. one each for Fourth year male student and female student on the basis of performance up

to 3<sup>rd</sup> year. In case the recipient is receiving another award at the same time, the award should go to next performer.

#### Item No. 43.3.2: To report the amendment of Clause No. 36(2) of the Academic Programme Ordinances & Regulations- 2011

The Senate noted that the Director has approved the amendment of Clause No. 36(2) of the Academic Programme Ordinances & Regulations- 2011 as stated below:

"A student registered for the fifth year of the IDD Programme" may be amended as "A student registered for the fifth year of IDD/IMT programmes".

#### Item No. 43.3.3: To report the reallocation of seat for JEE-2012.

The Senate noted the reallocation of seats for JEE-2012 for admission through JEE-2012 as given at **Appendix** 'L'.

# Item No. 43.3.4: To report the matter related to delay in the declaration of Spring Semester (2010-11) results for several classes.

The Senate noted the reasons giving by the Dean, Academic Studies on the delay in the declaration of results for some branches of B.Tech./ IDD/ Integrated M.Sc./Integrated M.Tech. Programme.

The meeting ended with a Vote of Thanks to the Chair.

## Appendix 'A' Item No. Senate/43.2.1

715/111

| CURRICULAR COMPONENTS                       | Credits   | Permissible  |
|---|-----------|--------------|
|   | (B.Tech.) | Range        |
| (a) Institute Core (IC) Courses             |           | · · · ·      |
| L Humanities, Social Sciences and           | 10        | 10           |
| Management (HSSMC)                          |           |              |
|   | 21        | • 21         |
| III General Sciences (GSC)                  |           | 06           |
| W Engineering Sciences (ESC)                |           | 28           |
|   |           | · 20 .       |
| Total                                       | 65.       | 65           |
| (b) Department Core Courses (DCC)           |           |              |
| Class Contact Core courses                  | 64        | 62-65        |
| II: Communication skills                    | 02        | 02           |
| III. Maior Project                          | .08       | 08           |
| IV. Minor Project/ Practical Work/ Case     | 02        | 02           |
| Studies                                     | 02        | 02           |
| V Practical/Field Training                  |           |              |
| Total                                       | 78        | 76-79        |
|   |           |              |
| (d) Departmental Elective Courses (DEC)     | 16        | 15-18        |
|   |           |              |
|   | •         |              |
| (e) Institute Elective Courses (IEC)        | 20        | · 20-24      |
|   |           |              |
| (f) Extra-Curricular Activities (ECA)       |           |              |
| I, Discipline (2 Credits/year for 3 years)  | .06 1     | <b>0</b> 6 · |
| II. NCC/NSS/NSO (First Year)                | 02        | 02           |
| III. NSO/Proficiency (Second year to Fourth | 03        | 03           |
| year)                                       |           | •            |
| Total                                       | 11        | . 11.        |
|   | ļ         | · • • •      |
|   |           |              |
| Grand Total                                 | 190       | 187-193      |
|   | . `       |              |

### Revised Structure of B.Tech. (Electrical) Program

-2/0-

#### Program Code: 15

ÍV

B.Tech. (Electrical Engineering)

Department: EE Department of Electrical Engineering

Year:

|        |                 | Teaching Scheme           |                 | -       | Co<br>Hou | ontao<br>Irs/W | ct<br>eek | Exa<br>Dura | am<br>tion | Re  | lative | e Wei | ght (% | %)  |
|--------|-----------------|---------------------------|-----------------|---------|-----------|----------------|-----------|-------------|------------|-----|--------|-------|--------|-----|
| S. No. | Subject<br>Code | Course Title              | Subject<br>Area | Credits | L         | т              | ₽         | Theory      | Practical  | CWS | PRS    | MTE   | ETE    | PRE |
|        |                 | Se                        | emester- VII    | (Autu   | mn)       |                |           |             |            |     |        |       |        |     |
| 1.     | EE-401          | Protection and Switchgear | DCC             | 4       | 3         | 0              | 2         | 3           | 3          | 15  | 15     | 15    | 40     | 15  |
| 2.     | EE-403          | Training & Seminar        | DCC             | 2       | 0         | 2              | 0         | 0           | 0          | 100 | -      | -     | -      | -   |
| 3.     | EE-405          | Minor Project             | DCC             | 2       | 0         | 0              | 2         | 0           | 0          | 100 | -      | -     | -      | -   |
| 4.     | EE-ELE1         | Departmental Elective-I   | DEC             | 4       | 3         | <b>-</b> '     | -         | 3           | 0          | -   | -      | -     | -      | -   |
| 5.     | EE-ELE2         | Departmental Elective-II  | DEC             | 4       | 3         | -              | -         | 3           | 0.         | -   | -      | -     | -      | -   |
| 6.     | EE-IE5          | Institute Elective-V      | ESEC            | 4       | 3         | 1              | 0         | 3           | 0          | 25  | -      | 25    | 50     | -   |
| 7.     | EE-402          | Major Project             | DCC             | 0       | 0         | Õ              | 3         | 0           | 0          | -   | -      | -     |        | -   |
|        |                 | Total                     |                 | 20      | 12        | 3              | 7         |             |            |     |        |       |        |     |
|        |                 |                           |                 |         |           |                |           |             |            |     |        |       |        |     |
|        |                 | S                         | emester-VII     | l (Spr  | ing)      |                |           |             | -          |     |        |       | -      |     |
| 1.     | EE-402          | Major Project             | DCC             | 8       | 0         | 0              | 8         | 0           | 0          | 100 | -      | -     | -      | -   |
| 2.     | EE-ELE3         | Departmental Elective-III | DEC             | 4       | 3         | -              | -         | 3           | 0          | -   | -      | -     | -      | ~   |
| 3.     | EE-ELE4         | Departmental Elective-IV  | DEC             | 4       | 3         | -              | -         | 3           | 0          | -   | -      | -     | -      | -   |
| 4.     | EE-IE6          | Institute Elective-V1     | HSSMEC          | 3       | 2         | 1              | 0         | 2           | 0          | 25  | -      | 25    | 50     | -   |
|        |                 | Total                     |                 | 19      | 8         | 1              | 8         |             |            |     |        |       |        |     |

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| Teaching Scheme |                 | Contact<br>Hours/Week                               |                 | Exam<br>Duration |          | Relative Weight (%) |     |        |           | %)  |     |     |     |     |
|-----------------|-----------------|---|-----------------|------------------|----------|---------------------|-----|--------|-----------|-----|-----|-----|-----|-----|
| S. No.          | Subject<br>Code | Course Title  | Subject<br>Area | Credits          | <b>L</b> | Т                   | Р   | Theory | Practical | CWS | PRS | MTE | ETE | PRE |
| 1.              | EE-601          | Artificial Neural Networks                          | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 2.              | EE-602          | Utilization and Traction                            | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 3.              | EE-603          | Testing and Commissioning of Electrical Equipment   | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | .25 | -   | 25  | 50  | -   |
| 4.              | EE-604          | Introduction to Robotics                            | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 5.              | EE-605          | Power System Operation and Control                  | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 6.              | EE-606          | Digital Image Processing                            | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 5Ō  | -   |
| 7.              | EE-607          | Digital Design with VHDL                            | DEC             | 4                | 3        | 0                   | 2   | 3      | -         | 15  | 15  | 30  | 40  | -   |
| 8.              | EE-608          | Digital Control Systems                             | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 9.              | EE-609          | Substation Automation                               | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 10.             | EE-610          | Power System Deregulation                           | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 25  | -   | 25  | 50  | -   |
| 11.             | EE-611          | Single Chip Microcontroller and Its<br>Applications | DEC             | 4                | 3        | 0                   | 2   | 3      | -         | 15  | 15  | 30  | 40  | -   |
| 12.             | EE-612          | Digital Signal Processing                           | DEC             | 4                | 3        | 1                   | 0   | 3      | -         | 15  | 15  | 30  | 40  | -   |
| 13              | EE-613          | Advanced Microprocessors and Interfacing            | DĒC             | 4                | 3        | 1                   | 2/2 | 3      | -         | 15  | 15  | 30  | 40  | -   |

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# List of Departmental Electives (Autumn/Spring Semester)

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### Appendix 'B' Item No. Senate/43.2.1

75/11/1

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAME OF DEPTT./CENTRE:           | Department of Electrical Engineering     |
|----------------------------------|--|
| 1. Subject Code: EE- 601         | Course Title: Artificial Neural Networks |
| 2. Contact Hours: L: 3           | T: 1 P: 0                                |
| .3. Examination Duration (Hrs.): | Theory 3 Practical 0                     |
| 4. Relative Weight: CWS          | 25 PRS 0 MTE 25 ETE 50 PRE 0             |
| 5. Credits: 4 6. Se              | mester: Both 7. Subject Area: DEC        |

7. Pre-requisite: Nil

9. Objective: •

۰<sup>.</sup>..

To familiarize with the concepts, strength and weaknesses of neural networks in problem solving.

10. Details of Course:

| S. No. | Contents   | •Contact Hours |
|--------|--|----------------|
| 1.     | 'Introduction: History of neural networks, biological neurons and    | . 3 .          |
| • •    | information processing in biological neurons; Neural networks,       |                |
| . •    | artificial neurons, networks of artificial neurons.                  |                |
| 2. ·   | Single Layer Perceptron: Single neuron models, learning and          | 7              |
|        | generalization in single layer perceptrons, convergence of           |                |
| •      | perceptron learning rule, Hebbian learning, gradient descent         | •              |
|        | learning, least mean square (LMS), concept of decision boundaries,   |                |
| •      | practical considerations, adaline and madaline, adaptive filtering.  | •              |
| 3.     | Multi-Layer Perceptrons (MLP): Back-Propagation, learning with       | 6              |
|        | momentum, problems with back-propagation networks under-fitting      | · ·            |
| •      | and over-fitting, methods to improve generalization, applications of |                |
|        | multi-layer perceptrons, and computational power of multi-layer      |                |
|        | perceptrons.   | • •            |
| 4 / ·  | Radial Basis Function (RBF) Networks: Introduction, Radial           | 4              |
|        | Basis Functions, learning in RBF networks, unsupervised learning of  | ·              |
|        | hidden layer, comparison of RBF networks and MLP networks.           | · .            |

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| S. No. | Contents   | Contact Hours |
|--------|--|---------------|
| 5.     | Attractor Type Networks: Hopfield networks, dynamics of            | 8             |
| ·      | Hopfield networks, energy concepts, Boltzman machine, brain-state- |               |
| ļ·     | in a box (BSB) networks, generalized BSB networks, attractor type  |               |
|        | networks for content addressable memories, solving optimization    | •             |
|        | problem using attractor type networks.                             |               |
| 6.     | Support Vector Machines (SVM): Concept of statistical learning,    | 5             |
|        | concept of VC dimension, linear SVM, kernels, nonlinear SVM,       | •             |
|        | classification and function approximation using SVM.               |               |
| 7.     | Unsupervised Learning: Maxnet, competitive learning, self-         | 8             |
|        | organizing feature maps, ART networks, grow when required          |               |
|        | (GWR) networks, learning vector quantizers (LVQ).                  | •             |
| 8.     | Advanced Topics: Evolving neural networks, fuzzy logic and         | · 8 · ·       |
|        | evolutionary computation applications in neural networks, hidden   | -             |
| . (    | Markov models (HMM) and hybrid approaches, implementation of       | • •           |
|        | neural networks- hardware and optical, spiking neurons and pulsed  |               |
|        | neural networks (PNN)  |               |
|        | Total  | 42            |

### 11. Suggested Books:

| S. No. | Name of Authors /Books / Publishers  | Year of<br>Publication/ |
|--------|--|-------------------------|
|        |  | . Reprint               |
| 1.     | Haykin S., "Neural Networks - A Comprehensive Foundation", 2 <sup>nd</sup> | 2007                    |
| •.     | Ed., Prentice Hall International Edition.                                  |                         |
| 2.     | Mehrotra K., Mohan C. K. and Ranka S., "Elements of Artificial             | 2007                    |
|        | Neural Networks", Penram International.                                    |                         |
| 3.     | Jacek M. Z., "Introduction to Artificial Neural Systems", Jaico            | 2003                    |
|        | Publishing House.  | • •                     |
| 4.     | Anderson J. A., "An Introduction to Neural Networks", Prentice             | . 2007                  |
| · .    | Hall of India Private Limited.   |                         |
| 5.     | Hassoun M. H., "Fundamentals of Artificial Neural Networks",               | 2007                    |
|        | Prentice Hall of India Private Limited.                                    | · :                     |

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# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAME OF DEPTT./CENTRE:          | Department of Electrical Engineering |                       |   |  |  |  |
|---------------------------------|--------------------------------------|-----------------------|---|--|--|--|
| 1. Subject Code: EE-602         | Course Title: Uti                    | lization and Traction |   |  |  |  |
| 2. Contact Hours: L: 3          | <b>T:</b> : 1                        | P: 0                  |   |  |  |  |
| 3. Examination Duration (Hrs.): | Theory 3                             | Practical 0           |   |  |  |  |
| 4. Relative Weight: CWS         | 5 PRS 0.MT                           |                       |   |  |  |  |
| 5. Credits: 4 6. Se             | mester: Both                         | 7. Subject Area: DEC  | • |  |  |  |

### 8. Pre-requisite: EE-202 or equivalent

9. Objective:

To familiarize with important industrial applications of electrical energy such as electric traction, illumination, electric welding, electric heating and electrolytic process.

10. Details of Course:

|        |  | • • • •       |
|--------|--|---------------|
| S. No. | Contents   | Contact Hours |
| • -    | Electric Traction  |               |
| 1.     | Classification of electric traction services, operational constraints of         | 2             |
| •      | main line and suburban trains, electric power supply system.                     |               |
| 2.     | Nature of traction load, coefficient of adhesion, duty cycle, driving axle code. | • 3           |
| 3.     | Types of dc motors used in traction and their series-parallel                    | ÷ 2 .         |
|        | connections for sharing load.  |               |
| 4      | Calculation of tractive effort and energy consumption, maximum                   | 5             |
|        | allowable tractive effort.   |               |
| 5.     | Traction dc motor control, conventional and semiconductor                        | . 5           |
|        | converter control, different topologies.   |               |
| 6.     | Poly-phase motors in traction drives, different topologies.                      | 3 :           |
| 7.     | Diesel electric traction.  | · 1           |
| ÷.     | Illumination   |               |
| · 8.   | Nature of sunlight, definition of lighting terms, luminous efficiency,           | 4 .           |
| •      | production of light, electric discharge, fluorescent and filament                |               |
|        | lamps, polar curves.   |               |

S/11/1.)

| S. No.    | Contents  | Contact Hours |
|-----------|---|---------------|
| <b>9.</b> | Lighting calculation, solid angle, square law, cosine cube law, light flux method.  | 3             |
| 10.       | Design of flood lighting, design of street lighting.  | 3             |
| 11.       | Electric Welding and Heating ·<br>Advantages and methods of electric heating, resistance ovens,<br>induction heating, dielectric heating, arc furnace, heating of<br>buildings, electric welding. | 6             |
| 12.       | Electrolytic Process<br>Fundamental principles, extraction and refining of metals, electro-<br>deposition, power supply for electrolytic processes.   | 5             |
|           | Total   | 42.           |

11. Suggested Books:

| S. No. | Name of Authors /Books / Publishers  | Year of .    |
|--------|--|--------------|
|        |  | Publication/ |
|        |  | Reprint      |
| 1.     | Dubey G. K., "Fundamentals of Electric Drives", 2 <sup>nd</sup> Ed., Narosa<br>Publishing House.                     | 2007         |
| 2.     | Taylor E. O., "Utilisation of Electric Energy (in Sl units)", Orient<br>Longman, Revised in S.I. units by Rao, V.V.L | 1999         |
| 3.     | Hancock N. N., "Electic Power Utilisation", Wheelers.  | 1979         |
| 4      | Pratap H., "Modern Electric Traction", Dhanpat Rai and Sons.   | 2007         |

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|                                   |                        | 01 E100                                  | meening          |
|-----------------------------------|------------------------|--|------------------|
| 1. Subject Code: EE-603           | Course Title: To<br>El | esting and Commis<br>lectrical Equipment | isioning of<br>t |
| 2. Contact Hours: L: 3            | T: 1                   | P: 0                                     | :                |
| 3. Examination Duration (Hrs.): 7 | heory 3                | Practical                                | 0                |
| Relative Weight: CWS 25           | PRS 0 M                | TE 25 ETE 50_                            |                  |

9. Objective: To provide the installation, commissioning, testing and maintenance procedures of large rating transformers, induction machines and synchronous machines.

10. Details of Course:

|              |   | · · · ·              |
|--------------|---|----------------------|
| S. No.       | Contents  | <b>Contact Hours</b> |
|              | Transformers  |                      |
| <b>1.</b> `. | Terminal marking, construction of transformers, cooling arrangement.  | 4                    |
| 2            | Routine tests, measurement of winding resistance, impedance, voltage ratio, insulation resistance.  | 4                    |
| 3.           | Type tests, impulse voltage test, measurement of losses, temperature-rise test.   | 5                    |
| 4.           | Installation and commissioning of transformers, foundation, codes<br>of practice, earthing, pre-commissioning test, testing of oil strength.                  | 4                    |
|              | Induction Machines  |                      |
| ., 5.        | Rating and name plate data, installation and foundation, types of coupling, pre and post commissioning checks.  | 4                    |
| . 6.         | Routine tests and type tests, resistance measurement, no load and blocked rotor test, load test, temperature rise test, high voltage test.                    | 5                    |
| 7.           | Shaft alignment, drying of windings, mechanical tests, air gap<br>symmetry, insulation test, speed and load test, codes of practice,<br>maintenance schedule. | 5                    |

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| S. No. | Contents   | Contact Hours |
|--------|--|---------------|
|        | Synchronous Machines   |               |
| 8.     | Installation, commissioning and performance tests, methods of cooling.   | 5             |
| 9.     | Excitation test, waveform and telephone interference, over-speed<br>test, generator and motor operation, sudden short circuit test,<br>bearing currents. | 6             |
|        | Total  | 42            |

11. Suggested Books:

|         | · · · · · ·   | •               |
|---------|---|-----------------|
| S. No.  | Name of Authors /Books / Publishers                               | Year of         |
| · · · · |   | .' Publication/ |
|         |   | Reprint         |
| 1.      | Fitzgerald A. E., Kingsley C. and Kusko A., "Electric Machinery", | - 2008          |
|         | 6 <sup>th</sup> Ed., McGraw-Hill International Book Company.      |                 |
| 2.      | Say, M. G., "The Performance and Design of Alternating Current    | . 2005          |
|         | Machines", CBS Publishers and Distributors.                       |                 |
| 3.      | Langsdorf A. S., "Theory of AC machines", 2nd Ed., Tata McGraw-   | 2008            |
|         | Hill Publishing Company Limited.                                  |                 |
| 4,      | Transformers: BHEL, Bhopal (Book), Tata McGraw-Hill               | 2008            |
| •       | Publishing Company Limited.                                       | • •             |
| 5.      | BIS Code on Transformers IS-10561                                 | 1983            |
| Í       | BIS Code on Transformers IS-10028                                 | 1985            |
|         | BIS Code on Transformers IS-3151                                  | 1982            |
| 6.      | BIS Code on Motors IS-900   | 1992            |
|         | BIS Code on Motors IS-4722  | 1992            |
|         | BIS Code on Motors IS-4029  | 1967            |
|         | BIS Code on Motors IS-325   | 1978            |
|         | BIS Code on Motors IS-7306  | 1974            |
|         | BIS Code on Motors IS-7132  | 1973            |

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<u> 28</u>-

### INDIAN INSTITUTE OF TEHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Electrical Engineering

1. Subject Code: EE-604 Course Title: Introduction to Robotics

2. Contact Hours: L: 3 T: 0

3. Examination Duration (Hrs.):

Theory

3

4. Relative Weight: CWS 15 PRS 15 MTE 30 ETE 40 PRE

5. Credits:

6. Semester: Both

7. Subject Area: DEC

0

Practical

8. Pre-requisite: EE-306 or equivalent

9. Objective:

To familiarize with the working of robot, its components, position and orientation analysis, robot kinematics, dynamics and control, sensing and vision.

10. Details of Course:

|        | •  |                      |
|--------|--|----------------------|
| S. No. | Contents   | <b>Contact Hours</b> |
| · 1.   | Evolution of robots and robotics, robot anatomy, links, joints,  | 3                    |
|        | degrees of freedom, arm configuration, wrist configuration, end-<br>effector.  |                      |
| 2.     | Mapping between rotated and translated frames, combined rotation<br>and translation of vectors, fundamental rotation matrices.                             | 4                    |
| 3.     | Kinematic modeling of the manipulator, Denavit-Hartenberg<br>notation, kinematic relationship between adjacent links, manipulator<br>transformation matrix | 5                    |
| 4.     | The inverse kinematics, solvability of inverse kinematic model, solution techniques.   | 4                    |
| 5      | Linear and angular velocity of a rigid body, velocity propagation along links, manipulator Jaccobian, static analysis.                                     | . 5                  |
| 6.     | Dynamic modeling, Lagrange-Euler formulation, Newton- Euler formulation.   | 5                    |
| 7.     | Trajectory planning, joint space techniques, cartesian space formulation.  | .4                   |
| · 8.   | Control, of manipulator, PID control scheme, computed torque control, force control of robotic manipulators.   | 4                    |

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| S. No. |   | Contents | 5 |  | ····· |       | Contact | Hours |
|--------|---|----------|---|--|-------|-------|---------|-------|
| 9.     | Sensors in robotics, kinds of sensors used in robotics, robotic vision, |          |   |  |       | 5     |         |       |
|        | industrial applications of vision-controlled robotic systems.           |          |   |  |       |       |         |       |
| 10.    | Robot Applications.   |          | , |  |       | ,     | . 3     |       |
| · .    |   | •        |   |  | · . · | Total | 42      |       |

11. Suggested Books:

|        |   | ·····        |  |
|--------|---|--------------|--|
| S. No. | Name of Authors /Books / Publishers                               | . Year of    |  |
| · ·    |   | Publication/ |  |
| · ·    |   | Reprint      |  |
| 1.     | Fu K. S., 'Gonzalez R. C. and Lee C. S. G., "Robotics: Control,   | 2008         |  |
|        | Sensing, Vision and Intelligence", McGraw-Hill International Book |              |  |
|        | Company.  |              |  |
| 2.     | Klafter R. D., Chmielewski T. A. and Negin-M., "Robotic           | 2007         |  |
| ·J     | Engineering: An Integrated Approach", Prentice-Hall of India.     |              |  |
| 3.     | Niku S. B., "Introduction to Robotics: Analysis, Systems,         | 2007         |  |
|        | Applications", Pearson Education.                                 |              |  |
| 4.     | Schilling R. J., "Fundamental of Robotics: Analysis and Control", | 2007         |  |
| -      | Prentice Hall of India Private Limited.                           | •            |  |
| 5.     | Sciavicco L., "Modeling and Control of Robot Manipulators",       | 2003         |  |
|        | McGraw-Hill International Book Company.                           | •            |  |
| 6.     | Mittal R. K. and Nagrath I. J., "Robotics and Control", Tata      | 2008         |  |
|        | McGraw-Hill Publishing Company Limited.                           | · / ·        |  |

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22/15/11/11 .
NAME OF DEPTT./CENTRE:Department of Electrical Engineering1. Subject Code:EE-605Course Title:Power System Operation and<br/>Control

T:

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MTE

. 25

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ETE

PRE

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

5. Credits: . 4 6. Semester: Both 7. Subject Area: DEC

PRS

#### 8. Pre-requisite: EE-301 or equivalent

L: 3

CWS

25

9. Objective:

To introduce the engineering and economic aspects of planning, operation, controlling power generation and transmission systems in electric utilities.

10. Details of Course

2. Contact Hours:

4. Relative Weight:

| 10. DCG                               |  |               |
|---------------------------------------|--|---------------|
| S. No.                                | Contents   | Contact Hours |
| 1.                                    | General characteristics of modern power systems, evolution,            | 8             |
|                                       | structure, power system control, operating states of a power system    |               |
|                                       | and control strategies, economic load dispatch, function and           |               |
|                                       | applications, price based unit commitment problem.                     | · · · ·       |
| <b>2.</b> <sup>•</sup>                | Concept of reactive power, control of active power and reactive        | 8             |
|                                       | power - active power and frequency control, reactive power flow        | · · ·         |
|                                       | analysis, real power balance and its effect on system frequency;       | -             |
|                                       | Static VAR systems, types of SVC, fundamental frequency.               |               |
| $\sim$                                | performance of SVC, application of SVC.                                | ·             |
| 3.                                    | Automatic generation control (AGC), generation control loops, load     | 10            |
|                                       | frequency control, AGC, tie-line bias control, AGC in isolated and     | · · ·         |
| · · · · · · · · · · · · · · · · · · · | interconnected power systems, AGC with economic dispatch.              | · . ·         |
| 4.                                    | Elements of an excitation system, types of excitation systems, dc, ac, | 8             |
| • .                                   | static and recent developments and future trends, dynamic              | •             |
| • .                                   | performance measures, large signal, small signal, control and          |               |
| ,                                     | protective functions, ac and dc regulators, design of robust           |               |
|                                       | controllers in power systems.  |               |

| S. No. | Contents   | Contact Hours |
|--------|--|---------------|
| 5.     | Division of power system into control areas, load-frequency control<br>of single area and two area system - optimum control criterion, two<br>area and multi-areas power system with and without integral control,<br>SCADA systems, supervisory control, supervisory master stations,<br>remote terminal units, communication links, SCADA systems<br>applications in power networks: | 8             |
|        | Total  | 42            |

. •

11. Suggested Books:

4

| · · ·   |   | · · .                   |
|---------|---|-------------------------|
| 'S- No. | Name of Authors /Books / Publishers   | Year of                 |
|         |   | Publication/<br>Reprint |
| 1.      | Elgerd O. I., "Electric Energy Systems Theory - An Introduction",               | 2008                    |
| · · ·   | 2 <sup>nd</sup> Ed., Tata McGraw-Hill Publishing Company Limited.               | · · · · ·               |
| 2.      | Nagrath I. J. and Kothari D. P., "Power System Engineering", 2 <sup>nd</sup>    | 2008                    |
| ·<br>   | Ed., Tata Mc-Graw Hill Publishing Company.                                      | •                       |
| 3.      | Grainger J. J. and Stevenson W. D., "Power System Analysis", Tata               | 2008                    |
| •••     | McGraw-Hill Publishing Company Limited.   | · · ·                   |
| 4       | Wood A. J. and Wollenberg B. F., "Power Generation, Operation                   | 2008                    |
|         | and Control", Second Edition, Willey - Inter Science Publications.              | • •                     |
| 5.      | Kundur P. and Balu N. J., "Power System Stability and Control",                 | 1998                    |
| ••      | EPRI Series, McGraw-Hill International Book Company.                            |                         |
| 6.      | Saadat H., "Power System Analysis", 1 <sup>st</sup> International Edition, Tata | 2008 ·                  |
|         | McGraw-Hill Publishing Company Limited.   |                         |

MISIMM

NAME OF DEPTT./CENTRE: Department of Electrical Engineering 1. Subject Code: EE-613 Course Title: Advanced Microprocessors and Interfacing

T: 1

2: Contact Hours: " L: 3

3. Examination Duration (Hrs.): Theory 3

PRS\_15 30 .40 PRE 4, Relative Weight: CWS 15 MTE ETE 5. Credits:

6. Semester: Both

7. Subject Area: DEC

P: 2/2

0

Practical

8. Pre-requisite: EE-307 or equivalent

.9. Objective:

The aim is to expose the students to the architecture, instruction set and assembly language programming of typical 16-bit microprocessors. The course also provides interfacing details of I/O devices with the processor.

10. Details of Course:

|        |  | · .                                   |
|--------|--|---------------------------------------|
| S. No. | Contents   | <b>Contact Hours</b>                  |
| . 1.   | Evolution of Microprocessors: 8-bit and 16-bit microprocessors,        | . 2 .                                 |
| •      | Intel, Zilog and Motorola processors.                                  |                                       |
| 2.     | Architecture of a 16-bit Microprocessor: Intel 8086 and 8088           | 3                                     |
| · · ·  | processor, concept of pipelining and memory segmentation, logical      | ,                                     |
| •      | address, offset address and physical address; Bus Interface Unit       | •                                     |
|        | (BIU); Execution Unit (EU), segment registers.                         |                                       |
| · 3. · | Operation of 16-bit Microprocessor: Pin configuration of Intel         | 6                                     |
|        | 8086/8088; Minimum and maximum modes of operation; Address             | · · · ·                               |
| •      | bus, data bus and control bus; Clock generator Intel 8284; Memory      |                                       |
| · ·    | organization, memory address space.                                    | · · ·                                 |
| · 4.   | Interfacing: Interfacing concepts, interfacing memory; Input-output    | 2                                     |
| · .    | techniques, interfacing of I/O devices to the processor.               |                                       |
| 5.     | Addressing Modes: Data related addressing modes- register,             | 3                                     |
|        | immediate, direct, register indirect, based relative, indexed relative |                                       |
|        | and based indexed, branch related addressing modes- intrasegment       |                                       |
| · :    | direct and indirect, intersegment direct and indirect.                 |                                       |
| 6:     | Instruction Set of 16-Bit Microprocessor: Machine cycles, data         | 8                                     |
|        | transfer arithmetic bit manipulation. string program execution         |                                       |
| · · ·  | transfer and processor control instructions                            | · · · · · · · · · · · · · · · · · · · |
|        |  |                                       |

En

| S. No.        | Contents  | Contact Hours |
|---------------|---|---------------|
| 7.            | Assembler Directives: ASSUME, DB, DD, DQ, DT, DW, DUP,  | 2             |
|               | END, EQU, EVEN, ORG, OFFSET, PROC, ENDP, LABEL and PTR.   | •             |
| . 8           | Assembly Language Programming: Macro-assembler, segment definition and models.  | 4             |
| • <b>9.</b> . | Interrupt Structure: Interrupt pointer, type numbers, processing of interrupt, internal and external interrupts, interrupt priorities, BIOS routines.   | 3             |
| 10.           | <b>Programmable Support Chips:</b> Interfacing of programmable parallel interface Intel 8255, programmable interval timer Intel 8253, programmable interrupt controller Intel 8259 with 16-bit processor. | 5             |
| 11            | Coprocessors and Multiprocessing  | 4             |
|               | - Total   | 42            |

11. Suggested Books:

| S. No.     | Name of Authors /Books / Publishers   | Year of<br>Publication/ |
|------------|---|-------------------------|
| - <u>-</u> |   | Keprint                 |
| 1.         | Hall D. V., "Microprocessor and Interfacing –Programming and                    | 2006                    |
|            | Hardware", Tata McGraw-Hill Publishing Company Limited.                         |                         |
| 2.         | Liu Yu-Cheng and Gibson G. A., "Microcomputer Systems; The                      | 2007                    |
| •          | 808618088 Family", 2 <sup>nd</sup> Ed., Prentice Hall of India Private Limited. |                         |
| 3.         | Brey B. B., "Intel 8086, 8088, 80186, 80187, 80286, 80386, 80486,               | 2006                    |
| • • •      | Pentium and Pentium Pro Processors, Architecture, Design and                    |                         |
|            | Application", Prentice Hall of India Private Limited.                           |                         |
| 4          | Mazidi M. A. and Mazidi J. G., "The 80x86 IBM PC and                            | 2003                    |
| •          | Compatible Computers (Vol. I and II), Assembly Language, Design                 |                         |
|            | and Interfacing", Prentice Hall International Edition.                          |                         |
| 5.         | Triebel W. A. and Singh A., "The 8088 and 8086 Microprocessors,                 | 2007                    |
| · ·        | Programming Interfacing, Software, Hardware and Applications",                  | · · ·                   |
|            | 4 <sup>th</sup> Ed., Prentice Hall of India Private Limited.                    | · ·                     |
| 6.         | Intel Manual on 16-bit Microprocessor.  |                         |
|            |   |                         |

### Appendix 'C' Item No.Senate/ 43.2.2

|                    | · .      | M.Sc. (Inc                            | lustria | l Mat  | he       | ema          | tics  | & Inf | forma  | atics)    |                  | •            |       |       |
|--------------------|----------|---------------------------------------|---------|--------|----------|--------------|-------|-------|--------|-----------|------------------|--------------|-------|-------|
|                    |          | Teaching Scheme                       | • .     |        | Τ        | Contact      |       | E     | xam.   |           | Relati           | ve Weig      | htage |       |
| ļ                  |          | •                                     | •       |        |          | н            | rs.   | Du    | ration | ·         | , <sup>,</sup> , | (%)          |       |       |
| <u> </u>           | • •      |                                       | •       |        |          | Рег          | week  | (H    | Irs.)  | •         | • •              |              |       |       |
| S.                 | Sub      | . Course Title Area                   | Sub     | Crs    | Τ.       | L [ ]        | P.    | ŢΤ    | P      | CWS       | PRS              | MTE          | ETE   | PRE   |
| 1 <sup>51</sup> Vo |          |                                       |         | L.     | Ŀ        |              |       |       |        |           | · ·              |              |       |       |
| +                  | MA SEO   | Computer Applications                 | - ISEN  | 123121 | 40       |              |       | 1 3   |        | 15        | 16               | . 20         | [     |       |
| 2                  | MA-550   | Computer Applications                 | 1000    | 4.     |          | 5 7          |       | 3     | -      | 15        | 15               | 1 30         | 40    |       |
| 4.                 | MA-551   | Cinear Algebra                        |         | 4.     |          |              | · /   | 3     |        | 25        |                  | 23           | 20    |       |
| J.                 | MA-555   | Equations                             |         | 4      |          | <b>5</b> - 7 | -     | 3     | -      | 23.       |                  | . 25         | . 50  | •.    |
| 4. •               | MA-555   | Numerical Analysis                    | PCC     | 4      | 3        | 3 1          | 1.    | - 3   | -      | 15        | 15               | . 30         | 40    | -     |
| 5.                 | MA-559   | Real & Complex Analysis               | PCC     | : 4    | 3        | 3 1          |       | 3.    | · -    | 25        | -                | 25           | 50    | -     |
| 6.                 | MA-561   | Discrete Mathematics.                 | PCC     | 4      | 13       | 3 1          | -     | 3.    | -      | 25 ′      | 1 <u></u>        | 25           | 50'   | -     |
|                    | <u> </u> | Sub Total: .                          |         | 24     |          |              |       |       |        | · · .     |                  | • •          |       |       |
|                    |          |                                       | II SE   | MEST   | ER       | (SPI         | RING) |       |        |           |                  |              | •     |       |
| 1.                 | MA-552   | Mathematical Methods'                 | PCC     | . 4    | 3        | 1 1.         | -     | 3.    |        | , 25      | -                | 25           | 50.   |       |
| 2.                 | MA-554   | Operations Research                   | PCC     | 4      | 3        | 1.           |       | 3     | * •-   | 25        | <u> </u>         | 25           | . 50  |       |
| 3                  | MA-556   | Probability & Statistics              | PCC     | 4      | 3        | 1            | -     | 3     | -      | * 25      | •                | <b>£</b> .25 | 50 -  | -     |
| -4.                | MA-560   | Mathematical Modelling &              | ICC .   | 4      | 3        | 1            | . 1   | 3     | 7.     | 15        | 15               | . 30         | 40    |       |
| · ·                |          | Simulation :                          | •       | • .'   |          |              |       |       |        | <br>      |                  |              | •     |       |
| 5.                 | MA-566,  | Computer Lab                          | PCC     | 2      | 1        | -            | ,2    |       | 2      | · _       | 50               | -            | -     | . 50  |
| 6.                 |          | Programme Elective-1                  | PEC     | .4     | .3       | 1            |       | 3     |        | 25        | -                | 25           | 50    | •     |
| 7:                 | MA-568   | Data Structure Techniques             | PCC     | 4      | 3        | 1            | 1     | 3     | -      | 25        |                  | · 25 ·       | 50    | -     |
| 8.                 | HS-501 . |                                       | :       |        | 1        | 2            |       | 2     |        | 25        |                  | 25           | 50    |       |
| •                  |          | Sub Total :                           |         | 26.    | <b>!</b> |              |       | , ,   |        | -         | ۰ <u>۰</u>       |              |       |       |
| 2 <sup>nd</sup> Ye | ar ·     | III SE                                | MESTER  | R (AUT | UN       | IN)          |       |       |        |           |                  | · · ·        |       | · · · |
| 1.                 | MA-570   | Practical Training with Industry      | RP      | 2      | -        | -            | •     | . :   |        | •         | . •              | · -          |       | -     |
| 2.                 | MA-611.  | Project & Seminar                     | RP      | 2      | +        |              | -     | •     |        |           | - 1              | 50           | 50    | -     |
| 3.                 | MA-613   | Applied Functional Analysis           | PCC     | 4      | 3        | 1            |       | 3     |        | . 25      | •                | 25           | 50    |       |
| 4.                 | MA-615   | Mathematical Modelling II             | PCC     | 3      | 2        | 1            |       | 3     |        | 25        |                  | 25           | 50    | -     |
| 5.                 |          | Programme Elective II                 | PEC     | 4      |          |              | -     | •     |        |           |                  |              |       |       |
| 6.                 |          | Open Elective 1                       | OEC     | 3/4    | -        | ·            | -     |       |        |           |                  | _ • •        |       |       |
|                    |          | Sub Total :                           |         | 18/    |          | <u> </u>     |       |       |        | -         |                  | · · ·        | [-    | ·     |
| •                  |          |                                       |         | 19     |          | •            | · .   |       |        |           |                  | · ·          |       |       |
| l                  |          | · · · · · · · · · · · · · · · · · · · | IV SE   | MESTE  | R        | (SPF         | RING  |       |        | · · · · · |                  | <b>.</b>     |       |       |
| 1.                 |          | Programme Elective III                | PEC     | 4      | 3        | 4            | - 1   |       | /      | -         |                  |              |       |       |
| 2.                 |          | Programme Elective IV                 | PEC     | .4 ,   | -        |              | -     |       | - 1    | · - ·     | · ·-             | •••          |       | -     |
| 3.                 |          | Open Elective It                      | OEC     | 3/4    | -        | -            |       |       |        |           | t                |              |       |       |
| 4.                 | MA-616   | Dissertation                          | DIS     | 12     | -        | •••          | -     | -     |        |           |                  | -            | 100   | -     |
|                    |          | Sub Total :                           | •       | 23/    | -        | ·            |       |       |        |           |                  |              |       |       |
|                    |          |                                       | •       | 24     |          |              |       |       | :      | •.        | · .              |              | 1     |       |
| • •                |          | Total :                               |         | 91/    |          |              |       |       |        |           |                  |              |       |       |
| · .                |          |                                       |         | 93     |          |              |       |       | -      | • •       |                  |              | · . · | -     |
|                    |          | ,,,,,,,,,,                            |         | -      | _        |              | ·     |       |        | · · · · · |                  |              |       |       |

#### Proposed Scheme of

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### Programme Electives

2.

| M.Sc  | . (Industr | ial Mathematics and Informa | itics) |        |                             |
|-------|------------|-----------------------------|--------|--------|-----------------------------|
| 1 .   | MA-622     | Finite Element Methods      | 10     | MA-632 | Computer Aided Design       |
| 2     | MA-623     | Fuzzy Sets & Fuzzy Systems  | 11     | MA-633 | Quèues & Reliability        |
| 3     | MA-624     | Wavelet Theory              | 12     | MA-634 | Computer Graphics           |
| 4     | MA-625     | Image Processing            | 13     | MA-635 | Data Base Management        |
| • 5   | MA-627     | Robotics and Control        | 14     | MA-636 | Financial Mathematics       |
| · 6 · | MA-628     | Optimal Control Theory      | 15     | MA-685 | Bio-Mathematics             |
| 7     | MA-629     | Approximation Theory        | 16     | MA-686 | Advanced Numerical Analysis |
| 8     | MA-630     | Artificial Intelligence     | 17     | MA-687 | Optimization Techniques     |
| • 9   | MA-631     | Graph Theory                |        |        |                             |

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### Appendix 'D' Item No. Senate/ 43.2.3

| NAME OF DEPTT/CENTRE:           | Departmen     | t of Mathematics            |
|---------------------------------|---------------|-----------------------------|
| I. Subject Code: CA-601         | Course Title: | Data Base Management System |
| 2. Contact Hours: L: 3          | T: 1          | P: 0                        |
| 3. Examination Duration (Hrs.): | Theory        | 3 Practical 0               |
| 4. Relative Weightage: CWS 2    | 5 PRS 0,      | MTE 25 ETE 50 PRE 0         |

8. Pre-requisite: Nil

9. Objective: To introduce the basic concepts of data base management

10. Details of Course:

2

| S.No.       | Contents .  | Contact<br>Hours |
|-------------|---|------------------|
| `1.         | Introduction: Database Concepts, storage structures, ER model;<br>relational data model, formal query languages.  | 7                |
| 2.          | Relational Database: Domains and attributes, keys, relations, relation<br>algebra, tuple relation and domain relation calculus, structured query<br>language. | 8                |
| 3.          | Data Base Design: Normalization, various normal forms, functional and multi valued dependencies, decomposition.   | 8                |
| <b>4</b> .  | System Implementation: Query processing and optimization, transaction processing, concurrency control, recovery schemes, data security and authorization.     | 7                |
| 5: .        | <b>Distributed Database Design:</b> Distributed query processing, concurrency and deadlock handling; data fragmentation and replication                       | 6                |
| <u>.</u> 6. | Data Mining: Introduction, Knowledge Discovery, Association rules, support and Confidence, Use of Association rules for Prediction.                           | 6                |
| · ·         | TOTAL   | .42              |

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# 11. Suggested Books:

| S.No.         | Name of Authors/Book/Publisher   | Year of<br>Publication/<br>Reprint |
|---------------|--|------------------------------------|
| 1.            | Date C.J., An Introduction to Database Systems, Addison Wesley Longman.                        | 2002                               |
| ′ <b>2.</b>   | Elmasri R. and Navathe S.B., Fundamentals of Database Systems, 3rd Edition, Benjamin/Cummings. | 2003                               |
| - 3. ·<br>- ( | Ramakrishnan R. and Gehrke J., Databse Management Systems, McGraw –Hill.                       | 2003_                              |
| <b>4</b> ,    | Silberschatz A., Korth H.F., and Sudarshan S., Database System Concepts, McGraw –Hill.         | 2004                               |

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| NAME OF DEPTT /CENTRE:          | Department of     | Mathematics          | • |
|---------------------------------|-------------------|----------------------|---|
| 1. Subject Code: CA-602         | Course Title: Sim | ulation and Modeling |   |
| 2. Contact Hours: L: 3          | T: 1              | P: 0                 |   |
| 3. Examination Duration (Hrs.): | Theory 3          | Practical 0          |   |
| 4. Relative Weightage: CWS 2    | 5 PRS 0 MTE       | 25 ETE 50 PRE (      | ) |
| 5. Credits: 4 6. Ser            | nester: Spring    | 7. Subject Area: PCC |   |
| 8. Pre-requisite: Nil           |                   |                      |   |

9. Objective: To introduce simulation and modeling concepts to enable students to handle mathematical modeling problems.

10. Details of Course:

| S.No. | Contents  | Contact<br>Hours  |
|-------|---|-------------------|
| 1.    | Models: Models classification, mathematical models, physical  | 10                |
| · ·   | models based on ordinary and partial differential equations,  |                   |
|       | difference equations, analog model, estimation of model parameters, design of experiments, confounding. |                   |
| 2.    | Simulation Methodology: Experimental nature of simulation,  | 8                 |
| •     | steps involved in simulation studies  |                   |
| 3.    | Random numbers: Computer generation of pseudo-random  | .5                |
| -     | numbers, tests for acceptability.   |                   |
| 4.    | Continuous and discrete functions: Generation, continuous time  | . <sup>.</sup> 10 |
|       | simulation. Monte carlo simulation, discrete event simulation,  | • •               |
|       | simulation languages.   |                   |
| 5.    | Simulations Applications: Queuing models, inventory model and   | .9, •             |
| ° .   | their simulation, pure pursuit problem, chemical reactor, water   |                   |
| · • • | reservoir system  | • .               |
|       | TOTAL   | 42                |

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?15/11/1

#### 11. Suggested Books:

| S.No. | Name of Authors/Book/ Publisher  | Year of<br>Publication/<br>Reprint |
|-------|--|------------------------------------|
| • 1.  | Law, A.M., Simulation Modeling and Analysis, Tata McGraw Hill.   | 2007                               |
| 2.    | Deo, N., System Simulation with Digital Computer, Prentice Hall, 1979.                                       | 2006                               |
| 3.    | Kapur, J.N., Mathematical Modeling, Wieley Eastern Ltd.  | 1998                               |
| 4.    | Banks, J., Handbook of simulation: principles, methodology, advances, applications, and practice, Wiley-IEEE | 1998                               |

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| INDIAN INSTI   | TUTE OF TE        | CHNOLOGY ROOF                         | RKEE      |
|--|-------------------|---------------------------------------|-----------|
| NAME OF DEPTT./CENTRE:                               | Department        | of Mathematics                        |           |
| 1. Subject Code: CA-603                              | Course Title:     | Design and Analysis of A              | lgorithms |
| 2. Contact Hours: L: 3                               | T: 1              | P: 0                                  |           |
| 3. Examination Duration (Hrs.):                      | Theory 3          | Practical 0                           |           |
| 4. Relative Weightage: CWS 2<br>5. Credits: 4 6. Ser | 5. PRS 0 M        | TE 25 ETE 50 PR                       | E 0       |
| 8. Pre-requisite: Nil                                |                   |                                       |           |
| 9. Objective: To impart kr                           | nowledge of desig | n and analysis of algorithn           | ns        |
| 10. Details of Course:                               |                   | · · · · · · · · · · · · · · · · · · · | <br>      |

| S.No. | Contents   | Contact |
|-------|--|---------|
|       |  | Hours   |
| 1.    | Review of Data Structures: Stack, Queues and Binary Trees.   | 2       |
| 2. ·  | Program Performance: Time and space complexity, asymptotic notation,   | 4       |
|       | complexity analysis, recurrence equations and their solution.  | ŀ       |
| 3.    | Algorithmic Methodologies: Algorithm design strategies, divide and   | 4       |
|       | conquer, merge sort. quick sort and its performance analysis, randomized quick sort, Strassen's matrix multiplication. |         |
| 4.    | Greedy method: Method and its applications, knapsack problem; Dynamic  | 5       |
|       | programming and its performance analysis, optimal binary search trees, 0/1   |         |
|       | knapsack problem; Traveling salesman problem.  |         |
| 5.    | Back-tracking: n-queens problem, graph coloring, Hamiltonian cycles,   | 5       |
|       | knapsack problem; Branch and bound examples; applications and analysis.  |         |
| 6.    | Graph Algorithms: Graph search methods( BFS, DFS), Minimum cost  | 6       |
|       | spanning trees: Kruskal's, Prim's and Sollin's algorithms: Path finding and  | • •     |
|       | shortest path algorithms; Topological sorting; Bipartite graphs.   | · · .   |
| - 7.  | Infeasibility: P and NP-classes, NP-hard problems, reduction   | 4       |
|       | Parallel Algorithms: Data and control parallelism, embedding of problem  | • 6     |
| 8.    | graphs into processor graphs, parallel algorithms for matrix multiplication.   | •       |
| 9.    | Other Algorithms: Number theoretic algorithms, string matching   | 6       |
|       | algorithms, approximation algorithms, randomized algorithms  | · · ·   |
|       | Total .  | 42      |

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### 11. Suggested Books:

| S.No. | Name of Authors/Book/ Publisher   | Year of<br>Publication/<br>Reprint |
|-------|---|------------------------------------|
| 1     | Sahni S., Data Structures, Algorithms and Applications in C++, McGraw-Hill  | 2001                               |
| 2.    | McHugh; J.A., Algorithmic Graph Theory, Prentice-Hall.  | . 1990 .                           |
| 3.    | Quinn, M.J., Parallel Computing Theory & Practice, McGraw-Hill.   | 1994                               |
| 4.    | Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C.,<br>Introduction to Algorithms, Prentice-Hall of India. | 2002                               |
| 5.    | Dasgupta,S., Papadimitriou, C. and Vazirani, U., Algorithms,<br>TataMcGraw-Hill.                                  | -2008                              |

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| NAME OF DEPTT /CENTRE:  | Department of Mathematics           |  |
|---|-------------------------------------|--|
| 1. Subject Code: CA-604 Course Title: Computer Communication Netw |                                     |  |
| 2. Contact Hours: L: 3  | T: 1 P: 2                           |  |
| 3. Examination Duration (Hrs.):                                   | Theory 3 Practical 2                |  |
| 4. Relative Weightage: 'CWS 1                                     | 5 PRS 15 MTE 15 ETE 40 PRE 15       |  |
|   | nester: Spring 7. Subject Area: PCC |  |

9. Objective: To introduce the basic concepts of Communication Networks.

10. Details of Course:

| S.No.        | Contents   | Contact |
|--------------|--|---------|
|              |  | Hours   |
| 1.           | Introduction: Layered architecture, OSI model, TCP/IP                              | 4       |
| 2.           | Physical Layer and Media: Transmission media, digital and analog                   | . 9     |
| •            | transmission, multiplexing, switching techniques.                                  |         |
| 3.           | Data Link Layer: Design issues, framing, error control and flow control.           | 5       |
| 4.           | Multiple Access Sublayer: CAMA/CD, Token Ring, DQDB, FDDI.                         | · 6·    |
| · <u>5</u> . | Wireless Networks: Wireless LAN, cellular telephone                                | · 2 ·   |
| 6.           | Network Layer: Routing algorithms, internetworking, IP layer, X.25, ISDN etc.      | 6       |
| .7.          | Transport Layer: Congestion control and quality of service, connection management. | 4       |
| 8.           | Application Layer: Network security, electronic mail, SNMP, FTP,                   | 6       |
|              | DNS, WWW and HTTP etc.   |         |
| ,            | Total  | 42      |
| •.           | in in Sm   | A5(1111 |

### 11. List of practicals

| (i)   | •   | Simple simulation programs for implementation of following |    |
|-------|-----|--|----|
|       | ٠   | - Sliding Window protocol                                  | •  |
|       | •   | -Leaky Bucket Algorithm                                    |    |
| 1.    | • . | -Shortest Path Algorithm                                   |    |
|       |     | -Routing Algorithm   |    |
| (ii)  |     | Client-Server programs using TCP and UDP protocols         | ٠, |
| (iii) |     | Programs for implementation of following:                  |    |
|       | •   | -RSA algorithm   |    |
|       |     | -Digital Signatures  |    |

# 12. Suggested Books

| S.No. | Name of Authors/Book/Publisher                                | Year of      |
|-------|---|--------------|
| · · · |   | Publication/ |
|       |   | Reprint      |
| 1.    | Forouzan B.A., Data Communication and Networking, 4th         | 2007         |
|       | Edition, Tata McGraw Hill.                                    | •            |
| 2.    | Tannenbaum, A.S., Computer Networks, Prentice Hall of India.  | 2003         |
| 3     | Larry L. Peterson and Bruce S. Davie Morgan Kaufman,          | 2007 .       |
| ,     | Gomputer Networks, 4 <sup>th</sup> Edition, Tata McGraw Hill. | · •          |
| 4. ·  | W. Richard Stevens, Unix Network Programming, Pearson/PHI     | 1991.        |
|       |   |              |

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| NAME OF DEPTT /CENTRE:          | Department of Mathe     | matics         |
|---------------------------------|-------------------------|----------------|
| 1. Subject Code: CA-605         | Course Title: Operating | Systems        |
| 2. Contact Hours: L: 3          | T: 1                    | P: 2           |
| 3. Examination Duration (Hrs.): | Theory 3 Pr             | actical        |
| 4. Relative Weightage: CWS 1    | 5 PRS 15 MTE 30         |                |
| 5. Credits: 5 6. Ser            | nester: Autumn 7. Sub   | ject Area: PCC |

8. Pre-requisite: Nil

9. Objective: To impart knowledge on operating system concepts, design and implementation

10. Details of Course:

| S. No. | Contents   | Contact        |
|--------|--|----------------|
| . •    |  | Hours          |
| 1.     | Fundamental Concepts of Operating System: Historical evolution of      | 5·             |
| •      | operating systems, operating system functions and characteristics,     | ÷ .            |
|        | issuess in operating system design.                                    |                |
| .2.    | Process Management: Process abstraction, process address space,        |                |
| •      | process management, system calls, threads, process hierarchy.          | 6 <sup>.</sup> |
| 3.     | CPU Scheduling: Levels of scheduling, comparative study of scheduling  | · 4 ·          |
|        | algorithms, multiple processor scheduling.                             |                |
| 4      | Deadlocks: Characterization, prevention and avoidance, deadlock.       | 4              |
|        | detection and recovery.  |                |
| 5:     | Concurrent Processes: Critical section problem, semaphores, onitors,   | 5              |
| : .    | inter-process communication, message passing mechanisms.               |                |
| 6.     | Memory Management: Storage allocation methods, virtual memory          | 5              |
|        | concept, demand paging, page replacement algorithms, segmentation,     | · · ·          |
| ·<br>  | thrashing.   |                |
| . 7. * | File Systems: Functions, file access and allocation methods, directory | · 5            |
|        | system, file protection mechanisms, implementation issues, file system |                |
|        | hierarchy.   | • •            |
| 8.     | Device Management: Hardware organization, device scheduling policies.  | 5              |
|        | device drivers   | ي.<br>در خاند  |
| ·9.    | Case Studies: Windows, Unix, Lihux.                                    | - 3            |
|        | Total  | 42             |
|        |  |                |

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# 11. Practical List based on

| •            |   |   |
|--------------|---|---|
| . 1.         | Basic commands of UNIX/ LINUX                       |   |
| 2.           | Advance commands of UNIX/ LINUX                     |   |
| 3.           | Simulate CPU scheduling                             |   |
| 4.           | Simulate memory paging and segmentation             | : |
| 5.           | Semaphore and message passing                       |   |
| 6.           | Producer consumers and dining philosophers problems |   |
| , <b>7</b> . | Simple multiprocessing operating system             |   |

12. Suggested Books:

| S.No. | Name of Authors/Book/Publisher                                | Year of      |
|-------|---|--------------|
|       |   | Publication/ |
|       |   | Reprint      |
| 1.    | Silberscharz, A. and Galvin, P.B., Operating System Concepts, | 2006         |
| •     | 7th Edition, Addison-Wesley.                                  | ••           |
| 2.    | Tanenbaum, A., Modern Operating Systems, Prentice-Hall of     | 2004         |
|       | India.  |              |
| 3.    | Nutt, G., Operating Systems, Addison-Wesley.                  | 2004         |
| 4.    | Joshi, R. C. and Tapaswi S., Operating Systems, Wiley         | 2005 ·       |
|       | Dreamtech.  | · · ·        |

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| NAME OF DEPTT./CENTRE          | Department of     | Mathematics          |
|--------------------------------|-------------------|----------------------|
| 1. Subject Code: CA-606        | Course Title: Sof | tware Engineering    |
| 2. Contact Hours: L: 3         | T: 1              | P: 0                 |
| 3. Examination Duration (Hrs.) | : Theory 3        | Practical 0          |
| 4. Relative Weightage: CWS     | 25 PRS 0 MTE      | 25 ETE 50 PRE 0      |
| 5. Credits: 4 6                | Semester: Spring  | 7. Subject Area: PCC |

8. Pre-requisite: Nil

9. Objective: To introduce the concepts of Software development.

10. Details of Course:

| S.No.    | Contents  | Contact |
|----------|---|---------|
| ·. ·     |   | Hours   |
| 1.       | Introduction to software and software engineering, various software       | • 6 • . |
| · . :    | process models, capability maturity model and KPAs.                       |         |
| 2        | Software measures, indicators and metrics, software risk analysis         | 4       |
| 3.       | Project planning, project introduction, cost estimation, COCOMO, team     | 8       |
|          | organization, schedule estimation, staffing and personnel planning,       | •       |
| • •<br>• | software configuration management plan, quality assurance plan,           |         |
|          | monitoring plans, risk management.  |         |
| 4.       | Software requirement analysis, specifications and validation,             | 5.      |
| •        | applicability to small, medium, and large-scale systems.                  | · .     |
| 5.       | Software design, technical design, objectives of design, design metrics,  | - 8 -   |
|          | modularity, module coupling and cohesion, relation between cohesion       | •       |
|          | and coupling; Detailed design considerations, verification. Design        |         |
| • .      | strategies-Bottom up design, top down design, hybrid design, functional.  |         |
| · ·      | oriented design, object oriented design; IEEE recommended practices       | · ·     |
| · _ ·    | for software design description   |         |
| · · · ·  | Software testing, testability, testing process, structural testing, unit- | 8 .     |
| 6.       | testing and integrated testing, debugging, testing tools, software        |         |
| · ·      | maintenance, maintenance process, maintenance cost, reverse               | ·       |
|          | engineering and reengineering.  |         |
| 7.       | CASE tools and workbenches.   | .3 .    |
| }        | Total   | .42     |

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| S.No. | Name of Authors/Book/Publisher  | Year of<br>Publication/<br>Reprint |
|-------|---|------------------------------------|
| 1.    | Pressman R., "Software Engineering", McGraw-Hill.   | 2000                               |
| 2.    | Jalote P, "Software Engineering: A Precise Approach, Wiley, India                             | 2010                               |
| 3.    | Sommerville, I., "Software Engineering", Pearson Education.                                   | 2007                               |
| 4.    | Pfleeger, S. L., Atlee, J.M., "Software Engineering: Theory and Practice", Pearson Education. | 2005                               |
|       |   | MIS/11111 -                        |

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|--|------------------|
| NAME OF DEPTT /CENTRE: Department of Mathematics   |                  |
| 1. Subject Code: CA-607 Course Title: Practical Lab (DBMS)   | · · ·            |
| 2. Contact Hours: L: 0 T: 0 P: 4   |                  |
| 3. Examination Duration (Hrs.): Theory 0 Practical 2   | ]                |
| 4. Relative Weightage: CWS 0 PRS 50 MTE 00 ETE 00 PRE  | 50               |
| <ul> <li>5. Credits: 2</li> <li>6. Semester: Autumn 7. Subject Area: PCC</li> <li>8. Pre-requisite: Nil</li> <li>9. Objective: To expose the students to the hands on experience ousing data base and operating system</li> </ul>  | of designing and |
| 10. List of Practicals:  |                  |
| <ul> <li>(ii) Insertion and deletion in a table.</li> <li>(iii) SELECT command with different clauses including nested queries</li> <li>(iv) SINGLE ROW functions (character, numeric,</li> </ul>  |                  |
| (v)       GROUP functions (avg, count, max, min, Sum).         (vi)       Various type of SET OPERATORS (Union, Intersect, Minus).   |                  |
| (VII)     Various type of Integrity Constraints.       (viii)     Various types of JOINS.       (ix)     Views and Indices.  |                  |
| (xi) Hands on Experience on ORACLE/Db2   |                  |
| S.No. Name of Authors/Book/Publisher Year of Publication   | /                |
| Ivan         Bayross         Teach         Yourself         SQL/PLSQL;         BPB         2005           Publication         Publicatio |                  |
| 2. PL/SQL User Guide and Reference Release 8.0, 1997<br>Oracle Corp. Ltd.  |                  |
| -48-   | [7]              |

| NAME OF DEPTT/CENTRE:           | Department of     | Mathematics           |         |
|---------------------------------|-------------------|-----------------------|---------|
| 1. Subject Code: CA-701         | Course Title: Org | ganizational Behavior | •       |
| 2. Contact Hours: L: 3          | T: 1              | P: 0                  |         |
| 3. Examination Duration (Hrs.): | Theory 3          | Practical 00          | ]       |
| 4. Relative Weightage: CWS      | 5 PRS 0 MTE       | 25 ETE 50 PRE         | 0       |
| 5. Credits: 4 6. Se             | mester: Autumn    | 7. Subject Area: PCC  | · · · · |

8. Pre-requisite:

9. Objective: To expose the students with the concepts and processes of organizational behavior.

10. Details of Course:

| S.No.  | Contents   | Contact                               |
|--------|--|---------------------------------------|
|        |  | Hours                                 |
| · 1: . | <b>Introduction</b> : Organizational behavior, major contributing disciplines to OB, functions and roles of managers, challenges and opportunities for OB. | • 4                                   |
| 2. ·   | Personality: Role of biological and cultural factors in its development.   |                                       |
| · ·    | agents of socialization, personality traits relevant to OB and theory of personality.  | 6                                     |
| 3.     | Foundations of group behavior: Stages of group development, group  |                                       |
|        | properties: roles, norms status size ads cohesiveness, Sociometry, teams, difference between group and teams, types of teams                               | . 6                                   |
| 4.     | Leadership: Importance and functions of leadership, styles of leadership.  | · 4                                   |
| 5      | Motivation: Difference among drives needs and motives theories of  | · · ·                                 |
|        | motivation Two-factor theory FRG theory and McClelland's theory of   | 4                                     |
| ].     | needs  | ч.                                    |
| 6      | Dereantian and individual decision making: Dercontian and its relevance  | · · · · · · · · · · · · · · · · · · · |
| 0.     | Ferception and multioudal decision-making. Ferception and its relevance  | •                                     |
| ) ·    | tindements should attem Attribution theory fundemental attribution areas   | 4                                     |
|        | Judgments about others. Altinoution theory, jundamental attribution errors.  |                                       |
|        | Cultural differences in it.  | · _ · _                               |
| , 7.   | Communication: Functions of communication, communication process,  | · /                                   |
|        | non-verbal communication and barriers to effective communication.  |                                       |
| 8.     | Organizational Culture: Culture's functions, types of culture and creating a   |                                       |
|        | positive organizational culture.   | 4 . <sup>1</sup>                      |
| 9.     | Organizational change: Stress Management   | -3                                    |
| 10.    | Human values in organization: Work ethics and corporate social   | · ·                                   |
|        | responsibilities.  | 3                                     |
|        | Total  | 42                                    |
| L      | -49-   | · · · · ·                             |
|        |  | ,                                     |
| • • •  |  | vin                                   |

### 11. Suggested Books

| S. No.          | Name of Authors/Books/Publisher  | Year of                 |
|-----------------|--|-------------------------|
|                 |  | Publication/<br>Reprint |
| 1.              | Uma Sekaran, Organizational Behavior, 2 <sup>nd</sup> Edition,<br>McGraw Hill Companies.                         | 2004                    |
| 2.              | Fred Luthans, Organizational Behavior, 10 <sup>th</sup> Edition,<br>McGraw Hill Companies.                       | 2004                    |
| 3.              | Morgan, King, Weisz and Schopler, Introduction to Psycholgoy, 7 <sup>th</sup> Edition, Tata McGraw Hill Edition. | 2004                    |
| 4               | Robert a. Baron and Donn Byrne, Social Psychology, 10 <sup>th</sup> Edition, Pearson Education Inc.              | 2004                    |
| - <del>5.</del> | Stephen P: Robins, Organizational Behavior, 13 <sup>th</sup> Edition,<br>Prentice Hall of India Pvt. Ltd.        | 2009                    |

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| NAME OF DEPTT./CENTRE:                                 | Department of Mathematics   | ÷ |
|--|---|---|
| 1. Subject Code: CA-703                                | Course Title: Computer Graphics   |   |
| 2. Contact Hours: L: 3                                 | T: 1 P: 2   | • |
| 3. Examination Duration (Hrs.):                        | Theory 3 Practical 2  |   |
| 4. Relative Weightage: CWS. 4.<br>5. Credits: 5 6. Sen | 5   PRS   15   MTE   15   ETE   40   PRE   15     mester: Autumn   7: Subject Area: PCC |   |

8. Pre-requisite: Nil

9. Objective: To introduce the basic concepts of Computer Graphics.

### 10. Details of Course:

| S.No.        | Contents  | Contact |
|--------------|---|---------|
|              |   | Hours   |
| 1.           | Introduction to basic techniques and graphic devices.   | 4       |
| 2.           | Point plotting techniques, line drawing algorithms, circle generation and eillipse drawing algorithms.                | 5       |
| <b>3.</b>    | Two dimensional transformations-translation, rotation and scaling with matrix representations and their applications. | 5       |
| 4.           | Clipping and windowing.   | 4       |
| 5.           | Three dimensional curves and surfaces, Bezier methods, B-spline, Natural spline, Bezier surfaces.                     | 8       |
| 6.           | Three dimensional transformations and their matrix representation, perspective projections and implementation.        | 6       |
| 7            | Hidden line and surface elimination.  | -3      |
| 8.           | Applications in computer aided design (CAD), Introduction to  | 5       |
| <b>6</b> 4 - | computer animation.   | . •     |
| 9.           | Case studies.   | 2       |
|              | TOTAL   | · 42    |

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### 11. List of Practicals

| •                 | · · · · · ·  |
|-------------------|--|
| •                 | List of Practicals   |
| (i)               | Introduction to OpenGL   |
| (ii) ·            | Implementation of Line, circle, Ellipse Drawing algorithms                     |
| (iii)             | Two and Three dimensional Transformations, Translation, Scaling and Rotations. |
| (iv)              | Clipping   |
| (v)               | Three dimensional Curves   |
| (vi) <sup>:</sup> | Hidden Surface Removal and applications  |
|                   |  |

12. Suggested Books:

| S.No. | Name of Authors/Book/Publisher  | Year of ∙    |
|-------|---|--------------|
| s     |   | Publication/ |
| 1.    | Adams J.A. and David R. Rogers, Mathematical Elements<br>of Computer Graphics, IInd Edition, McGraw Hill. | 2002         |
| 2.    | Foley J.D., Computer Graphics Principle & Practice, Pearson, IInd Edition.                                | 2006         |
| 3.    | Hearn D. and Baker M.P., Computer Graphics, C.Version,<br>Prentice Hall, IInd Edition.                    | 2004         |

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Appendix 'E' Item No. Senate/ 43.2.5

| INDIAN INSTITUT                               | TE OF TECHNOLOGY ROORKEE            |
|---|-------------------------------------|
| NAME OF DEPTT./CENTRE:                        | Civil Engineering Department        |
| 1. Subject Code: CE-455                       | Course Title: Advanced Steel Design |
| 2. Contact Hours: L: 2 T: 1                   | P: 0                                |
| 3. Examination Puration (Hrs.):               | Theory 3 Practical 0                |
| 4. Relative Weightage: CWS 25                 | PRS 0 MTE 25 ETE 50 PRE 0           |
| 5. Credits: 3 6. Sem<br>8. Pre-requisite: Nil | ester: Autumn 7. Subject Area: DCC  |

9. Objective: To introduce the concept of stability of components, analysis and design of steel towers and thin walled sections.

10. Details

Principality .

| 10.000 |  | · · ·                |
|--------|--|----------------------|
| S. No. | / Contents   | <b>Contact Hours</b> |
| 1.     | Concept of stability, buckling of columns : Concept of stability;        | 8                    |
|        | Byckling of columns; Buckling of columns with intermediate               |                      |
|        | compressive forces and changes in cross-section; Effect of shearing      |                      |
|        | force on critical load, Lateral instability of beams, Buckling of plates | • •                  |
| ŀ .    | compressed in one/two directions, Buckling of plates under the           | · ·                  |
|        | action of shearing stresses.   |                      |
| 2.     | Behaviour and design of cold formed thin walled structures :             | 8.                   |
|        | Methods of cold forming; Influence of cold forming on mechanical         | .'                   |
|        | properties; Behaviour and design of compression element; Stiffened       | -                    |
| · · ]  | and unstiffened elements; Design of flexural members; Bracing            |                      |
|        | requirements.  |                      |
| 3      | Wind loads, gust factor microwave & TV towers : Design                   | × 8                  |
|        | considerations; forms of structures; Wind loading and its effects;       |                      |
|        | Codal provision, Simplified analysis and design                          |                      |
| -4.    | Example problems of pre-engineered steel buildings using softwares       | 4                    |
|        | such as SAP and STADD etc.   |                      |
|        | . Total  | 28                   |

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N15/11/11

### 11. Suggested Books:

| S. No. | Name of Authors / Books / Publishers  | Year of<br>Publication /<br>Reprint |
|--------|---|-------------------------------------|
| 1.     | Arya, A.S. and Ajmani, J.L., "Design of Steel Structures", Nem Chand & Bros.                                  | 2004                                |
| 2.     | Englekirk, R., "Steel Structures - Controlling Behaviour Through Design", John Wiley.                         | 2003                                |
| . 3    | Subramanian, N., "Design of Steel Structures", Oxford University Press.                                       | 2009                                |
| 4.     | Trahair, N.S. and Bradford, M.A., "The Behaviour and Design of<br>Steel Structures to EC3", Taylor & Francis. | 2008                                |

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21/15/11/11

Appendix 'F' Item No. Senate/43.2.18

### M.Tech. (Earthquake Engineering)

### (SEISMIC VULNERABILITY AND RISK ASSESSMENT)

|         | Teaching Scheme                       |  |                 |  | Contact<br>Hours Per<br>Week |     | Exam<br>Duration<br>(Hrs.) |        | Relative Weightage (% |                                    |          |     | <b>)</b> |           |
|---------|---------------------------------------|--|-----------------|--|------------------------------|-----|----------------------------|--------|-----------------------|------------------------------------|----------|-----|----------|-----------|
| S. No.  | Subject<br>Code                       | Course Title                           | Subject<br>Area | Credits                                      | L                            | T   | Р                          | Theory | Practical             | CWS                                | PRS      | MTE | ETE      | PRE       |
| 1st Yes | ar                                    | Autumr                                 | Semest          | er   |                              |     |                            |        |                       |                                    |          |     |          | . <b></b> |
| Ι.      | MA-501E                               | Optimization Techniques                | ICC             | 4  | 3                            | 1   | -                          | 3      | -                     | 25                                 | <u>.</u> | 25  | 50       | -         |
| 2.      | EQ -502                               | Vibrations of Elastic Media            | PCC             | 4  | 3                            | 1   | 2/2                        | 3      | -                     | 15                                 | 15       | 30  | 40       | -         |
| 3.      | EQ-531                                | Seismological Modelling and Simulation | PCC             | 4  | 3                            | 1   | -                          | 3      | -                     | 25                                 | -        | 25  | 50       | -         |
| 4.      | EQ-532                                | Vulnerability and Risk Analysis        | PCC             | 4  | 3                            | 1   | , <b>-</b>                 | 3      | -                     | 25                                 | -        | 25  | 50       | -         |
| 5.      |                                       | Open Elective I                        | OEC             | 4/3  | -                            | -   | -                          | -      | -                     | -                                  | -        | -   | -        | -         |
| 6.      | HS-501                                | Technical Communication (Optional)     | -               | 2  | I                            | 0   | 2                          | 2      | -                     | 15                                 | 15       | 30  | 40       | -         |
|         | <u> </u>                              | Sub Total                              |                 | 19/22  |                              |     |                            |        |                       |                                    |          |     | <u>-</u> |           |
|         | •                                     | Spring S                               | Semester        | <u>.                                    </u> |                              |     |                            |        |                       |                                    |          |     |          | <b>.</b>  |
| 1.      |                                       | Programme Elective                     | PEC             | 4  | -                            | -   | -                          | -      | -                     | · ·                                | -        | -   | -        | -         |
| 2.      |                                       | Programme Elective                     | PEC             | 4  | •                            | -   | -                          | -      | -                     |                                    | -        | -   | -        | -         |
| 3.      |                                       | Programme Elective                     | PEC             | 4  | -                            | -   | -                          | -      | -                     | •                                  | -        | -   | -        | -         |
| 4.      |                                       | Programme Elective                     | PEC             | 4  | -                            | - ( | -                          | •      | -                     | •                                  | -        | •   | ) -      | -         |
| 5.      | ``                                    | Open Elective II                       | OEC             | 4/3  | -                            | -   | -                          | -      | -                     |                                    | -        | -   | -        | -         |
| 6.      | HS-501                                | Technical Communication (Optional)     |                 | 2  |                              | 0   | 2                          | 2      | -                     | 15                                 | 15       | 30  | 40       | •         |
|         | · · · · · · · · · · · · · · · · · · · | Sub Total                              | - <b>I</b>      | 19/22  | I                            |     |                            |        |                       | L                                  |          |     |          |           |
|         | 2 <sup>nd</sup> Year                  | Autumn                                 | Semeste         | r  |                              |     | _                          |        |                       |                                    |          |     |          |           |
| T.      | EQ-601                                | Seminar                                | SEM             | 2  | - 1                          | •   | -                          | -      | -                     |                                    | -        | 100 | ŢŢ       | -         |
| 2.      | EQ-602                                | Project                                | RP              | 4  | +                            | -   | -                          | •      | -                     | -                                  | -        | 100 | -        | -         |
| 3.      | EQ-603                                | Dissertation <sup>*</sup>              | DIS             | -  | -                            | -   | -                          | -      | -                     | -                                  | -        | -   | 25       |           |
|         | ·                                     | Sub Total                              | <b>-</b>        | 6  | L                            | ŀ   | L                          |        |                       |                                    |          |     |          |           |
|         |                                       | Spring S                               | lemester        |  |                              |     |                            |        |                       |                                    |          |     | · _      | _         |
| ١.      | EQ-603                                | Dissertation                           | DIS             | 20   | -                            |     | -                          | -      | -                     | -   -                              | -        | -   | 75       | -         |
|         | · · · · · · · · · · · · · · · · · · · | Sub Total                              |                 | 20   |                              |     |                            |        |                       | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ |          |     |          |           |
|         |                                       | Total                                  |                 | 64/68  |                              |     |                            |        |                       |                                    |          |     |          |           |

\*NOTE: To be continued and Grade to be awarded in the next semester.

| Teaching Scheme |                 |  |                 |         | H | Contact<br>Hours Per<br>Weck |     | Exam<br>Duration<br>(Hrs.) |           | Relative Weightage (%) |     |     |     | 6)  |
|-----------------|-----------------|--|-----------------|---------|---|------------------------------|-----|----------------------------|-----------|------------------------|-----|-----|-----|-----|
| S. No.          | Subject<br>Code | Course Title   | Subject<br>Area | Credits | L | т                            | Р   | Theory                     | Practical | CWS                    | PRS | MTE | ETE | PRE |
| 1.              | EQ-514          | Seismic Evaluation and<br>Retrofitting of Structures | PEC             | 4       | 3 | ł                            | 0   | 3                          | 0         | 25                     | 0   | 25  | 50  | 0   |
| 2.              | EQ-533          | Ground Shaking Hazard                                | PEC             | 4       | 3 | 1                            | 0   | -3                         | 0         | 25                     | 0   | 25  | 50  | 0   |
| 3.              | EQ-534          | Advanced Seismic Microzonation                       | PEC             | 4       | 3 | l                            | 0   | 3 .                        | 0         | 25                     | 0   | 25  | 50  | 0   |
| 4.              | EQ-535          | Seismic Disaster Mitigation and Management           | PEC             | 4       | 3 | 1                            | 0   | 3                          | Ó         | 25                     | 0   | 25  | 50  | 0   |
| 5.              | EQ-536          | Ground Failure Hazard                                | PEC             | 4       | 3 | l                            | 0   | 3                          | 0         | 25                     | 0   | 25  | 50  | 0   |
| 6.              | EQ-537          | Earthquake Precursors and Early<br>Warning Systems   | PEC             | 4       | 3 | l                            | 0   | 3                          | 0         | 25                     | 0   | 25  | 50  | 0   |
| 7.              | EQ-538          | Geoinformatics                                       | PEC             | 4       | 3 | I                            | 2/2 | 3                          | 0         | 15                     | 15  | 30  | 40  | 0   |
| 8.              | EQ- 546         | Instrumentation and Model Testing<br>Techniques      | PEĊ             | 4       | 3 | 1                            | 0   | 3                          | 0         | 25                     | 0   | 25  | 50  | 0   |
| 9.              | EQ-571          | Ground Improvement Techniques                        | PEC             | 4       | 3 | 1                            | 0   | 3                          | 0         | 25                     | 0   | 25  | 50  | 0   |

### List of Programme Elective Courses (Seismic Vulnerability and Risk Assessment)

1

| NAM | IE OF DEPARTMENT:                   | DEPARTMENT OF EARTHQUAKE ENGINEERING      |             |                      |  |  |  |  |
|-----|-------------------------------------|---|-------------|----------------------|--|--|--|--|
| 1.  | Subject Code: EQ – 502              | Course Title: VIBRATIONS OF ELASTIC MEDIA |             |                      |  |  |  |  |
| 2.  | Contact Hours: L: 03                | <u>T: 01</u>                              | P: 2/2      |                      |  |  |  |  |
| 3.  | Examination Duration (Hrs.); Theory | 0 3                                       | Practical 0 | 0                    |  |  |  |  |
| 4.  | Relative Weightage: CWS 1 5 P       | RS 1 5                                    | MTE 3 0 ETF | E 4 0 PRE 0 0        |  |  |  |  |
| 5.  | Credits: 0 4                        | 6. Semester                               | : Autumn    | 7. Subject Area: PCC |  |  |  |  |
| 8.  | Pre-requisite: Nil                  |   |             |                      |  |  |  |  |

Objective of Course: To provide the basic framework for studying time-dependent response of mechanical systems to external excitations.
 Details of Course:

#### Details of Course: SI. Contents Contact No. Hours 1. Vibrations and the Nature of Time Dependent Phenomena: Incrtia, dynamic equilibrium and 2 mathematical models of physical systems, energy storing and dissipation mechanisms. Dynamics of Single Degree of Freedom Systems: Undamped and damped, free and forced 2. 9 vibrations, steady-state and transient response, impulse response; Vibration isolations. Convolution Integral and Solution of Equation of Motion: Numerical methods for solution of 3. 6 linear and non-linear equations of motion; response/shock spectra, Fourier transforms and analysis in frequency domain. 4. Dynamics of Multi-Degree of Freedom Systems: Lagrange's equations, equations of motion for 9 mdof systems, algebraic eigenvalue problem and free vibration analysis, undamped and damped normal modes, mode superposition method for dynamic analysis of linear systems, mode-truncation and correction for the missing mass. Probability Theory and Stochastic Processes: Random variables, functions of random variables, 8 5. correlation, stationary and ergodic random processes, power spectrum, extreme value statistics, first passage problem, peak value statistics. Response of SDoF and MDoF Systems to Random Excitations: Time domain characterization, 8 б. frequency domain analysis, estimation of maximum response, normal mode theory. Total 42

#### 11. List of Experiments:

Suggested Books:

- 1. Vibration transducers and elementary data processing.
- 2. Free vibration characteristic of structural systems-natural frequency and damping ratio.
- 3. Harmonic forced vibration response of structural models and frequency response functions.
- 4. Dynamic vibration absorber.
- 5. Prototype testing and system identification.

#### 12.

| Sl.<br>No. | Name of Authors/ Books/ Publishers  | Year of<br>Publication/Reprint |
|------------|---|--------------------------------|
| 1.         | Warburton, G.B., "The Dynamic Behaviour of Structures", 2nd edition Pergamon Press,                                 | 1976                           |
| 2.         | Clough ,R.W. and Penzien J., "Dynamics of Structures", 2 <sup>nd</sup> edition, Mc-Graw Hill Book<br>Company.       | 1993                           |
| 3.         | Chopra, A.K., "Dynamics of Structures", 3rd edition, PHI Learning Pvt. Ltd.   | 2006                           |
| 4.         | Craig, R.R. Jr. and Kurdila, A., "Fundamentals of Structural Dynamics", 2 <sup>nd</sup> edition, John Wiley & Sons. | 2006                           |
| 5          | Nigam N.C., Introduction to Random Vibrations, MIT Press.   | 1983                           |
| 6.         | Wirsching, P.H., Paez, T.L. and Ortz, H., "Random Vibration", Dover Publications                                    | 2006                           |

| NAM<br>1. | E OF DEPARTMENT:<br>Subject Code: EQ -538 | DEPARTMENT OF EARTHQUAKE ENGINEERING<br>Course Title: GEOINFORMATICS  |  |  |  |  |  |
|-----------|---|---|--|--|--|--|--|
| 2.        | Contact Hours: L: 03                      | T: 01 P: 2/2  |  |  |  |  |  |
| 3.        | Examination Duration (Hrs.): Theory       | 0 3 Practical 0 0   |  |  |  |  |  |
| 4.        | Relative Weightage: CWS 1 5 P             | TRS         I         5         MTE         3         0         ETE         4         0         PRE         0         0 |  |  |  |  |  |
| 5.        | Credits: 0 4                              | 6. Semester: Both 7. Subject Area: PEC  |  |  |  |  |  |

- 8. Pre-requisite: Nil
- 9. Objective of Course: The course is designed to provide basic knowledge about mapping and geoinformatics need in earthquake engineering.

#### Details of Course: 10.

| S1.<br>No. | Contents   | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Introduction: Earthquakes, characteristics and distribution, tectonic features of the earth, geotectonic divisions of Indian continent, geologic hazards perception.   | 3                |
| 2.         | Earthquakes in Different Geological Set Ups: Geological structures and deformation pattern, inter<br>and intra – continent set up, convergent zones, divergent margins, trenches, thrusts and faults.<br>Earthquake implication of structural discontinuities, impact of neo-tectonic activity.  | 8                |
| 3.         | Mapping: Coordinate and coordinate systems; geographical and map projection system, 2D and 3D data transformation, types of maps, scales, mapsheet numbering systems and uses, types of maps, introduction to topographical and geological maps, thematical maps, geological sections, data processing, analysis and presentation techniques.  | 8                |
| 4.         | Remote Sensing in Earthquake Geology: Basic concepts of satellite imaging of ground, types of satellite data in identifying the tectonic features, recognising characteristics of earthquake deformation features, SAR interferometry for earthquake deformation studies; Application of GPS for mapping.  | 12               |
| 5.         | GIS: Basic GIS concepts, vector and raster data understanding, database creation for geological, tectonic and earthquake themes, GIS data integration and analysis techniques; Tectonic hazard assessment using GIS, geospatial data modelling, geographic information systems, hardware and software components, data transformation, processing and analysis models, overlay, network and proximity analysis, data visualization tools and models. | 11               |
| -          | Total  | 42               |

#### 11. List of Experiments:

- Demonstration of GIS Software (i)
- Scanning and digitization of thematic maps. (ii)
- Registration and Georeferencing. (iii)
- Database creation and management. (iv)
- Processing of pre and post earthquake satellite images. Collection of data using GPS and mapping. (v)
- (vi)
- Use of SAR interferometry for surface displacement measurement. (vii)

| SI.<br>No. | Name of Authors/ Books/ Publishers   | Year of<br>Publication/Reprint |
|------------|--|--------------------------------|
| 1.         | Lillesand, T.M., "Remote Sensing and Image Interpretation", John Wiley and Sons.   | 1979                           |
| 2.         | Burrough, P.A., "Principles of Geographic Information Systems for Land Resources Assessment", Oxford University Press.         | 1986                           |
| 3.         | Ramsay, J.G. and Huber, M.I., "The Technique of Modern Structural Geology", Vol 2: Folds and Fracture. Academic Press, London. | 1987                           |
| 4.         | Goodman, R.E., "Engineering Geology", Wiley, New York.   | 1993                           |
| 5.         | Moores, E.M., and Twiss, R.J., "Tectonics", W.H. Freeman and Company, New York   | 1995                           |
| 6.         | Yeats, R.S., Sieh, K. and Allen, C.R., "Geology of Earthquakes", Oxford Univ. Press, New York                                  | 1997                           |
| 7.         | Gupta, R.P., "Remote Sensing Geology", Springer-Verlag Press, Berlin   | 2002                           |

#### NAME OF DEPARTMENT:

### DEPARTMENT OF EARTHQUAKE ENGINEERING

| 1. | Subject Code: EQ – 532              | Course Title: VI | ULNERABILITY | AND RISK | ANALYSIS          |
|----|-------------------------------------|------------------|--------------|----------|-------------------|
| 2. | Contact Hours: L: 03                | T: <b>0</b> 1    | P: 00        |          |                   |
| 3. | Examination Duration (Hrs.): Theory | 0 3              | Practical    | 0 0      |                   |
| 4. | Relative Weightage: CWS 2 5 F       | RS 0 0           | MTE 2 5      | ETE 5    | 0 PRE 0 0         |
| 5. | Credits: 0 4                        | 6. Semeste       | er: Autumn . | 7. 5     | Subject Area: PCC |

- 8. Pre-requisite: Nil
- 9. Objective of Course: The course introduces various methods and approaches of vulnerability and risk assessment.
- 10. Details of Course:

| Sl.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Concepts and Components of Seismic Risk: Hazard, vulnerability, exposure and risk; estimation of risk from components.  | 4                |
| 2.         | Modelling and Analysis of Structures: Introduction to matrix and finite element procedures, modelling of buildings and bridges  | 8                |
| 3.         | Seismic Vulnerability of Buildings and Lifelines: Empirical, analytical, experimental and hybrid approaches, building typology, intensity scales, use of intensity scales for estimating seismic vulnerability, capacity spectrum method, HAZUS methodology, displacement based approach. | 8                |
| 4.         | Assessment of Exposure: Building stock inventory, sources of available information, census data, application of satellite imageries, stratified random sample survey, application of GIS.   | 6                |
| 5.         | Risk Estimation: Convolution of hazard, vulnerability and exposure to quantify risk, loss ratios, indoor and outdoor casualty rates; case studies of different projects- RADIUS, HAZUS, PAGER, GEM, EU-RISK.  | 6                |
| 6.         | Post Earthquake Damage Studies: Damage surveys; questionnaires and data to be collected, handling and processing of data, classification of damage, estimation of fragility from damage data.   | 5                |
| 7.         | Risk Communication: Role of planners, architects, engineers, banks and insurers, rating damage assessment, disaster impact analysis   | 5                |
|            | Total   | 42               |

| SI.<br>No. | Name of Authors/ Books/ Publishers   | Year of<br>Publication/Reprint |
|------------|--|--------------------------------|
| 1,         | Krammer, S. L., "Geotechnical Earth quake Engineering", Pearson Education.                             | 1996                           |
| 2.         | Reiter, L. "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press.               | 2001                           |
| 3.         | Coburn, A. and Spence R., "Earthquake Protection", John Wiley and Sons, Ltd.                           | 2002                           |
| 4.         | McGuire, Robin K., "Seismic Hazard and Risk Analysis", Earthquake Engineering Research<br>Institute.   | 2004                           |
| 5.         | "HAZUS-MH, MR1 & MR2 Technical Manual", FEMA, Federal Emergency Management<br>Agency, Washington, D.C. | 2006                           |

| NAME OF DEPARTMENT: |                                     |        | DEPARTMENT OF EARTHQUAKE ENGINEERING |                          |  |  |  |
|---------------------|-------------------------------------|--------|--------------------------------------|--------------------------|--|--|--|
| 1.                  | Subject Code: EQ -531               | Course | Title: SEISMOLOGICAL                 | MODELLING AND SIMULATION |  |  |  |
| 2.                  | Contact Hours: L: 03                | T: 01  | P: 00                                |                          |  |  |  |
| 3.                  | Examination Duration (Hrs.): Theory | 0      | 3 Practical                          | 0 0                      |  |  |  |
| 4.                  | Relative Weightage: CWS 2 5 P       | RS 0   | 0 MTE 2 5                            | ETE 5 0 PRE 0 0          |  |  |  |
| 5.                  | Credits: 0 4                        | 6.     | Semester: Autumn                     | 7. Subject Area: PCC     |  |  |  |
|                     |                                     |        |                                      |                          |  |  |  |

#### 8. Pre-requisite: Nil

7

9. Objective of Course: To provide basic knowledge about simulation and modeling of strong ground motion.

#### 10. Details of Course:

| Sl.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Introduction: Definition of important terms; Scope of seismology and engineering seismology;<br>Causes of earthquakes; Earthquake effects on ground and structures; Strong ground motion<br>characteristics; Wave equation, laws of reflection, refraction and attenuation, diffraction and<br>dispersion; Earthquake magnitude and intensity scales, energy.   | 12               |
| 2.         | Strong motion synthetics: Concepts of strong motion synthetics; Numerical modelling of realistic fault rupture processes, kinematic dislocation models, 3-D modelling of spontaneous fault rupture processes; Stochastic simulation; Far field and near field radiation, attenuation mechanism; Aki's law of scaling, energy release, types and proportions, correlation between ground motion parameters and magnitude and other parameters derived from analyses of strong motion records; Fault surface integral techniques, source parameterization to finite faults, Path effects in strong motion seismology. | 18               |
| 3.         | Strong ground motion processing: Basic theory and introduction, types of signals, properties of digital system (time invariance, causality, linearity), sampling theorem, antialiasing filter; Discrete Fourier Transform, Fast Fourier Transform, Inverse Transform; Characterisation of digital filters, low pass and high pass filters; Convolution in time domain and in frequency domain; Interpolation and decimation of digital data; Correlation and power spectrum estimation; Instrument correction and restitution of ground motion.   | 06               |
| 4.         | Strong ground motion: Displacement, velocity and acceleration response spectra, deconvolution, response spectrum based time histories, selection of strong ground motion for earthquake engineering.  | 06               |
|            | Total   | 42               |

| SI.<br>No. | Name of Authors/ Books/ Publishers  | Year of<br>Publication/Reprint |
|------------|---|--------------------------------|
| 1.         | Bolt, B. A., "Seismic Strong Motion Synthetics", Academic Press.  | 1990                           |
| 2.         | Reiter, L., "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press.                               | 2001                           |
| 3.         | Stein, S. and Wysession, M., "An Introduction to Seismology, Earthquake and Earth Structures", Black Well Publications. | 2003                           |
| 4.         | Villaverde, R., "Fundamental Concepts of Earthquake Engineering", Taylor & Francis.                                     | 2008                           |

| NAME | OF DEPARTMENT:                      | DEPARTMEN        | NT OF EARTH  | QUAKE ENGINEERING    |
|------|-------------------------------------|------------------|--------------|----------------------|
| 1.   | Subject Code: EQ -534               | Course Title: AD | VANCED SEISN | AIC MICROZONATION    |
| 2.   | Contact Hours: L: 03                | T: 01            | P: 00        |                      |
| 3,   | Examination Duration (Hrs.): Theory | 0 3              | Practical    | 0 0                  |
| 4.   | Relative Weightage: CWS 2 5 P       | RS 0 0           | MTE 2 5      | ETE 5 0 PRE 0 0      |
| 5.   | Credits: 0 4                        | 6. Semeste       | r: Both      | 7. Subject Area: PCC |

8. Pre-requisite: Nil

9. Objective of Course: To provide advance knowledge on seismic microzonation, procedures and methodologies and deliverables.

10. Details of Course:

| SI.<br>No. | Contents   | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Introduction: Seismic microzonation; Basic steps, data requirements, scales, general methodology;<br>Site characterization and quantification; Seismic zonation map of India; Socio-economic aspects of<br>seismic microzonation, factors affecting seismic microzonation, seismic microzonation of mega<br>cities.  | 6                |
| 2.         | <b>Procedures and Methodologies:</b> Multidisciplinary input data, geological, geotechnical, geomorphological and geophysical data; Seismic hazard assessment analysis, site characterization and its response, ground shaking effects and liquefaction, integration of hazards.   | 8                |
| 3.         | Site Response and Analysis: Experimental, analytical and numerical methods, empirical relations;<br>Effects of topography, ground water and bedrock; Ground response analysis using SHAKE-program;<br>Determination of in-situ shear-wave velocity and Q-factor; Site amplification and its relation to<br>surficial geologic condition; Engineering uses of strong motion data and seismic microzonation.   | 12               |
| 4.         | Seismic microzonation deliverables: Amplification maps, fundamental frequency map, surface iso acceleration maps for different time periods and return periods, probability of exceedance of strong ground motion; Liquefaction potential maps; Landslide hazard zonation maps; Thematic maps with various primary and secondary effects of earthquakes; Earthquake engineering perspective and limitations. | 12               |
| 5.         | Case Studies: Mega cities, Delhi, Guwahati, Bangalore, Dehradun, Istanbul, Mexico city, etc.   | 4                |
|            | Total  | 42               |

| SI.<br>No. | Name of Authors/ Books/ Publishers  | Year of<br>Publication/Reprint |
|------------|---|--------------------------------|
| 1.         | Kramer, S. L., "Geotechnical Earthquake Engineering", Pearson Education.  | 1996                           |
| 2.         | Reiter, L., "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press.   | 2001                           |
| 3.         | Ansal, A., "Recent Advances in Earthquake Geotechnical Engineering and Microzonation", Springer.  | 2006                           |
| 4.         | Villaverde, R., "Fundamental Concepts of Earthquake Engineering", Taylor & Francis.   | 2008                           |
| 5.         | "Geotechnical/Geophysical Investigations for Seismic Microzonation Studies of Urban Centres in<br>India-Technical Report", NMDA, New Delhi. | 2011                           |

| NAME | OF DEPARTMENT:                      | DEPARTMEN        | NT OF EARTHQUAKE E  | NGINEERING        |
|------|-------------------------------------|------------------|---------------------|-------------------|
| 1.   | Subject Code: EQ533                 | Course Title: GI | ROUND SHAKING HAZAR | D                 |
| 2.   | Contact Hours: L: 03                | T: <b>01</b> '   | P: 00               |                   |
| 3.   | Examination Duration (Hrs.): Theory | 0 3              | Practical 0 0       |                   |
| 4.   | Relative Weightage: CWS 2 5 P       | RS 0 0           | MTE 2 5 ETE         | 5 0 PRE 0 0       |
| 5.   | Credits: 0 4                        | 6. Semeste       | r: Both 7.          | Subject Area: PEC |

#### 8. Pre-requisite: Nil

1

9. Objective of Course: The basis objective of the course is to provide knowledge for estimation of ground shaking hazard.

#### 10. Details of Course:

| SI.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Introduction: Seismic hazard definition, probabilistic and deterministic approach, earthquake occurrence models, seismotectonic modeling, type of sources, estimation of maximum magnitude, maximum credible earthquake, design basis earthquake, maximum probable earthquake, frequency magnitude relationship, ground motion prediction equations, uncertainties in seismic hazard assessment and their quantification, return periods and strong motion exceedance rates.  | 8                |
| 2.         | Seismicity Data and Treatments: Seismicity catalogues, spatial coverage, temporal coverage, completeness in size and time, cut off magnitude, earthquake swarms, foreshocks and aftershoeks, declustring of data, homogenisation, bivariate orthogonal regression, estimation of maximum probable magnitude, earthquake sources, types of sources, point, line and areal sources-random seismicity method, seismotectonic providence method, geological slip rate method, Gutenberg Richter frequency magnitude distribution. | 12               |
| 3.         | Earthquake Occurrence Modeling: Poissonian model, non-Poissonian models, normal, Weibull,<br>Gamma distributions, extreme value statistics – Gumbel I, II and III type distributions, Markov and<br>semi-Markov chains.   | <b>8</b>         |
| 4.         | Site-specific Ground Motion Prediction: Empirical Green's function; numerical methods; basic concept, recent developments, domain method, boundary method & hybrid method, effects of nonlinearity on ground motion.  | 8                |
| 5.         | Deterministic and Probabilistic Seismic Hazard Analysis: Deterministic and probabilistic seismic hazard methods, compilation of data, epistemic and aleatory uncertainty estimation, attenuation relationships, deaggregation, logic tree, hazard estimation at the bedrock, various types of iso acceleration maps and return periods, probability of exceedance and return periods in earthquake engineering.   | 6                |
|            | Total   | 42               |

| SL<br>No. | Name of Authors/ Books/ Publishers  | Year of<br>Publication/Reprint |
|-----------|---|--------------------------------|
| 1.        | Kramer, S. L., "Geotechnical Earthquake Engineering", Pearson Education.  | 1996                           |
| 2.        | Reiter, L. "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press.                                | 2001                           |
| 3.        | Stein, S. and Wysession, M., "An Introduction to Seismology, Earthquake and Earth Structures", Black Well Publications. | 2003                           |
| 4.        | McGuire, Robin K., "Seismic Hazard and Risk Analysis", Earthquake Engineering Research<br>Institute.                    | 2004                           |

| NAME OF DEPARTMENT: |                                     |        | DEPARTMENT OF EARTHQUAKE ENGINEERING |              |      |       |           |         |   |
|---------------------|-------------------------------------|--------|--------------------------------------|--------------|------|-------|-----------|---------|---|
| 1.                  | Subject Code: EQ -571*              | Course | Title: GR                            | OUND IMPROVI | EMEN | IT TE | CHNIQ     | UES     |   |
| 2.                  | Contact Hours: L: 03                | T: 01  |                                      | P: 00        |      |       | 1         |         |   |
| 3.                  | Examination Duration (Hrs.): Theory | 0      | 3                                    | Practical    | 0    | 0     |           |         |   |
| 4.                  | Relative Weightage: CWS 2 5 P       | RS 0   | 0                                    | MTE 2 5      | ETE  | 5     | 0         | PRE 0 0 | ) |
| 5.                  | Credits: 0 4                        | 6.     | Semeste                              | r: Both      |      | 7. St | ibject Ai | ea: PEC |   |
| 8.                  | Pre-requisite: Nil                  |        |                                      |              |      |       |           |         |   |

9. Objective of Course: The course describes various ground improvement techniques to mitigate the effects of earthquakes.

#### 10. Details of Course:

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| Sl.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Introduction: Objective, history and development, classifications of techniques, advantage and limitations of various techniques.   | 2                |
| 2.         | Densification using Vibration Techniques: Vibro compaction: blasting, vibratory probe, vibratory compactors; Vibro-displacement compaction: displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping.   | 8                |
| 3.         | Geosythetics: Types, geotextiles, geomembranes, geonets, geocomposites; Manufacturing, functions and applications; Modeling for dynamic analysis.   | 6                |
| 4.         | <b>Reinforcement Techniques:</b> Reinforced earth, engineering applications, strength characteristics;<br>Improvement in bearing capacity and settlement characteristic; Randomly distributed fiber<br>reinforced soil: strength characteristics, improvement in bearing capacity and reduction in<br>settlement; Soil nailing; Analysis and design of steep open cuts. | 12               |
| 5.         | Drainage Methods: Introduction, ground water and seepage control, methods of dewatering system including design steps, various types of drains with their design.   | 6                |
| 6.         | Precompression: Introduction, compressibility of soils & consolidation, preloading and surcharge fills, monitoring of compression, dynamicb consolidation, consolidation by electro-osmosis.  | 4 .              |
| 7.         | Grouting and Injection: Introduction; Aspects of grouting; Grouting procedure; Applications.  | 4                |
|            | Total   | 42               |

#### 11. Suggested Books:

| Sl.<br>No. | Name of Authors / Books / Publishers  | Year of<br>Publication/Reprint |
|------------|---|--------------------------------|
| 1.         | Rao, G.V. and Raju, G.V.S.S., "Engineering with Geosynthetics", Tata                  | 1990                           |
|            | McGraw-Hill Publishing Co.  |                                |
| 2.         | Koerner, R.M., "Designing with Geosynthetics", Premice-Hall.                          | 1990                           |
| 3.         | Shukla, S.K., "Geosynthetics and their Applications", Thomas Telford.                 | 2002                           |
| 4.         | Kramer, S.L, "Geotechnical Earthquake Engineering", Pearson Education - Indian        | 2004                           |
|            | Low Price Edition.  |                                |
| 5.         | Purushothama, R.P., "Ground Improvement Techniques", Laxmi Publications.              | 2005                           |
| 6.         | Saran, S., "Reinforced Soil and its Engineering Applications", IK International, Pvt. | 2006                           |
|            | Ltd.  |                                |

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| NAME | C OF DEPARTMENT:                    | DEPARTMENT OF EARTHQUAKE ENGINEERING |                   |                      |  |
|------|-------------------------------------|--------------------------------------|-------------------|----------------------|--|
| 1.   | Subject Code: EQ -536               | Course Title: GR                     | OUND FAILURE HAZA | RD                   |  |
| 2.   | Contact Hours: L: 03                | T: 01                                | P: 00             |                      |  |
| 3.   | Examination Duration (Hrs.): Theory | 0 3                                  | Practical 0       | 0                    |  |
| 4.   | Relative Weightage: CWS 2 5 P       | RS 0 0                               | MTE 2 5 ETE       | 5 0 PRE 0 0          |  |
| 5.   | Credits: 0 4                        | 6. Semester                          | r: Both           | 7. Subject Area: PEC |  |

#### 8. Pre-requisite: Nil

9 Objective of Course: The objective of the course is to impart knowledge of ground failure due to earthquakes and related phenomena. Details of Course:

10.

| Sl.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Introduction: Background of geotechnical seismic hazards including ground shaking and liquefaction, geotechnical damages and problems encountered during earthquakes; Deterministic and probabilistic seismic hazard analysis.  | 5                |
| 2.         | Behaviour of Soil for Dynamic Loads: Geotechnical methods, cyclic triaxial, resonant column, shaking table, SPT, CPT, cyclic plate load test, block vibration test; Geophysical methods, surface wave analysis, up hole and down hole tests, dynamic soil coefficients, it assessment; effect of strain level on dynamic soil properties including nonlinear soil models.   | 6                |
| 3          | Soil-Structure Interaction: Concepts, ground amplification analyses; Finite element nonlinear analysis, kinematic and inertial interactions, effects of SSI.  | 6                |
| 4.         | Liquefaction Hazard: Damages due to liquefaction in past earthquakes, excess pore pressure due to shaking, liquefaction susceptibility of cohesionless soils and sensitive clays; Liquefaction potential assessment: characterization of earthquake loading and liquefaction resistance using different approaches; Remedial measure for liquefaction.  | 8                |
| 5.         | Local Site Effects: Effects of local site condition on ground motion, development of site specific design parameters, development of ground motion time histories.  | 4                |
| 6.         | Earth Retaining Structures: Type of earth pressures, numerical methods, pseudostatic methods; Retaining walls: types, failure modes, static pressure, seismic response.   | 4                |
| 7.         | Landslides, Seismic Stability of Embankments: Case histories of earthquake induced landslides;<br>Slope stability using pseudostatic limit equilibrium analysis, seismic coefficients, stability analysis<br>with dynamic loading, damage potential, displacement analysis, dynamic analysis of slope stability;<br>Seismic behavior of slopes and embankments; Possible counter measures for large ground<br>movements including design of retaining walls for seismic forces. | 9                |
|            | Total   | 42               |

#### 11.

| SI.<br>No. | Name of Authors / Books/Publishers  | Year of<br>Publication/Reprint |
|------------|---|--------------------------------|
| 1.         | Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Int. Ltd., New Delhi.           | 2000                           |
| 2.         | Kameshwara Rao, N.S.V., "Dynamic Soil Tests & Applications", Wheeler Publications, New Delhi,           | 2000                           |
| 3.         | Day Robert W., "Geotechnical Earthquake Engineering Handbook", McGraw-Hill, New York.                   | 2001                           |
| 4.         | Kramer, S.L., "Geotechnical Earthquake Engineering", Pearson Education-Indian Low Price Edition, Delhi. | 2004                           |
| 5.         | Saran, S., "Soil Dynamics and Machine Foundation", Galgotia Pub. Pvt. Ltd., New Delhi.                  | 2006                           |
| 6.         | Towhata Ikou, "Geotechnical Earthquake Engineering", Springer-Verlag, Berlin Heidelberg,                | 2008                           |

| NAM | E OF I                                    | DEPARTMENT: DEPARTMENT OF EARTHQUAKE ENGINEERING   |                                |                           |
|-----|---|--|--------------------------------|---------------------------|
| 1.  | Subje                                     | ect Code: EQ -514* Course Title: SEISMIC EVALUATION AND RETROFITTING   | G OF STI                       | RUCTURES                  |
| 2.  | Conta                                     | act Hours: L: 03 T: 01 P: 00   |                                |                           |
| 3.  | Exam                                      | nination Duration (Hrs.): Theory 0 3 Practical 0 0   |                                |                           |
| 4.  | Relat                                     | ive Weightage: CWS 2 5 PRS 0 0 MTE 2 5 ETE 5 0 I   | PRE 0                          | 0                         |
| 5.  | Credi                                     | its: 0 4 6. Semester: Both 7. Subject A  | rea: PEC                       | 2                         |
| 8.  | Pre-re                                    | equisite: Nil  |                                |                           |
| 9.  | Objec                                     | tive of Course: To impart the knowledge for improvement in the performance of buildings not de   | esigned as                     | per seismic               |
| 10. | codes<br>Detail                           | of practice.<br>Is of Course:  | U                              | •                         |
|     | SI.<br>No.                                | Contents   |                                | Contact<br>Hours          |
|     | 1.  | Introduction: Terminology, basic principles of seismic evaluation and retrofitting.  |                                | 2                         |
|     | 2.  | Qualitative Methods of Seismic Evaluation: Rapid visual screening procedure (RVS simplified evaluation of buildings; Visual inspection method and nondestructive testing method.   | P) and<br>(NDT)                | 8                         |
|     | 3.  | Quantitative Methods of Seismic Evaluation: Performance based method using nonlinea<br>push-over analysis (NSP) and non linear dynamic method of analysis (NDP); Estimation of s<br>capacity (strength and ductility).   | r static<br>seismic            | 8                         |
|     | 4.  | Local and Global Methods of Seismic Retrofitting of RC Buildings: System comp<br>strengthening of existing components; RC, steel and FRP jacketing, addition of new components; shear walls and braced frames, introduction to supplemental energy dissipation and<br>isolation. | oletion,<br>nents –<br>id base | 8                         |
|     | 5.  | Re-evaluation of Buildings with Retrofitting Elements: Linear and non-linear modeling, mo of soil and foundations.   | delling                        | 4                         |
|     | 6.  | Seismic Repair and Retrofitting of Earthquake Damaged RC Buildings: Schemes of tem<br>shuttering damages; methods of repair and retrofitting.  | porary                         | 3                         |
|     | 7.  | Seismic Evaluation and Retrofitting of RC Bridges: Seismic evaluation and retrofitting tech for reinforced concrete bridges - columns/piers, cap beams, cap beam-column joint, footing.  | niques                         | 3                         |
|     | 8.  | Seismic Safety of Equipments and Accessories: Retrofitting solutions against slidin<br>overturning of equipments and accessories.  | g and                          | 2                         |
|     | 9.  | Case Studies in Seismic Retrofitting: Case studies RC buildings, masonry buildings, bridges tanks and gravity dams.  | , water                        | 4                         |
|     |   |  | Total                          | 42                        |
|     | Sugges                                    | ted Books:   |                                | Variat                    |
| Í   | Name of Authors/ Books/ Publishers Public |  |                                | year of<br>ication/Reprin |
| ſ   | 1.  | "Seismic Evaluation and retrofit of concrete building - Vol. I & II", Applied Technology   | /                              | 1996                      |

| No. | Tame OI Authors/ Books/ Publishers  | Publication/Reprint                   |
|-----|---|---------------------------------------|
| 1.  | "Seismic Evaluation and retrofit of concrete building – Vol. I & II", Applied Technology<br>Council, California, ATC 40.  | 1996                                  |
| 2.  | Priestley, M.J.N., Seible, F. and Calvi, G.M, "Seismic Design and Retrofit of Bridges", John-Wiley & Sons.  | 1996                                  |
| 3.  | Penelis, George G., and Kappos, Andreas J., "Earthquake Resistant Concrete Structures", E & FN Spon.  | 1997                                  |
| 4.  | "Rapid Visual Screening of Buildings for Potential Seismic Hazards", Federal Emergency<br>Management Agency, Building Seismic Safety Council, Washington, D.C., FEMA 154/155. | 2002                                  |
| 5.  | "Evaluating the Seismic Resistance of Existing Building", ATC -14 project, Applied Technology Council, California.  | 2002                                  |
| 6.  | "Seismic Evaluation of Existing Building" ASCE/SEI 31-03.   | 2003                                  |
| 7.  | "Seismic Rehabilitation of Existing Buildings" ASCE & SEI.  | 2007                                  |
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| NAME | OF DEPARTMENT:                      | DEPART      | MENT OF EARTHQUAKE ENGINEERI     | NG         |
|------|-------------------------------------|-------------|----------------------------------|------------|
| 1.   | Subject Code: EQ -537               | Course Titl | e: EARTHQUAKE PRECURSORS AND EAR | LY WARNING |
| 2,   | Contact Hours: L: 03                | T: 01       | P: 00                            |            |
| 3.   | Examination Duration (Hrs.): Theory | 0 3         | Practical 0 0                    |            |
| 4.   | Relative Weightage: CWS 2 5 P       | RS 0 0      | MTE 2 5 ETE 5 0 PRE              | 0 0        |
| 5.   | Credits: 0 4                        | 6. Se       | nester: Both 7. Subject Area:    | PEC        |

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8. Pre-requisite: Nil

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9. Objective of Course: The course describes present knowledge base of earthquake precursors and details of earthquake early warning systems. Details of Course: 10.

| SI.<br>No. | Contents   | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Introduction to Precursors: Precursor definition, scope and its relation with earthquake prediction, forecast and warning.   | 2                |
| 2.         | Earthquake Precursors: Types of precursors- seismological, geological and geophysical; fault creep, foregoing seismic activity, vertical crustal deformation, electrical resistively, tectonomagnetic effects; Seismo-electromagnetics, radon emanation, ground water changes, electrokinetie effects, seismic wave anomalies, migration of seismie activity, precursory swarms, seismic quiescence, thermal anomaly, multiple precursor observations.   | 4                |
| 3.         | Other General Preeursors: biological precursors, environmental changes, animal behaviour, recent IASPEI recommended precursors.  | 2                |
| 4.         | Analysis of Earthquake Precursors: Identification of precursors, precursors' relation to main event,<br>physical phenomenon associated with precursors, IASPEI procedure for the evaluation of earthquake<br>precursors, experimental observation of precursor and evaluation, case studies.   | 5                |
| 5.         | Earthquake Precursor Models: Dilatancy models, premonitory fault creep model, propagating deformation front model, static stress changes (CFS) and accelerating moment release (AMR).  | 4                |
| 6.         | <b>High-priority Precursor Regions:</b> Seismic gaps for large and great earthquakes, linear migration of large earthquakes, seismic gaps for minor and moderate earthquakes, Indian earthquake precursors monitoring program, other countries' earthquake prediction programs.  | 4                |
| 7.         | Introduction of Earthquake Early Warning (EEW) Systems: Concept of EEW systems, onsite EEW, regional EEW, details of some EEW systems operating in different countries, advantages and problems of EEW systems, engineering aspects of EEW.  | 3                |
| 8.         | <b>Requirements of EEW:</b> Instrumentation, selection of locations, density of network, specifications, blind zone, data transmission, various options for data transmission, central processing unit, protocol for issue of warning.   | 8                |
| 9.         | Algorithms for EEW System: Algorithms for picking onset of earthquake record, real-time location<br>of earthquakes, characteristics of first few seconds of recorded strong ground motion data and their<br>relationship with magnitude, $\tau_p - P_d$ method for estimating magnitude, cumulative average velocity<br>(CAV) and other attributes for estimating magnitude for EEW, ANN approach for estimating<br>magnitude, flow chart and logic tree for issue of warning, development and testing of EEW<br>algorithms. | 10               |
|            | Total  | 42               |

#### Suggested Books: 11.

| S<br>N | SL<br>Io. | Name of Authors /Books/ Publishers   | Year of<br>Publication |
|--------|-----------|--|------------------------|
|        | 1.        | Scholz, C.H., H., Sykes, L.R., and Agarwal Y.P., "Earthquake Predication: A Physical Basis", Sciencel No. 4102,803-810 | 1973                   |
| 1      | 2.        | Rikitake, T., "Earthquake Prediction", Elesever, Amsterdam   | 1976                   |
| 3. | Berlin, G. L., "Earthquake and the Urban Environment", Vol. II, CSR Press Inc. Florida   | 1978 |
|----|--|------|
| 4. | Ma zongjin, Fu zhenxing, Zang Yingzen, Wang chengmin, Zhang guomin, Iieu Defu, "Earthquake<br>Predication", Seismological Press, Beijing                       | 1990 |
| 5. | Wyss, M. and David, C., "The IASPEI procedure for the Evaluation of Earthquake Precursors,<br>Booth., Geophysical Journal International Volume – 131, Issue 3. | 1997 |
| 6. | Jochen Zschau and Andreas, N. Kiippers, "Early Warning Systems for Natural Disaster<br>Reduction", Springer  | 2003 |
| 7. | Sen, P. and Das, N. K., "Geochemical Precursors for Earthquake", Macmillan India Ltd.  | 2007 |
| 8. | Gasparini, P., Manfredi, G. and Jochen Zschau, "Earthquake Early Warning Systems", Springer.   | 2007 |

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#### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAMH | E OF DEPARTMENT:                    | DEPARTMENT OF EARTHQUAKE ENGINEERING |                   |                             |  |  |  |  |
|------|-------------------------------------|--------------------------------------|-------------------|-----------------------------|--|--|--|--|
| 1.   | Subject Code: EQ -546*              | Course Title: I                      | NSTRUMENTATION AN | ND MODEL TESTING TECHNIQUES |  |  |  |  |
| 2.   | Contact Hours: L: 03                | T: 01                                | P: 00             |                             |  |  |  |  |
| 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: Both    | 7. Subject Area: PEC        |  |  |  |  |
| 8.   | Pre-requisite: EQ-501 or equivalent | t                                    |                   |                             |  |  |  |  |

Objective of Course: The course introduces basic principles and applications of seismic instrumentation and also imparts knowledge on model studies for experimental validation in dynamic environment.
 Details of Course:

| S. No. | Particulars   | Contact<br>Hours |
|--------|---|------------------|
| 1.     | Introduction of Motion Measurement: Devices for relative motion measurement, requirements of ground motion measurement; Requirements for instrumentation of structures.   | 2                |
| 2.     | Seismic Sensors: Description of seismic sensors, equation of motion, acceleration, velocity and displacement sensors, seismographs, strong motion accelerographs, SRRs; Characteristics and calibration of sensors, seismic instrumentation networks.                                 | 8                |
| 3.     | Sampling and Recording: Conditioning of analog signal, sampling theorem, anti-aliasing filter,<br>AD conversion, parameters for configuration of data acquisition system, laboratory demonstration of<br>a typical data acquisition system.   | 6                |
| 4      | <b>Processing of Recorded Data:</b> Causes and characteristics of noise, transducer correction in frequency domain and time domain; Basics of digital filters, examples of some typical low pass and high pass filters, filter implementation in time domain and in frequency domain. | 6                |
| 5.     | Characteristics of Recorded Data: Determination of response spectra, determination of Fourier spectra, shape of spectra and its relation with site condition, algorithms for development of spectrum compatible time history.   | 4                |
| б.     | Real Time Engineering Seismology: Development of shake maps using strong ground motion data, ground motion parameters for early warning systems, description and case studies of some existing early warning systems in different parts of world.                                     | 4                |
| 7.     | Model Analysis: Similitude, true model, dead load effect, adequate model, distorted models, model material.   | 4                |
| 8.     | Dynamic Model Testing: Details of shake tables, issues in design of structural models, model material and fabrication of models, simulation of shake table excitation, data acquisition, interpretation and prediction of response of prototype.                                      | 6                |
| 9.     | Case Studies: Case studies of seismic testing of models of buildings and dams.  | 2                |
|        | Total   | 42               |

# 11.Suggested Books:

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| S. No. | Name of Authors / Books / Publishers   | Year of<br>Publication/Reprint |
|--------|--|--------------------------------|
| 1.     | Harry, G. Harris and Gajanan M. Sabnis, "Structural Modeling and Experimental Techniques", CRC Press.                                  | 1999                           |
| 2.     | Samuel, D. Stearns, "Digital Signal Processing with Examples in MATLAB", Prentice Hall.  | 2003                           |
| 3.     | Havskov, J. and Gerardo Alguacil, "Instrumentation in Earthquake Seismology", Springer.  | 2004                           |
| 4.     | Agarwal, Pankaj and Shrikhande, Manish, "Earthquake Resistant Design of Structures",<br>PHI Learning Pvt. Ltd, Easten Economy Edition. | 2006                           |

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#### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAME | OF DEPARTMENT:               | DEPARTMENT C        | OF EARTHQUAKE    | EENGINEERING           |
|------|------------------------------|---------------------|------------------|------------------------|
| 1.   | Subject Code: EQ –535        | Course Title: SEISN | MIC DISASTER MIT | IGATION AND MANAGEMENT |
| 2.   | Contact Hours: L: 03         | <b>T: 01</b>        | P: 00            |                        |
| 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. Sem              | nester: Both     | 7. Subject Area: PEC   |
| 8.   | Pre-requisite:               |                     |                  |                        |

- 9. Objective of Course: The course introduces various aspects of disaster mitigation and management.
- 10. Details of Course:

·····

| Sl.<br>No. | Contents   | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Introduction to Seismic Hazard: Definitions, uncertainties in hazard, vulnerability and risk, seismic hazard estimation and mapping, effect of local site conditions, processing and integration of data (such as tectonics, geology, remote sensing, various geophysical anomalies, soil characteristics, economic development).          | 8                |
| 2.         | <b>Damages:</b> Grades of damages, direct and indirect damages, damage to structures, structure types, quantitative analysis, lessons learnt from past earthquakes.  | 4                |
| 3.         | Seismic Vulnerability and Risk: Seismic vulnerability assessment – various methodologies,<br>building typology survey, empirical and analytical methods, estimation of life loss, direct and indirect<br>economic losses, shelter needs.   | 8                |
| 4          | Disaster Mitigation: Do's and don't about disaster, warning and evacuation, damage survey for designing aid package and detailed survey for reconstruction, repair and retrofitting, post disaster surveys, survey proformas; Long term measures- disaster resistant construction, codal practices, retrofitting cost-benefit analysis.    | 10               |
| 5.         | Post Disaster Issues: Post disaster reconstruction and recovery for sustainable development, issues and policies.  | 6                |
| 6.         | <b>Disaster Management Act :</b> Disaster management policy; Techno legal aspect: techno-legal and techno-financial work; Model town and country planning legislation land use zoning regulation, development control regulations and building bye-laws registration, qualification and duties of professionals, disaster response policy. | 6                |
|            | Total  | 42               |

#### 11. Suggested Books:

| SI.<br>No. | Name of Authors /Books/ Publishers   |      |  |  |  |
|------------|--|------|--|--|--|
| 1.         | Reiter, L. "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press.             | 2001 |  |  |  |
| 2.         | Andrew, C. and Spence, R., "Earthquake Protection", John-Wiley & Sons.                               | 2002 |  |  |  |
| 3.         | McGuire, Robin K., "Scismic Hazard and Risk Analysis", Earthquake Engineering Research<br>Institute. | 2004 |  |  |  |
| 4.         | Carter, W.N., "Disaster Management: A Disaster Manager's Handbook", Manila, ADB.                     | 2006 |  |  |  |
| 5.         | Villaverde, R., "Fundamental Concepts of Earthquake Engineering", Taylor & Francis.                  | 2008 |  |  |  |
| 6.         | Sinvhal, A., "Understanding Earthquake Disaster", McGraw Hill.                                       | 2011 |  |  |  |
| 7.         | "Guide lines, National Disaster Management Authority, Govt. of India                                 | 2011 |  |  |  |

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# Appendix 'G'

Item No. Senate/ 43.2.19

#### CENTRE OF EXCELLENCE IN DISASTER MITIGATION AND MANAGEMENT INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1

### PROPOSAL

#### for New M. Tech. Programme in Disaster Mitigation and Management

#### Preamble

1.

Since time immemorial, our country has witnessed a number of major disasters resulting in loss of lives. leaving behind trails of devastation and causing high societal disruption. Being a developing country, we have had a major share of disruption. As we move forward to become a developed nation in time to come, the country has seen tremendous advancement in technical as well as management aspects of natural hazard prediction, monitoring and mitigation (disaster resistant systems etc.) during last one decade. A significant progress has been made in this regard. A number of bodies/organizations have been created. Academic institutions have initiated a range academic UG and PG programmes in this area. The launching of National Earthquake Risk Mitigation Program (NERMP) program by NDMA is another effort in this direction.

The foundation of Center of Excellence in Disaster Mitigation and Management at IIT Roorkee is also geared up to start an full time M. Tech Programme in Disaster Mitigation and Management. The main aim of this programme is to impart advanced knowledge on technical and managerial skills to the professionals to make them equipped with innovative technologies for effective mitigation and management of natural and man-made disasters, risk reduction strategies for overall benefit of the society.

#### Qualification / Eligibility Requirements :

#### For M. Tech. Programme :

- i. B. Tech. (Civil, Structural, Mechanical, Industrial, Chemical, and Engineering/Computer Science or equivalent. B. Arch. & B. Planning
- ii. M. Tech in Geological Technology and Geophysical Technology or equivalent.
- iii. M.B.A. or M.C.A. or M.Sc. in Physics/Geophysics/Geology/Mathematics/ Environmental Sciences (with Maths in B. Sc.) Computer Science or equivalent.

Note: The candidate should have a valid GATE Score for MHRD Assistance.

• Other requirements for MLTech and Ph.D. Programme: As per IIT Rootkee norms

2. Intake of Students : 15+3 proposed with 10-20% variation (15 full time + 3 sponsored) students

3. Fellowship/Scholarship: Institute MHRD fellowship, Fellowships/ Scholarship from funding agency such as DST, Min. of Agriculture, Ministry of Home Affairs, Govt. of India. ICCR & Internal agencies like UNESCO & UNDP, USMD, World Bank ADB are possible.

4. Employment Opportunities: There is a great need to produce trained engineers and scientists in the country for disaster management and mitigation. Various organizations are involved for evolving suitable measures to prevent disasters. This M. Tech. programme will be a unique one to provide specialized training and education in disaster mitigation and re-engineering of structures for prevention of disasters and reduction of risks.

5. The graduates from this course will have ample opportunities to be employed in various construction companies, research organizations, Govt. institutions, insurance companies, banking and financial institutions etc.

# Centre of Excellence in Disaster Mitigation and Management, Indian Institute of Technology Roorkee Structure of M. Tech. Programme in Disaster Mitigation and Management

| S.<br>No          | Subject<br>Code | Course Title                                    | Subject<br>Area | Teaching Scheme<br>(Hrs/Week) |      |           | Subject Teaching S<br>Area (Hrs/W |            | Exa<br>Dnrs<br>(H | n <b>m.</b><br>Ition<br>rs) | R   | lelative | Weight | tage (%    | ) |
|-------------------|-----------------|---|-----------------|-------------------------------|------|-----------|-----------------------------------|------------|-------------------|-----------------------------|-----|----------|--------|------------|---|
|                   |                 |   |                 | Credit                        | L    | T         | P                                 | Theor<br>v | Pract<br>ical     | CWS                         | PRS | MTE      | ETE    | PRE        |   |
| 1 <sup>st</sup> Y | 'EAR            | IS  | EMESTER         | A (AUTU                       | MN)  |           |                                   |            |                   |                             |     |          | _      |            |   |
| 1.                | MA-501E         | Optimization Techniques                         | ICC             | 4                             | 3    | 1         | -                                 | 3          | -                 | 25                          | -   | 25       | 50     | <b> </b> - |   |
| 2.                | DM-501          | Geodata processing Techniques and Models        | PCC             | 4                             | 3    | -         | 3                                 | 3          | -                 | -                           | 25  | 25       | 50     | -          |   |
| 3.                | DM-502          | Natural Hazards and Impact Assessment           | PCC             | 4                             | 3    | 1         |                                   | 3          | -                 | 25                          | -   | 25       | 50     | -          |   |
| 4.                | DM-503          | Hazard Monitoring, Prediction and Microzonation | PCC             | 4                             | 3    | 1         | 2/2                               | 3          | -                 | 15                          | 15  | 30       | 40     | -          |   |
| 5.                |                 | Open Elective –I                                | OEC             | 3/4                           |      |           |                                   |            |                   |                             |     |          |        |            |   |
| 6.                | HS-501          | Technical Communication (Optional)              | IEC             | 2                             | 1    | -         | 2                                 | 2          | -                 | 15                          | 15  | 30       | 40     | -          |   |
|                   |                 | Sub Total                                       |                 | 19-22                         |      |           |                                   |            |                   |                             |     |          |        |            |   |
|                   |                 |   | MESTER (        | (SPRING                       | )    |           |                                   |            | -                 |                             |     |          |        | -          |   |
| 1.                | DM - 601        | Seismic Evaluation and Retrofitting             | PCC             | 4                             | 3    | 1         | -                                 | 3          | -                 | 25                          | -   | 25       | 50     |            |   |
| 2.                |                 | Program Elective-I                              | PEC             | 4                             |      |           |                                   |            |                   |                             |     |          |        |            |   |
| 3.                |                 | Program Elective-II                             | PEC             | 4                             |      |           |                                   |            |                   |                             |     |          |        |            |   |
| 4.                |                 | Program Elective-III                            | PEC             | 4                             |      |           |                                   |            |                   |                             | _   |          |        |            |   |
| 5.                |                 | Open Elective-II                                | OEC             | 3/4                           | -    |           |                                   |            |                   |                             |     |          |        |            |   |
| б.                | HS-501          | Technical Communication (Optional)              | IEC             | 2                             | 1    | -         | 2                                 | 2          | -                 | 15                          | 15  | 30       | 40     | -          |   |
|                   |                 | Sub Total                                       | ,               | 19-22                         |      |           |                                   |            |                   |                             | _   |          |        |            |   |
| 2 <sup>nd</sup>   | YEAR            | Ш   | SEMESTI         | E <mark>R (AU</mark> T        | UMN) |           |                                   |            |                   |                             |     |          |        |            |   |
| 1,                | DM-761          | Seminar   | SEM             | 2                             | -    | <b> -</b> |                                   | -          | -                 | -                           | -   | [-       | 100    | -          |   |
| 2.                | DM-762          | Project   | RP              | 4                             | -    | -         | -                                 | -          | -                 | -                           | -   | -        | 100    | -          |   |
| 3.                | DM-760          | Dissertation                                    | DIS             | 0                             | -    | -         | -                                 | -          | -                 |                             | -   | -        | 25     |            |   |
|                   |                 | Sub Total                                       |                 | 06                            |      |           |                                   |            |                   |                             |     |          |        | 1 -        |   |
|                   |                 | . IV  | SEMEST          | ER (SPR                       | NG)  |           |                                   |            |                   |                             | ·   |          |        |            |   |
| 1.                | DM-760          | Dissertation (Contd from III Semester)          | DIS             | 20                            | -    | -         | -                                 | -          | -                 | -                           | -   | -        | 75     | -          |   |
|                   |                 | Sub Total                                       |                 | 20                            |      |           | •                                 |            |                   |                             |     |          |        | -          |   |
|                   |                 | Total   |                 | 64-68                         |      |           |                                   |            |                   |                             |     |          |        |            |   |

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| S.<br>No. | Subj <sup>i</sup> ect<br>Code | Course Title   | Subject<br>Area | Cre<br>dit | Сол | ntact Hrs/ Exam<br>week Duration<br>(Hrs) |    | Contact Hrs/<br>week |               | Contact Hrs/<br>week |     | Contact Hrs/<br>week |     | Contact Hrs/<br>week |  | Contact Hrs/<br>week |  | Contact Hrs/<br>week |  | Contact Hrs/<br>week |  | Exam<br>Duration<br>(Hrs) |  | Relative Weightage (%) |  |  |  |
|-----------|-------------------------------|--|-----------------|------------|-----|---|----|----------------------|---------------|----------------------|-----|----------------------|-----|----------------------|--|----------------------|--|----------------------|--|----------------------|--|---------------------------|--|------------------------|--|--|--|
|           | :                             |  |                 |            | L   | T   | P  | The<br>ory           | Prac<br>tical | CWS                  | PRS | MTE                  | ETE | PRE                  |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 1.        | DM-611                        | Disaster Preparedness and Mitigation                         | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 2.        | DM-612                        | Managerial and Financial Aspects of Disaster<br>Management   | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 3.        | DM-613                        | Landslide Hazard Assessment and Mitigation                   | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 4.        | DM-614                        | Disaster Induced Risks                                       | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 5.        | DM-615                        | Instrumentation and Data Mining Techniques                   | PEC             | 4          | 3   | 1   | 2/ | 3                    | -             | 15                   | 15  | 30                   | 40  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 6.        | DM-616                        | Flood Estimation, Forecasting and Control                    | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 7.        | DM-617                        | Application of Geospatial Data for Disaster<br>Mitigation    | PEC             | 4          | 3   | -   | 3  | 3                    | -             | -                    | 25  | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 8.        | DM-618                        | Vulnerability and Risk Analysis                              | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | - 1 | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 9.        | DM-619                        | Manmade and Biological Disasters-Detection<br>and Mitigation | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  |                      |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 10        | DM-620                        | Socio Economic Aspects of Disaster<br>Management             | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  |                      |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 11.       | DM-621                        | Cyclone and Wind Resistant Structures                        | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  |                      |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 12.       | CE-639                        | Geomatics Tools for Disaster Management                      | PEC             | 4          | 3   | 1   | -  | 2                    | -             | 25                   | -   | 25                   | 50  |                      |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 13.       | ES-432                        | Advanced Engineering Geology                                 | PEC             | 3          | 2   | 1   | -  | 3                    | -             | 25                   | · - | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 14.       | CE-565                        | Wind Engineering   | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |
| 15.       | EQ-512                        | Earthquake Resistant Design of Structures                    | PEC             | 4          | 3   | 1   | -  | 3                    | -             | 25                   | -   | 25                   | 50  | -                    |  |                      |  |                      |  |                      |  |                           |  |                        |  |  |  |

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# List of Program Electives

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| 1. | Subject Code : DM-501         | Course Title : Geodata Processing Techniques and Models |  |  |  |  |  |  |  |
|----|-------------------------------|---|--|--|--|--|--|--|--|
| 2. | Contact Hours:                | L: 3 T: 0 P: 3  |  |  |  |  |  |  |  |
| 3. | Examination Duration (Hrs.) : | Theory: 3 Practical: 0                                  |  |  |  |  |  |  |  |
| 4. | Relative Weightage: CWS 0     | PRS 25 MTE 25 ETE 50 PRE 0                              |  |  |  |  |  |  |  |
| 5. | Credits: 4                    | 6. Semester: Autumn 7. Subject Area: PCC                |  |  |  |  |  |  |  |
| 8. | Pre-requisite: Nil            |   |  |  |  |  |  |  |  |

9. Objective : To impart knowledge on various geodata processing techniques and models for earth resources mapping and their practices for disaster related studies.

Details of Course : 10.

| SI.<br>No. | Particulars   | Contact<br>Hours |
|------------|---|------------------|
| 1          | Importance of Geodata processing techniques to disaster related studies, Geodata systems and models   | 2                |
| 2          | Coordinate and coordinate systems: Geographical and map projection system, 2D<br>and 3D data transformation; Types of maps, scales, mapsheet numbering systems<br>and uses  | 3                |
| 3          | Modern field surveying and GPS surveying data acquisition tools, methods of total station and GPS surveys; Data processing, analysis and presentation techniques  | 6                |
| <b>4</b>   | Aircraft and space based geodata collection tools, photogrammetric and remote sensing models, aerial photogrammetric mapping methods, use of stereo-photogrammetry for creation of 3D earth surface models.                         | 8                |
| 5          | Remote sensing data acquisition, platforms and sensors, multi and hyperspectral data processing, visual data interpretation for information extraction  | 4                |
| 6 ·        | Introduction to digital image processing: Pre-processing, image enhancement, image classification and image change detection techniques   | 4                |
| 7          | Digital Geodatabase, spatial and non-spatial data, vector and raster data models, database management system  | 3                |
| 8          | Geospatial data modeling; Geographic information systems; Hardware and<br>software components, data transformation, processing and analysis models;<br>Overlay, network and proximity analysis; Data visualization tools and models | 6                |
| 9          | Techniques and tools for digital elevation models and their uses  | 4                |
| 10         | Quality assessment of geospatial data   | 2                |
|            | Total   | 42               |

#### List of Practicals

1. Familiarity with different types of Geodata.

2. Familiarisation with various 2D and 3D coordinate transformations and map projection Systems.

- 3. Control establishment using Total Station traversing
- 4. Topographical map preparation using Total Station surveys
- 5. Collection and processing of data using different types of GPS for mapping
- б. Determination of scale and flying height of an aerial photograph. 7.
  - Determination of 3D surface models using stereo-photogrammetry
    - a. «Introduction to different types of remote sensing data products.
    - b. Use of spectrometer for collection of signatures of different earth objects.
- 8. Visual analysis of a satellite data.
- 9. Demonstration and training on image classification module of ERDAS Imagine. Practice for selection of training areas and their quality assessment using histogram and separability analyses.

- Demonstration of a GIS software and their salient features. Understanding raster and vector data
   Scanning and digitization (on screen). Registration of various maps and digitization and editing of features.
- 12. Database creation and management. Buffering and overlay analysis.

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13. DEM creation and visualization

| S<br>No | Name of Authors/Book/Publisher   | Year of<br>Publication /<br>Reprint |
|---------|--|-------------------------------------|
| 1       | Schofield W and Breach M., Engineering Surveying, 6 <sup>th</sup> Edition,<br>Butterworth-Heinemam             | 2007                                |
| 2       | Chandra A.M., Surveying, New Age Publishers  | 2002                                |
| 3       | Lo, C.P. and Yeung, A.K.W., Concepts and Techniques of Geographical<br>Information System, Prentice Hall India | 2002                                |
| 4       | Bossler, J.D., Manual of Geospatial Science and Technology, Taylor and Francis                                 | 2001                                |
| 5       | Lillesand, T.L., and Keiffer, R.W., Remote Sensing Image<br>Interpretation, John Wiley and Sons                | 2000                                |

| 1. | Subject Code : DM-502         | Course Title : Natural Hazards and Impact Assessment |  |
|----|-------------------------------|--|--|
| 2. | Contact Hours:                | L: 3 T: 1 <u>P: 0</u>                                |  |
| 3. | Examination Duration (Hrs.) : | Theory: 3 Practical: 0                               |  |
| 4. | Relative Weightage : CWS 2.   | 5 PRS 0 MTE 25 ETE 50 PRE 0                          |  |
| 5. | Credits: 4                    | 6. Semester: Autumn 7. Subject Area: PCC             |  |
| -  | D                             | •  |  |

- 8. Pre-requisite: Nil
- 9. Objective : To impart knowledge about the various natural hazards, associated damages and lessons learnt.
- 10. Details of Course :

| ·SI. | Particulars  | Contact |
|------|--|---------|
| 110. | The dusting to contain a struct because on the surface flends surfaces and landstides. |         |
| 1.   | Introduction to various natural nazaros: earthquakes, moods, cyclones, and landshocs   |         |
| 2.   | Geological Processes leading to natural hazards, short term & long term prediction     | 5       |
| 3.   | Parameters and grade of damage, performa for damage studies, documentation of          | 4       |
|      | damage survey, loss assessment and lessons learnt                                      |         |
| 4.   | Earthquakes, causes and classification, estimation of size of earthquake, magnitude    | 5       |
|      | and intensity, seismic waves, site effect, attenuation effect, isoseismal maps,        |         |
|      | palaeoseismology, recurrence intervals, fault slip-rates, and fault behaviour models,  |         |
|      | earthquake ground motion, response spectra   |         |
| 5.   | Landslides, causative factors, landslide monitoring and prediction, landslide hazard   | 4       |
|      | zonation   |         |
| 6.   | Floods, causes of floods, flood damages, flood analysis and flood plain zoning,        | 4       |
|      | drought and its impact   |         |
| 7.   | Cyclones, their causes, characteristics and their impact                               | 4       |
| 8.   | Tsunami, Tsunamigenic earthquakes and its impact, tsunami modeling, inundation         | 4       |
|      | and tsunami intensity, tsunami zonation.   |         |
| 9.   | Other natural hazards: volcanic eruptions, forest fires etc., Case histories of hazard | 4       |
|      | assessment   | · ·     |
| 10.  | Vulnerability and risk due to natural hazards  | 2       |
| 11.  | Case studies for above natural hazards   | 4       |
|      | Total  | 42      |

| SI.<br>No. | Name of Authors/Book/Publisher  | Year of<br>Publication /<br>Reprint |
|------------|---|-------------------------------------|
| 1.         | Reiter, L., Earthquake Hazard Analysis: Issues and Insights, Columbia<br>University Press                         | 2000                                |
| 2.         | Hyndman D. and Hyndman D., Natural Hazard and Disasters, Brooks/Cole  | 2006                                |
| 3.         | Bryant E., Natural Hazards, Cambridge University Press  | 2005                                |
| 4.         | Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States; The National Academic Press | 1999                                |
| 5.         | Keller, Environment Geology, Prentice Hall  | 2000                                |

### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

#### Name of Centre : CENTRE OF EXCELLENCE IN DISASTER MITIGATION & MANAGEMENT

| 1.  | Subject Code : DM-503       | Course Title: Hazard Monitoring, Prediction and Microzonation |
|-----|-----------------------------|---|
| 2.  | Contact Hours:              | L: 3 <u>T</u> : 1 P: 2/2                                      |
| 3.  | Examination Duration (Hrs.) | : Theory: 3 Practical: 0                                      |
| 4.  | Relative Weightage : CWS    | 15 PRS 15 MTE 30 ETE 40 PRE 0                                 |
| 5.1 | Credits: 4                  | 6. Semester: Autumn 7. Subject Area: PCC                      |
| 8.  | Pre-requisite: Nil          |   |

9. Objective : To introduce methodologies to monitor, predict and assessment of various kinds of natural hazards.

10. Details of Course :

| SL | Particulars  | Contact |
|----|--|---------|
| No |  | Hours   |
| 1. | Monitoring of cyclones, earthquakes, tsunamis, floods, landslides; requirement of warning system, communication protocol   | 3       |
| 2. | Cyclone monitoring, instrumentation for cyclone monitoring, satellites communication, cyclone prediction, case studies of some major cyclones  | 4       |
| 3. | Flood monitoring, distribution of rainfall, hydrological forecasting, flood mapping, basin studies, case studies of some major floods  | 4       |
| 4. | Use of remote sensing in landslide monitoring, GIS application, qualitative and quantitative hazard approaches, landslide hazard zonation, statistical approaches, weight and rating schemes                       | 6       |
| 5. | Probabilistic and deterministic approaches for seismic hazard assessment, seismotectonic modeling, source and distance definitions, probabilistic distributions, conditional probabilities, uniform seismic hazard | 8       |
| 6. | Macrozonation and microzonation, social economic factors and considerations, microzones, engineering aspects, return periods   | 5       |
| 7. | Basic concepts and procedure for microzonation of urban cities   | 4       |
| 8. | Case studies of microzonation of some mega cities  | 2       |
| 9. | Foreshocks and aftershocks, earthquake monitoring using seismographs and accelerographs, earthquake alert systems, earthquake prediction   | 6       |
|    | Total  | 42      |

| SI.<br>No. | Name of Authors/Book/Publisher  | Year of<br>Publication /<br>Reprint |
|------------|---|-------------------------------------|
| 1.         | Reiter, L., Earthquake Hazard Analysis: Issues and Insights, Columbia University Press                            | 2000                                |
| 2.         | Keller, Environment Geology, Prentice Hall  | 2000                                |
| 3.         | Kramer S. L., Geotechnical earthquake engineering, Pearson Education  | 2003                                |
| 4.         | Hyndman D. and Hyndman D., Natural Hazards and Disasters, Brooks/Cole   | . 2006                              |
| 5.         | Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States, The National Academic Press | 1999                                |

| 1. | Subject Code : DM-601       | Course Title : Seismic Evaluation and Retrofitting |   |
|----|-----------------------------|--|---|
| 2. | Contact Hours:              | L: 3 T: 1 P: 0                                     | • |
| 3. | Examination Duration (Hrs.) | : Theory: 3 Practical: 0                           |   |
| 4. | Relative Weightage : CWS 25 | PRS 0 MTE 25 ETE 50 PRE                            | 0 |
| 5. | Credits: 4                  | 6. Semester: Spring 7. Subject Area: PCC           |   |
| 7. | Pre-requisite: Nil          |  |   |

- 9. Objective: To impart knowledge on relevant theories, practices and techniques for Seismic Evaluation and Retrofitting of existing structures.
- 10. Details of Course:

| SI. | Particulars   | Contact |
|-----|---|---------|
| No. |   | Hours   |
| 1.  | Principles of seismic evaluation and retrofit; Terminology                                    | 2       |
| 2.  | Introduction to seismic hazard evaluation   | • 3     |
| 3.  | Rapid visual screening and simplified evaluation of buildings                                 | 3       |
| 4.  | Material properties; In-situ testing for RC and masonry structures, interpretation of results | 3       |
| 5.  | Linear, non-linear, modelling of building, bridge structures - soil and foundations           | 3       |
| 6.  | Introduction to performance based engineering   | 2 ·     |
| 7.  | Analysis of structures for earthquake loading, linear analysis - Codal, demand capacity ratio | 8       |
|     | method; Non-linear pushover analysis, non-linear time-history analysis                        |         |
| 8.  | Retrofitting materials  | 2       |
| 9.  | Strategies and systems of retrofit of buildings: System completion; Strengthening of existing | 8       |
|     | components - RC, Steel and FRP Jacketing; Addition of new components - frames, shear walls    | •••     |
|     | and braced frames; Introduction to supplemental energy dissipation and base isolation         |         |
| 10. | Techniques of repair and retrofitting of masonry buildings, IS:13935-1993 provisions          | 2       |
| 11. | Retrofitting of Bridges   | 3       |
| 12. | Seismic safety of building equipment and services   | 3       |
|     | Total   | 42      |

10. List of Experiments:

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- 1. Evaluation of time period of vibration of an existing building
- 2. In-situ testing of concrete using rebound Hammer and USPV Method
- 3. In-situ testing of masonry using Flat-jacks
- 4. In-situ testing of concrete using Pull-out Test, and, using Pull-off Test
- 5. Location of reinforcement and measurement of cover using Rebar Locator

11. Suggested Books: SI. Name of Authors/Book/Publisher Year of No. **Publication** / Reprint Building Seismic Safety Council, FEMA 356, 2000, FEMA 440 / ATC 55, FEMA 1. 2005 310, 1998, Federal Emergency Management Agency 2. George G. and Kappos, A. J., Earthquake Resistant Concrete Structures, E & FN Spon 1997 Applied Technology Council, ATC 40 3. 1996 4. Paulay, T. and Priestley, M.J.N., Seismic Design of Reinforced Concrete and Masonry 1992 Buildings, John-Wiley & Sons The Testing of Concrete in Structures, Surrey University Press 5. 1989

| 1.          | Subject Code : D     | M-611  | Cou   | rse Title | : Dis  | aster Prep     | aredness and  | Mitigation |
|-------------|----------------------|--------|-------|-----------|--------|----------------|---------------|------------|
| 2.          | Contact Hours:       |        | L:    | 3         | T: 1   |                | P: _0         |            |
| 3.          | Examination Duration | (Hrs.) | ;     | Theory    | r: 3   | Practics       | al: 0         |            |
| <b>4.</b> · | Relative Weightage:  | cws 2  | 5 )   | PRS 0     | M      | <b>ITE</b> 2.5 | ETE 50        | PRE 0      |
| 5.          | Credits: 4           |        | 6. Se | emester:  | Spring | 7. Subje       | ect Area: PEC | · · ·      |
| 8.          | Pre-requisite: Nil   |        |       |           |        |                |               |            |

9. Objective: To impart knowledge towards the assessment of various hazards, disasters and their mitigation.

10. Details of Course :

| SI.<br>No. | Particulars   |     |
|------------|---|-----|
| 1.         | <b>Introduction to Various Hazard:</b> Definitions, vulnerability and risk, hazard estimation, hazard mapping, effect of site conditions on structures, event monitoring, processing and integration of data (such as topography, geology, remote sensing, various geophysical anomalies, soil characteristics, economic development)               | 10  |
| 2.         | Damages: Grade of damages, direct and indirect damages, damage to structures, lessons learnt  | 5   |
| 3.         | Seismic Vulnerability and Risk: Seismic Vulnerability Assessment – various methodologies, building typology survey, empirical and analytical methods, estimation of life loss, direct and indirect economic losses, shelter needs.  | 8   |
| 4.         | <b>Disaster Mitigation:</b> Warning and evacuation, do's and don't about disaster, damage survey for designing aid package and detailed survey for reconstruction, repair and retrofitting, post disaster surveys, survey proformas, long term measures- Disaster resistant construction, codal practices, retrofitting cost-benefit analysis.      | 10  |
| 5.         | Post Disaster Issues: Post Disaster Reconstruction and recovery for sustainable development, issues and policies  | . 3 |
| 6.         | <b>Disaster Management Act :</b> Disaster management policy; Techno legal aspect: Techno-Legal<br>and Techno-Financial work; Model Town and country planning legislation land use zoning<br>regulation, development control regulations and building bye-laws registration, qualification<br>and duties of professionals, disaster response policy. | 6   |
|            | Total   | 42  |

# 11. Suggested Books :

| SL<br>No. | Name of Authors/Book/Publisher   | Ycar of<br>Publication /<br>Reprint |
|-----------|--|-------------------------------------|
| 1.        | Dowrick D.J., Earthquake Risk Reduction, John Wiley & Sons   | 2003                                |
| 2.        | Reiter, L., Earthquake Hazard Analysis: Issues and insights, Columbia University Press                               | 1992                                |
| 3.        | Aki, K. and Richard, P. G., Quantitative seismology: Theory and Methods, Vol I and II, W. H. Freeman & Co.           | 1980                                |
| 4.        | Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States,<br>The National Academic Press | 1999,                               |
| 5         | Bryant E., Natural Hazards, Cambridge University Press   | 2005                                |
| 6.        | Richter, C.F., Elementary Seismology, W. H. Freeman and Company Inc/ Eurasia   | 1969                                |

Ĉ 6 ¢ C ¢ ¢ Ĉ C: **(** C: C: Ċ, ¢ ¢ C Ç ¢. G G ¢ Ç C C **\$** Ċ C ¢, ¢ C ¢ ٢

| 1. | Subject Code : DM-612       | Course Title : Mar<br>Dis | nagerial and Financial Aspects of aster Management |
|----|-----------------------------|---------------------------|--|
| 2. | Contact Hours:              | L: 3 T: 1                 | <b>P</b> : 0                                       |
| 3. | Examination Duration (Hrs.) | : Theory: 3               | Practical: 0                                       |
| 4. | Relative Weightage : CWS    | 25 PRS 0 MT               | e 25 ette 50 pre 0                                 |
| 5. | Credits: 4                  | 6. Semester: Spring       | 7. Subject Area: PEC                               |
| 8. | Pre-requisite: Nil          |                           |  |

9. Objective: To identify and examine the essential and fundamental elements of disaster prevention, response and recovery within an inclusive management policy framework.

10. Details of the Course:

| S.  | Particulars   | Contact |
|-----|---|---------|
| No. |   | Hours   |
| 1.  | Introduction to Disaster Management: Understand disaster hazards and how they pose                    | 7       |
|     | disaster threats. Categories and characteristics of disaster threats. Identification, description and |         |
|     | management of all potential hazards that may occur in the area of responsibility. Forecasting of      |         |
|     | disaster threats and measures relating to prevention of disaster threats.                             |         |
| 2.  | Disaster Management Principles and Practices: Consider most important factors that need               | 8       |
|     | attention for the implementation of disaster mitigation and management programmes,                    | 1       |
| 1   | legislation, key factors, principles and ethics, consideration for effective planning, controlling,   |         |
|     | co-coordinating, monitoring and implementing disaster mitigation and management                       | 1       |
|     | programmes.   |         |
| 3.  | Economic and Financial Aspect of Disaster Management: Financial Planning and control of               | 12      |
| ĺ – | disaster mitigation and management implementation programmes. Comparative analysis models             | ļ       |
|     | for disaster mitigation and management. Budgeting, Identifying sources of funds and provision         | 1       |
|     | of funds. Economic consequences of disaster and intangible economic impacts of disaster.              |         |
|     | Principles of economic recovery and strategies for economic recovery. Financial recovery from         | 1       |
|     | disaster- disaster insurance, natural disaster relief arrangements and public disaster appeals.       |         |
| 4.  | Strategic Disaster Management: Understanding the application of the principles and                    | 10      |
|     | procedures of strategic management in the domain of disaster mitigation and management.               | · ]     |
|     | Strategy formulation, understanding strategic intent, vision, mission for better forecasting of       |         |
|     | disaster threats and their prevention and strategic management of disaster. Strategic                 |         |
|     | management principles, methods and tools. planning, organizing, leadership and monitoring and         |         |
| ·   | evaluation of all role-players in disaster management.  |         |
| С   | Information Technology in Disaster Management: Understanding the link between                         | 5       |
|     | information and decision-making. Understanding and classifying information systems that can           |         |
|     | nave an impact on the dynamic disaster environment  |         |
|     | Total   | 42      |

### 11. Suggested Books:

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| SI.<br>No. | Name of Books/Authors  | Year of<br>Publication |  |
|------------|--|------------------------|--|
| 3 1        | Management: A Global Perspective, Weihrich, H. and Koontz, H., New York, McGraw Hill | 2006                   |  |
| 2          | Disaster Management: A Disaster Managers Handbook, Carter, W.N., Manila, ADB.        | 2006                   |  |
| . 3        | Disaster Management Handbook for Bangladesh, Parts I-IV. Dhaka, BDPC and PACT,       | 2005                   |  |
| · [ •      | Rahman, M.S  |                        |  |
| 4 14       | Management, Stoner, J.A.F. and Freeman, R.E., Prentice-Hall, New Delhi               | 2004                   |  |
| 5          | Geographic Information: Economic applications, Martin. D., Routledge, London         | 2001                   |  |

| 1. | Subject Code : DM- 613       | Course Title : Land | Islide Hazard Assessme | nt & Mitigation |
|----|------------------------------|---------------------|------------------------|-----------------|
| 2. | Contact Hours :              | L:3 T:1             | <b>P:</b> 0            |                 |
| 3. | Examination Duration (Hrs) : | Theory: 3           | Practicals: 0          |                 |
| 4. | Relative Weightage : CWS     | 5 PRS: 0 MTE:       | 25 ETE: 50             | PRE: 0          |
| 5. | Credits : 4 6. Sen           | nester: Autumn      | 7. Subject Area : PEC  |                 |

- 8. Pre-requisite: Nil
- 9. Objective: To understand mapping and hazard assessment techniques of landslides and protection against landslide.

|          | Bertierland   | Contract |
|----------|---|----------|
| 3.<br>N. | rarticulars   | Contaci  |
| NO.      |   | Hours    |
| 1.       | Definition; overview of Hazard assessment techniques on regional, semi detail and detailed scales           | 5        |
|          | and their application for planning purposes; Terrain classification and mapping methods, use of RS and GIS. |          |
| 2.       | Causative factors of landslides - natural including inherent factors and external factors as well as        | 8        |
| ]        | anthropogenic factors; Impacts of natural causative factors like lithology, structure, slope                |          |
|          | morphometry, relative relief, hydrogeological conditions and land use and land cover on stability of        | •        |
|          | slopes; Impacts of external factors like concentrated rain fall and earth quakes on slope stability;        |          |
|          | Various causes of slope instability in Himalaya; extreme hydro-meteorological conditions leading            |          |
|          | to landslide dams and related damages;  | •        |
| 3.       | Classification of landslides and mass movements, Landslide hazard zonation (LHZ) on regional                | 10       |
|          | scales of 1:50,000; LHZ practices in India; LHZ mapping technique suggested by Bureau of                    |          |
|          | Indian Standards with examples; Application of regional scale LHZ maps;                                     |          |
| 4.       | Landslide hazard zonation on Meso scale (1:5000); Application of Meso scale maps for town and               | 05       |
|          | zonal planning.   |          |
| 5        | Landslide hazard studies on detailed scale of 1:1000; Mechanics of landslide; Markland test for             | 08       |
|          | landslide probability; Strength of slope materials; Assessment of rock mass properties; Overview            |          |
|          | of slope stability studies for slopes characterized by overburden debris and rock materials.                | •        |
| 6        | Landslide control measures - grading of slopes, retaining walls, breast walls, drainage measures,           | 4        |
|          | rock bolts and rock anchors, Biotechnical measures, Special toe walls and other stability measures.         |          |
| 7        | Case studies of important landslides of Himalaya and their control practices                                | 2        |
|          | Total   | 42       |

| S.<br>No | Name of Books / Authors / Publisher etc.   | Year of<br>Publication |
|----------|--|------------------------|
| 1        | Mitigation of Natural hazards and Disasters: International perspective. Haque, C. Emdad, Springer, Dordrecht.                        | 2005                   |
| 2        | Rock slope Engineering. Hoek and Bray. Spon Press, 4 <sup>th</sup> edition   | 2000                   |
| 3        | Environmental geosciences. Keller, E.A. John Wiley & Sons, NY  | 1999                   |
| 4        | Natural hazard risk assessment and Public policy. Petak, W.J. and Atkinson, A.D. Springer Verlag, NY                                 | 1982                   |
| 5        | A field manual for landslide investigations, R.Anbalagan, B. Singh, D.Chakraborthy and A. Kohli. DST, Government of India, New Delhi | 2007                   |

| 1. | Subject Code : DM-614        | Course Title : Disaster Induced Risks and Impacts |
|----|------------------------------|---|
| 2. | Contact Hours:               | L: 3 T: 1 P: 0                                    |
| 3. | Examination Duration (Hrs.)  | : Theory: 3 Practical: 0                          |
| 4. | Relative Weightage : CWS 2.5 | PRS 0 MTE 25 ETE 50 PRE 0                         |
| 5. | Credits : 4                  | 6. Semester: Spring 7. Subject Area: PEC          |
| 8. | Pre-requisite: Nil           |   |

9. Objective: To develop understanding of both natural and anthropogenic disaster induced risks and impacts on various components of the environment and manmade systems.

## 10. Details of the Course:

| S.<br>No | Particulars   | Contact<br>Hours |
|----------|---|------------------|
| 1.       | Introduction and scope: Natural and anthropogenic disasters   | 2                |
| 2.       | Hazards and disasters: emergencies, disasters and related concepts, nature-society interface, fragmented Vs systems thinking, concept of disaster systematics, simple and compound disasters  | 6                |
| 3.       | <b>Disasters Vs development:</b> Disaster-development linkages, interaction of socio-economic developmental activities and disasters, development plans incorporating disaster risks; Human Development Index (HDI) Vs Disaster Risk Index (DRI), cross-cutting themes in Disaster-Development interface  | 6                |
| 4.       | <b>Causes and effects of disasters:</b> Hazards, vulnerability and risk; Risks taxonomy according to hazardous agents such as physical, chemical, and biological agents, natural forces, social-communicative hazards, and synergic (or complex) manmade-systems hazards; Risk patterns at the national and local levels; Disasters and climate change                                | 6                |
| 5.       | <b>Risk governance framework:</b> Risk perception, pre-assessment, appraisal, characterization and evaluation, analysis, assessment, communication, management and governance   | 4                |
| 6.       | <b>Risk assessment:</b> Hazard identification and estimation, exposure / vulnerability assessment, risk estimation; Risk characterization: Simple risk problems, complexity-induced risk problems, uncertainty-induced risk problems, ambiguity-induced risk problems   | 6                |
| 7.       | <b>Impacts of disasters:</b> Impacts on the environment, critical infrastructure and socio-economic systems, factors affecting social vulnerability to hazards, short-term and long-term impacts, systemic resilience, emergency response; Disaster recovery and rehabilitation; Lessons learnt for better policies and programs to effectively mitigate and manage future disasters  | 6                |
| 8.       | Present status and future directions in assessment and management of disaster-induced risks<br>and impacts: Hazard specific risk profiles, risks in urban and rural settings, disaster indicators,<br>disaster risk and impacts in the context of global change and technological advancement, multi-<br>hazard disaster risk and impact modeling; Integrated climate risk management | 6                |
|          | Total   | 42               |

#### 11. Suggested Books:

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| S. | Name of Authors/Book/Publisher  |             |  |
|----|---|-------------|--|
| No | <u> </u>  | Publication |  |
| 1. | Grossi, P. and Kunreuther, H. (eds.), Catastrophe Modeling: A New Approach to Managing          | 2005        |  |
|    | Risk, Springer  |             |  |
| 2. | Kirschenbaum, Chaos Organization and Disaster Management, Alan Marcel Dekker                    | 2004        |  |
| 3. | MacDaniels T.L. and Small M.J. (eds.)Risk Analysis and Society: An Interdisciplinary            | 2004        |  |
|    | Characterization of the Field, Cambridge University Press                                       | •           |  |
| 4. | Jaeger, C., Renn, O., Rosa, E. and Webler, T., Risk, Uncertainty and Rational Action, Earthscan | :200.1      |  |
| 5. | WBGU (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen),               | 2000        |  |
|    | World in Transition: Strategies for Managing Global Environmental Risks, Springer               |             |  |

| 1. | Subject Code : DM-615       | Course Title : Instrumentation and Data Mining Techniques |
|----|-----------------------------|---|
| 2. | Contact Hours:              | L: 3 T: 1 P: 2/2  |
| 3. | Examination Duration (Hrs.) | : Theory: 3 Practical: 0                                  |
| 4. | Relative Weightage: CWS     | 15 PRS 15. MTE 30 ETE 40 PRE 0                            |
| 5. | Credits: 4                  | 6. Semester: Spring 7. Subject Area: PEC                  |
| 8. | Pre-requisite: Nil          |   |

- 9. Objective: To impart knowledge of basic principles, methods, and applications of instrumentation, data processing and data mining
- 10. Details of Course :

| SI.<br>No. | Particulars  | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Seismic instrumentation, ground motion measurement, instrumentation of structures  | 2                |
| 2.         | Theory of seismic sensors - seismographs, strong motion accelerographs, SRRs; Equation of motion, characteristics, calibration and use                 | 4                |
| 3.         | Sampling theorem, anti-aliasing filter, recording system, networking and data transmission   | 4                |
| 4.         | Processing of recorded data, noise, transducer correction, low pass and high pass filters  | 4                |
| 5.         | Real time engineering seismology, shake maps, early warning systems  | 2                |
| 6.         | Response spectra, Fourier spectra, spectrum compatible time history  | 4                |
| 7          | Introduction to data mining, seismic instrumentation, displacement, velocity, and accelerometers, adjustment and interpretation of recorded data       | 2                |
| 8.         | Data preparation for knowledge discovery, data understanding, data cleaning, data transformation, discretization, feature selection                    | 5                |
| 9.         | Classification and regression - Maximum likelihood methods, Bayesian methods, Decision Tree classification; Neural Networks                            | 8                |
| 10.        | Clustering - K-means, hierarchical clustering, self organizing feature maps, principal component analysis  | 4                |
| 11.        | Evaluation and visualization - Classification with train, test and validation sets, cross-<br>validation, bootstrap, 1,2 and 3 D visualization of data | 3                |
|            | Total  | 42               |

| SL<br>No | SL Name of Authors/Book/Publisher   |         |
|----------|---|---------|
|          |   | Reprint |
| 1.       | Stearns S.D., Digital Signal Processing with Examples in MATLAB, Prentice Hall                          | 2003    |
| 2.       | Hano D., Mamnila H and Synth P., Data Mining, Prentice Hall of India                                    | 2004    |
| 3.       | Newnes, Digital Signal Processing : A Practical Guide for Engineers and Scientists,<br>Elsevier Science | 2003    |
| 4.       | Agarwal P. and Shrikhande M., Earthquake Resistant Design of Structures, Prentice Hall of India         | 2006    |
| 5.       | Dunham M.H., Data Mining: Introductory and Advanced Topics, Prentice Hall                               | 2003    |

| 1. | Subject Code : DM-616       | Course Title : Flood Estimation, Forecasting and Control |
|----|-----------------------------|--|
| 2. | Contact Hours:              | L: 3 T: 1 P: 0   |
| 3. | Examination Duration (Hrs.) | : Theory: 3 Practical: 0                                 |
| 4. | Relative Weightage : CWS    | 25 PRS 0 MTE 25 ETE 50 PRE 0                             |
| 5. | Credits: 4                  | 6. Semester: Spring 7. Subject Arca: PEC                 |
| 8. | Pre-requisite: Nil          | •  |

9. Objective : To introduce various methods of flood estimation, forecasting and control.

10. Details of Course :

| Sl. | Particulars  | Contact        |
|-----|--|----------------|
| No. | · · · · ·  | Hours          |
| 1.  | Understanding floods, rainfall runoff method, Importance and classification of         | 3              |
|     | hydrological forecasts, flash floods, coastal floods, flood routing                    |                |
| 2.  | Statistical procedure for flood frequency estimation, flooding due to dam break,       | 4              |
|     | flooding due to embankment failure   |                |
| 3.  | Urban drainage and runoff computations, urban flooding, GIS based inundation maps      | 3              |
| 4.  | Damage and loss due to flood, damage survey proforma                                   | 2 <sup>.</sup> |
| 5.  | Statistical and deterministic approaches for flood estimation                          | 4              |
| 6.  | Data collection and flood forecasting network design, data transmission                | 4              |
| 7.  | Physically based models, graphical and statistical models, stochastic models and       | 7              |
|     | adaptive filter models, UH and SCS based deterministic models, watershed models,       |                |
|     | updating   |                |
| 8.  | Verification and dissemination of forecast; Flood control measures, river training     | 4              |
|     | structures, protection measures for flood safe housing                                 |                |
| 9.  | River management using remote sensing techniques                                       | 2              |
| 10. | Concept of flood risk, risk assessment in technological, social and environment        | 5              |
|     | context, techniques of risk assessment, application of probabilistic and Markov models |                |
|     | in risk estimation   |                |
| 11. | Major flood case studies - Kosi flood, simulation of major flood events                | 4              |
|     | Total  | 42             |

| SI.<br>No. | Name of Authors/Book/Publisher   | Year of<br>Publication /<br>Reprint |
|------------|--|-------------------------------------|
| 1.         | Marcel, M., Flood risk management, Deltares  | 2010                                |
| 2.         | Schumann, A., Flood Risk Assessment & Management, Springer Publication   | 2010                                |
| 3.         | Kjeldsen, T. R., Flood Estimation Handbook, Centre of Ecology & Hydrology,<br>Oxfordshire, UK  | 2007                                |
| 4.         | Pertti H., Giuliano Z., André Van Der B., Hydrological Forecasting and Real-<br>Time Monitoring: The Watershed Simulation and Forecasting System (WSFS),<br>John Wiley & Sons, ISBN: 9780471899884 | 2007                                |
| 5.<br>`    | US Army Corps of Engineer (USACE), Flood Risk Management and the American<br>River Basin: An Evaluation, The National Academies Press  | 1995                                |
| 6.         | Central Water Commission, Manual on Flood Forecasting  | 1980                                |

|            | 1.Subject Code : DM-617Course Title: Application of Geo-spatial data for Disaster M2.Contact Hours:L: 3T: 0P: 3       | itigation |
|------------|---|-----------|
|            | 3. Examination Duration (Hrs.) : Theory: 3 Practical: 0   |           |
|            | 4. Relative Weightage : CWS 0 PRS 25 MTE 25 ETE 50 PRE (  | —<br>  .  |
| :          | 5. Credits: 4 6. Semester: Spring 7. Subject Arca: PEC  |           |
| ł          | 8. Pre-requisite: Nil   |           |
| 9          | Objective : To impart knowledge on the use of remote sensing, GIS and GPS tools in various disaster mitigation plans. | stages of |
|            | 0. Details of Course :  |           |
| No.        | Particulars   | lours     |
| 1.         | Meaning and types of disasters: Manmade and natural - earthquakes, volcanoes, landslides, floods,                     | 5         |
| ł –        | cyclones, tsunamis, anthropogenic, industrial, chemical and environmental, fire etc. Stages of a                      |           |
|            | disaster mitigation plan- pre-disaster planning, disaster preparedness, monitoring phase, emergency                   | ] [       |
| · ·        | each stage  |           |
| 2          | Earthquakes Causative factors bazard assessment selection of factors creation of thematic data                        | 5         |
|            | layers, preparation of seismic hazard zonation maps, regional risk assessment, GIS modeling for risk                  |           |
|            | mitigation plans; Case studies  |           |
| 3.         | Landslides: Causative factors, hazard assessment, selection of factors - triggering and non-                          | 7         |
|            | triggering, creation of thematic data layers, preparation of landslide hazard zonation maps, regional                 |           |
| Ļ          | and site specific risk assessments, GIS modeling for risk mitigation plans; Case studies                              |           |
| 4.         | Cyclones and Flooding: Cyclone: cyclone related parameters and effects on land and sea – damage                       | 5         |
|            | assessment, rooding, causes, identification of factors, space-time integration, Ors data fayers, flood                | ļ         |
| 5.         | <b>Drought and Desertification:</b> Types of droughts, factors influencing droughts identification of                 | ···ς      |
|            | variables, development of vegetation index, assessment of land use and ground water level changes:                    |           |
|            | delimiting drought prone areas, processes of desertification, over utilization of water and land                      | •         |
|            | resources. GIS data layer creation - GIS based management strategies; Case studies.                                   |           |
| 6.         | Anthropogenic Disasters: Atmospheric Disasters: Ozone layer depletion, green house / global                           | 5         |
|            | warming – acid rain – snow melt – sea level rise – related problems. GIS data layer creation; Case                    | 1         |
|            | studies; Marine Disasters: oil spill and chemical pollution, coastal erosion and deposition, factor                   |           |
| 7          | Biodiversity Disasters: Ecological degradation – nuclear disaster and biodiversity loss.                              | 5         |
| <i>'</i> . | of parameters (mapping of forest types protected areas and natural forests) – population extinction –                 | 5         |
|            | conserving bio-diversity (species and subspecies). Soil erosion, coral / mangrove depletion, forest                   |           |
|            | fire-mining. Remote sensing and GIS analysis for preparation of ecological degradation maps, erosion                  |           |
|            | maps, deforestation maps etc. GIS in environmental modeling; Case studies.  |           |
| 8.         | Differential SAR Interferometry for ground displacement estimations due to earthquakes, landslides,                   | 5         |
|            | subsidences etc. Validation of displacements through differential GPS surveys   |           |
|            | Total   | 42        |

| SI. | Name of Authors/Book/Publisher   | Year of             |
|-----|--|---------------------|
| No. |  | Publication/Reprint |
| 1.  | Demers, M. N., Fundamentals of Geographic Information Systems, John Willey and sons  | 2000                |
| 2.  | John A. M., Natural Hazards and Environmental Change, Bill McGuire                   | 2002                |
| 3.  | Skeil A., Environmental Modeling with GIS and Remote sensing, John Willey and Sons   | 2002                |
| 4.  | Bossler, J.D., Manual of Geospatial Science and Technology, Taylor and Francis       | 2001                |
| 5.  | Ariyabandu M. and Sahni P.(Eds), Disaster Risk Reduction in South Asia Prentice-Hall | 2003                |

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| 1. | Subject Code : DM-618         | Course Title : Vulnerability and Risk Analysis |
|----|-------------------------------|--|
| 2. | Contact Hours:                | L: 3. T: 1 P: 0                                |
| 3. | Examination Duration (Hrs.) : | Theory: 3 Practical: 0                         |
| 4. | Relative Weightage : CWS 25   | PRS 0 MTE 25 ETE 50 PRE 0                      |
| 5. | Credits: 4                    | 6. Semester: Spring 7. Subject Area: PEC       |
| 0  | Due ve suisite a NUI          |  |

8. Pre-requisite: Nil

9. Objective: To impart knowledge of basic steps and processes used for vulnerability and risk assessment due to different hazards.

10. Details of Course:

| SI.<br>No. | Particulars   | Contact<br>Hours |
|------------|---|------------------|
| 1.         | Probabilistic and deterministic risk analysis, concept of probability, random variables, probability distribution, functions of random variables, conditional probability, expectation, law of large numbers  | 8                |
| 2.         | Point estimation, method of moments, maximum likelihood, extreme value, Baysian statistics, prior and posterior probability, concept of utility and decision tree   | 8                |
| 3.         | Poison process, Filtered Poison process, Normal process, Seismic risk analysis with line, area<br>and volume source, Models of mathematical strength, Damage accumulation laws                                | . 4              |
| 4.         | Vulnerability Assessment: Damage statistics and cumulative damage models, analytical and hybrid methods, calibration of models  | 6                |
| 5.         | Preparation of exposure database: Sample surveys, sampling techniques, uncertainty analysis, applications of remote sensing and GIS   | 6                |
| 6.         | Risk assessment due to various types of structures, deterministic and probabilistic approach, role of planners, architects, engineers, banks and insurers, rating damage assessment; Disaster impact analysis | 10               |
|            | Total   | 42               |

| 11.       | Suggested Books:  |                                |
|-----------|---|--------------------------------|
| SI.<br>No | Name of Authors/Book/Publisher  | Year of<br>Publication/Reprint |
| 1.        | HAZUS-MH, MR1& MR2 Technical Manual, Federal Emergency Management<br>Agency                       | 2006                           |
| 2.        | Robin K., Seismic Hazard and Risk Analysis, Earthquake Engineering Research<br>Institute, McGuire | 2004                           |
| 3.        | Coburn, A. and Spence R., Earthquake Protection, John Wiley & Sons                                | 2002                           |
| 4.        | Reiter, L., Earthquake Hazard Analysis, Issues and Insights, Columbia<br>University Press         | 2001                           |
| 5.        | Srinivasan, S.K. and Mehta K.M., Probability and Random Processes, Tata McGraw-Hill               | 1981                           |

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Name of Centre : CENTRE OF EXCELLENCE IN DISASTER MITIGATION & MANAGEMENT

| 1. | Subject Code : DM-619       | Course Title : Man-made and Biological Disasters-<br>Detection and Mitigation |
|----|-----------------------------|---|
| 2. | Contact Hours:              | L: 3 T: 1 P: 0  |
| 3. | Examination Duration (Hrs.) | : Theory: 3 Practical: 0  |
| 4. | Relative Weightage : CWS    | 25 PRS 0 MTE 25 ETE 50 PRE 0  |
| 5. | Credits: 4                  | 6. Semester: Spring 7. Subject Area: PEC                                      |
| 8. | Pre-requisite: Nil          |   |

9. Objective : To impart knowledge on various manmade, biological disasters and various mitigation strategies related to them.

10. Details of Course :

| Sl.<br>No. | Particulars  | Contact<br>Hours |
|------------|--|------------------|
| 1.         | Bioterrorism – Bioterror agents: Bacterial and viral; Agribioterrorism- introduction of plant and animal diseases  | 6                |
| 2.         | Infectious diseases – Infectious agents, mortality due to major bacterial outbreaks,<br>spread of bacterial infections and the never ending fight, pathogens and multiple drug<br>resistance, means of detecting and mitigating bacterial pathogens                                    | 8                |
| 3.         | Viral diseases - Outbreaks and incidences; Viral outbreaks - SARS, Bird flu, Swine flu and HIV, detection and mitigation of viral agents   | 8                |
| 4.         | Chemical Emergencies: Pesticides, industrial pollutants, heavy metal contamination.  | 6                |
| 5.         | Radiation emergencies : Nuclear radiation leakage, Chernobyl disaster and<br>implications on biological systems, effect on genetic material; Mutations-<br>chromosomal   | 4                |
| 6.         | Biotechnology and Biodiversity : Issues of Biodiversity, value of biodiversity;<br>Emergence of Biotechnology; Biotechnology and promises to society; Biotechnology<br>Techniques; Managing the Hazards of Genetic Engineering, regulations and control of<br>biotechnology; Biosafety | 10               |
|            | Total  | 42               |

| Sl.<br>No. | Name of Authors/Book/Publisher   | Year of<br>Publication /<br>Reprint |
|------------|--|-------------------------------------|
| 1.         | Grey M. and Spaeth K., The Bioterrorism Sourcebook, McGraw Hill  | 2006                                |
| 2.         | Yousef A. K., et.al., Biology, Pathogenicity, Epidemiology, and Biodefense, Wiley-<br>Blackwell                    | 2007                                |
| 3.         | Luther E. L., George Korch, Biological Weapons Defense: Infectious Diseases and Counter bioterrorism, Humana Press | 2004                                |
| 4.         | Fong I.W. and Alibek K., Bioterrorism and Infectious Agents: A New Dilemma for the 21st Century, Springer          | 2009                                |
| 5.         | Hawksworth D.L., Methods and Practice in Biodiversity Conservation, Springer                                       | 2009                                |

|            | INDIAN INSTITUTE OF TECHNOLOGY ROORKEE<br>Name of Centre : CENTRE OF EXCELLENCE IN DISASTER MITIGATION & MANAGEMENT  |                  |
|------------|--|------------------|
|            | 1. Subject Code : DM-620 Course Title: Socio Economic Aspects of Disaster Managem  | ent              |
|            | 2. Contact Hours: L: 3 T: 1 P: 0   |                  |
|            | 3. Examination Duration (Hrs.): Theory: 3 Practical: 0   |                  |
|            | 4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0  | ]                |
|            | 5. Credits: 6. Semester: Spring 7. Subject Area: PEC   | 1                |
|            | 8. Pre-requisite: Nil  |                  |
|            | <ol> <li>Objective: To focus on the socio economic aspects of disaster management and its impact of mankind.</li> <li>Details of Courses</li> </ol>  | on the           |
| Sl.<br>No. | Particulars  | Contact<br>Hours |
| 1.         | <b>Introduction to disaster management:</b> Definition and Introduction to social and economic factors that affect the life of the people. Impact of the disasters on the social and economic fabric of the people living in the disaster prone areas. Assessment of the economic loss and disturbance of emotional stability along with human and material loss and its recoupment. Impact upon future generations living in the disaster prone areas and their preparedness for any such kind of happenings. A collective approach to deal with any kind of disasterous happenings.    | 07               |
| 2.         | <b>Emerging approaches in disaster management:</b> 1. Pre- disaster stage (preparedness) (a) Preparing hazard zonation and maps, Predictability/ forecasting & warning (b) Preparing disaster preparedness plan (c) Land use and zoning (d) Preparedness through (IEC) Information, education & Communication, 2. Emergency Stage (a) Rescue training for search & operations at national &  | 12               |
| 3.         | regional level (b) Immediate relief (c) Assessment surveys 3. Post Disaster stage-Rehabilitation.<br><b>Institutional setup &amp; programmes in India:</b> Institutions & National Centers for Natural Disaster<br>reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education &<br>training. Voluntary action, voluntary organization and non-government organizations and their role in<br>Disaster Management. Social Action Groups, Advocacy Initiatives, Civil Society Organizations and<br>Social Movements and their role in disaster management. | 08               |
| 4.<br>5.   | Standardization of the assessment of economic and social aspects: Standardization of the assessment of economic, social and environmental aspects/losses of disaster management for comparative purposes and for an approach that reflects the reality on the community level. Community-based disaster management. Risk sharing and risk transfer (Insurance). Valuation of losses. Response strategies at National, Regional and community level. Knowledge Management: Disaster knowledge management at international, national and regional  | 8                |
| <br>       | level and strategies of handling disasters. Sharing of disaster handling strategies at all levels. Case studies focusing on socio-economic and technical issues related to disasters about India, China, Indonesia and other Asian countries who have suffered from disasters.   | 42               |

# 11. Suggested Books :

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| SL<br>No.    | Name of Books/Authors  | Year of<br>Publication |
|--------------|--|------------------------|
| <u>1</u>     | Management: A Global Perspective, Weihrich, H. and Koontz, H., New York, McGraw Hill             | 2006                   |
| ´ <u>]`2</u> | Disaster Management: A Disaster Managers Handbook, Carter, W.N., Manila, ADB.                    | 2006                   |
| 3            | Mohanty, Ranjita and Prayag Mehta, NGOs and Civil Society, New Delhi: Sanskriti<br>Publications. | 2002                   |
| 4            | Siwach, Raj Kumar Voluntary Organizations and Social Welfare, Shanker Publications, Delhi,       | 2004                   |
| 5            | R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi.                               | 2000                   |
| 6            | Management, Stoner, J.A.F. and Freeman, R.E., Prentice-Hall, New Delhi                           | 2004                   |

| 1. | Subject Code: DM-621        | Course Title : Cyclone and Wind Resistant Structures |  |  |
|----|-----------------------------|--|--|--|
| 2. | Contact Hours:              | L: 3 T: 1 P: 0                                       |  |  |
| 3. | Examination Duration (Hrs.) | : Theory: 3 Practical: 0                             |  |  |
| 4. | Relative Weightage: CWS 25  | PRS MTE 25 ETE 50 PRE 0                              |  |  |
| 5. | Credits: 4                  | 6. Semester: Spring 7. Subject Area: PEC             |  |  |
| 8. | Pre-requisite: Nil          |  |  |  |

9. Objective: To impart knowledge on the basics of enhancing wind load resistance of structures.

10. Details of Course:

| SI. | Particulars   | Contact |
|-----|---|---------|
| No. | · · · ·   | Hours   |
| 1.  | Climate change and its impact on tropical cyclones, Nature of cyclonic wind   | 5       |
| 2.  | Boundary layer winds - velocities and pressures   | 3       |
| 3.  | Behaviour of structures in past cyclones and wind storms - lessons learnt   | 5       |
| 4.  | Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated<br>unsteady along and across wind forces. Peak factor and gust factor estimation. Analytical<br>procedures for along wind and across wind forces.                                | 10      |
| 5.  | Wind tunnel testing and its salient features.   | 2       |
| 6.  | General planning and design considerations under wind storms and cyclones;<br>Wind effects on buildings, towers, glass panels etc, and features in their design.<br>Codal Provisions – design wind speed, pressure coefficients; Introduction to international codes. | 8       |
| 7.  | Vulnerability and risk assessment in high cyclone prone areas   | 4       |
| 8,  | Cyclonic risk mitigation and preparedness. Life-line structures such as cyclone shelters.<br>Retrofitting and strengthening of structures. Rehabilitation,  | 5       |
|     | Total   | 42      |

11. Suggested Books:

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| SI.<br>No. | Name of Authors/Book/Publisher   | Year of<br>Publication /<br>Reprint |
|------------|--|-------------------------------------|
| 1.         | Simiu E. and Scanlan R.H., Wind Effects on Structures-Fundamentals and Applications to Design, 3 <sup>rd</sup> Ed., John Wiley           | 1996                                |
| 2.         | Dyrbye C.D., Dyrbye C., Dyrbye C., Wind Loads on Structures, John Wiley  | 1997                                |
| 3.         | Smith B.S. and Coull A., Tall Building Structures : Analysis and Design, Willey –<br>Inderscience  | 2001                                |
| 4.         | Taranath B.S., Wind and Earthquake Resistant Buildings : Structural Analysis and Design (Civil and Environmental Engineering), CRC Press | 2004                                |
| 5.         | Talwar A.K. and Juneja S., Cyclone Disaster Management, Commonwealth<br>Publishers   | 2009                                |
| 6.         | Holmes J.D., Wind Loading of Structures, 2 <sup>nd</sup> Ed., Taylor & Francis   | 2007                                |

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# Appendix 'H' Item No. Senate/ 43.2.21

Practical :

7. Pre-requisite : Nil

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# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

# NAME OF DEPTT. /CENTRE : Centre of Nanotechnology

1. Subject code : INT-01 Course Title: Bionanomaterials

- 2. Contact Hours : L:3 T:0 P:0
- 3. Examination Duration (Hours): Theory :

4. Relative weightage : CWS : 15 PRS : 00 MTE : 35 ETE : 50

03

5. Credits : 03 6. Semester : Both

8. Subject Area:

BGSEC

9. Objectives: To provide fundamental knowledge on various biomolecules at the nanoscale level and their potential applications.

10. Details of Course:

| S.No. | Contents  | Contact<br>Hours |
|-------|---|------------------|
| 1.    | <b>Introduction:</b><br>Cells and cellular organization; Biomolecules-Carbohydrates, lipids, proteins, nucleic acids; Central dogma of molecular biology; recombinant DNA technology.   | 4                |
| 2.    | <b>DNA Nanotechnology:</b><br>Introduction- Overview of DNA nanostructures; DNA origami and its<br>applications; Functional DNA nanotechnology; Dynamic DNA<br>nanotechnology by strand displacement reactions; DNA nanoarrays and its<br>applications; DNA-based nanobarcodes, nanowires, nanoelectronics and<br>nanomachines. | 8                |
| 3.    | <b>RNA Nanotechnology:</b><br>RNA Nanotechnology- Engineering, assembly and its potential applications;<br>RNA chemistry for nanoparticle synthesis, conjugation, and labeling;<br>Fabrication of stable and RNase- resistant RNA nanoparticles.  | 6                |

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| 4. | <b>Protein Nanotechnology:</b><br>Protein nanotechnology-overview; Nanostructures by self-assembly of peptides and proteins; Protein-mediated nanoscale biotemplating; Proteins and nanoparticles: Covalent and noncovalent conjugates; Protein cage architectures as nanomaterials and its potential applications; Peptide nanotubes; Nanobiocatalyst; Protein-based nanoarrays, nanomachines and nanosensors. | 8  |
|----|---|----|
| 5. | Carbohydrate Nanotechnology:<br>Glyconanotechnology-overview; Glyconanoparticles: types, synthesis,<br>characterization, and ligand presentation; Multifunctional glyconanoparticles<br>and its biomedical applications; Glyconanoparticles in material science;<br>Glyconanotechnology for understanding carbohydrate-carbohydrate<br>interactions.  | *  |
| 6. | Lipid Nanotechnology:<br>Lipid nanotechnology-overview; Solid Lipid Nanoparticles (SLN) —<br>Concepts, procedures, and physicochemical features; Characterization of<br>SLN; SLN interaction with cells: cytotoxicity, transfection efficiency, cell<br>uptake mechanism and biodegradation; Therapeutic applications of lipid<br>nanoparticles.  | 8  |
| ·  | Total   | 42 |

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# 11. Suggested Books:

| S.No. | Name of Authors /Books / Publishers   | Year of<br>Publication/<br>Reprint |
|-------|---|------------------------------------|
| 1.    | Berg, J.M., Tymoczko, J.L. and Stryer, L., "Biochemistry", 6 <sup>th</sup> EdW.<br>H. Freeman and Company.      | 2008                               |
| 2.    | Mirkin, C.A. and Niemeyer, C.M., "Nanobiotechnology II: More<br>Concepts and Applications", Wiley-VCH.          | 2007                               |
| 3.    | Goodsell, D.S., "Bionanotechnology: Lessons from Nature", Wiley-Liss.   | 2004                               |
| 4.    | Renugopalakrishnan, V. and Lewis, R.V., "Bionanotechnology: Proteins to Nanodevices", Springer.                 | 2006                               |
| 5.    | Vo-Dinh, T., "Protein Nanotechnology:   | 2005                               |
| -     | Protocols, Instrumentation, and Applications", Humana Press.  |                                    |
| 6.    | Nastruzzi, C., "Lipospheres in Drug Targets and Delivery: Approaches,<br>Methods, and Applications", CRC Press. | 2005                               |

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| NAME OF       | DEPTT. /CE      | NTRE :         | Centre of Nan | otechnology            |
|---------------|-----------------|----------------|---------------|------------------------|
| 1. Subject c  | ode : NT- :     | 543            | Cou           | rse Title: Nanomedicii |
| 2. Contact H  | Iours :         | L:3            | •<br>T:1      | P:0                    |
| 3. Examinat   | ion Duration (H | ours): Theor   | y: 03         | Practical : 00         |
| 4. Relative v | veightage : CWS | S 25 PRS       | : 00 MTE :    | 25 ETE : 50            |
|               | 04 6 5          | Semester · Snr | ing 7 Pre-re  | auisite Nil            |

9. Objective: The main objective of the course is to provide basic and advanced knowledge on biomedical applications of nanotechnology.

10. Details of Course:

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| S.No. | Contents  | Contact<br>Hours |
|-------|---|------------------|
| 1.    | Overview of Nanomedicine:   | • 6              |
|       | Synthesis of nanoparticles by physical, chemical and biological methods; Cell organization and subcellular structure; Cell-nanostructure Interactions; Nanostructures for medicinal applications. |                  |
| 2.    | Genetic Engineering and Gene Therapy:   | 4                |
| ;     | Introduction to genetic engineering and gene therapy, Virus-based nanoparticles for gene therapy, Nanotechnology in nonviral gene delivery.   |                  |
| 3.    | Tissue Engineering and Regenerative medicine:   | 10               |
|       | Introduction to tissue engineering; Nanotechnology in tissue Engineering;   |                  |
|       | Nanostructured extracellular matrix; Nanomaterials for cell engineering;  |                  |
| •     | Nanostructured biomaterials; Nanostructured surface modifications for   | · . ·            |
|       | biomedical implants; Artificial cells; Stem cells in tissue engineering;  |                  |
|       | Nanotechnology for regenerative medicine.   | •                |

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| 4. | Nanotherapeutics:<br>Nanopharmaceuticals; Biodegradable targeted nano drug delivery system;<br>Diagnostic and therapeutic applications of nanoparticles; Theranostic<br>nanoparticles; Pharmacokinetics of nanocarrier-mediated drug and gene<br>delivery. | 6  |
|----|--|----|
| 5. | <b>Biomedical Nanotechnology:</b><br>Design and applications of nanotechnology in the fields of Oncology,<br>Neurology, Cardiology, Orthopedics, Microbiology, Ophthalmology,<br>Dermatology, Pulmonology and Dentistry.                                   | 10 |
| 6. | Nanotoxicology:<br>Cytotoxicity and genotoxicity; Cell toxicity mechanisms and method of<br>analysis; Toxicity of nanoparticles <i>in vivo</i> .   | 6  |
|    | Total  | 42 |

# 11. Suggested Books:

| S.No. | Name of Authors /Books / Publishers   | Year of |
|-------|---|---------|
|       |   | Reprint |
| 1.    | Berg, J.M., Tymoczko, J.L. and Stryer, L., "Biochemistry", 6 <sup>th</sup> EdW.<br>H. Freeman and Company.  | 2008    |
| 2.    | Mirkin, C.A. and Niemeyer, C.M., "Nanobiotechnology II: More Concepts and Applications". Wiley-VCH.   | 2007    |
| 3.    | Battler, A. and Leor, J., "Stem Cell and Gene-based Therapy: Frontiers<br>in Regenerative Medicine", Springer-Verlag London Limited.  | 2006    |
| 4.    | Kumar, C. S. S. R., Hormes, J. and Leuschner C., "Nanofabrication<br>Towards Biomedical Applications: Techniques, Tools, Applications,<br>and Impact", WILEY -VCH Verlag GmbH & Co. | 2005    |
| 5. •  | Lamprecht, A., "Nanotherapeutics: Drug Delivery Concepts in Nanoscience", Pan Stanford Publishing Pte. Ltd:   | 2009    |
| 6.    | Jain, K.K., "The Handbook of Nanomedicine", Humana press.   | 2008    |
| 7.    | Monteiro-Riviere, NA. and Tran, C. L., "Nanotoxicology:<br>Characterization, Dosing and Health Effects", Informa Healthcare<br>USA, Inc.  | 2007    |

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# Appendix 'I' Item No. Senate/ 43.2.22

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

## NAME OF THE DEPARTMENT: EARTH SCIENCES

| 1. Sub    | ject Code: IES-01           | Course Title: FRACTA | LS AND APPLICA       | TIONS |
|-----------|-----------------------------|----------------------|----------------------|-------|
| 2.        | Contact Hours : L:2         | <b>T:</b> 1          | P:0                  |       |
| <b>3.</b> | Examination Duration (Hrs): | Theory 2 Practi      | ical 0               |       |
| 4.        | Relative Weightage: CWS     | 25 PRS 0 MTE         | 25 ETE 50            | PRE 0 |
| 5.        | Credits : <b>3</b> 6. Sem   | ester: Spring/Autumn | 7. Subject Area: BGS | SEC   |
| 8.        | Pre-requisite: Nil          |                      |                      |       |

Objective: To introduce the concepts of fractal geometry and its applications. Details of Course: 9.

10.

| S. | Contents  | Contact |
|----|---|---------|
|    | Mathematical background self similarity Signingki triangles Koch augus  | HOURS   |
| 1. | cantor sets   | . 4     |
| 2. | Box-counting dimensions, Kolmogrov capacity, 1D and 2-D box counting  | 3       |
| 3. | Hausdorff measures and dimension, deterministic and random fractals, natural  | 6       |
|    | fractals, iterated function systems, stochastic dynamical systems, compression  |         |
|    | of images   |         |
| 4. | Dynamical systems, interval self-mappings, complex iteration, perturbation theory, geometrical theory, small divisors, deterministic chaos to deterministic | 6       |
|    | division  |         |
| 5. | Applications in fragmentation, tectonics, geomorphology, seismology   | 4       |
| 6. | Applications in other fields, image compression, finance, soil mechanics  | 5       |
|    | Total   | 28      |

| S.<br>No | Name of Authors/ Books/ Publishers  | Year of<br>Publication<br>Reprint |
|----------|---|-----------------------------------|
| 1.       | Schroeder, M., "Fractals, Chaos, Power laws: Minutes from an infinite paradise", Dover  | 2009                              |
| 2.       | Edward, O. "Chaos in dynamical systems", Cambridge Univ. Press, 2 <sup>nd</sup> ed.   | 2005                              |
| 3.       | Falconer, K. "Fractal Geometry: Mathematical foundations and application", Wiley Pub.   | 2003                              |
| 4.       | Sprott, J. C. "Chaos and Time Series Analysis", Oxford Univ. Press  | 2003                              |
| 5.       | Turcotte, D.E., "Fractals and Chaos in Geology and Geophysics",<br>Cambridge Univ Press   | 1997                              |
| 6.       | Peitgen, H-O., Jurgens, H., Saupe, D., Maletsky, E. M., Perciante, T. &<br>Yunker, L. E., "Fractals for the classroom", Springer Verlag | 1 <b>992</b>                      |

#### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE

## NAME OF THE DEPARTMENT:

1

## EARTH SCIENCES

| 1. | Subject Code: IES-02        | Course: Globa          | l Climate  |            |      |
|----|-----------------------------|------------------------|------------|------------|------|
| 2. | Contact Hours: L: 2         | <b>T: 1</b>            | P- 0       | -          |      |
| 3. | Examination Duration (Hrs): | Theory 2 Pr            | actical: 0 |            |      |
| 4. | Relative Weight age: CWS    | 25 PRS 0 MTE           | 25 ETE     | 50 P       | RE 0 |
| 5. | Credits : 3 6. S            | emester: Spring/Autumn | 7. Subject | t Area: BG | SEC  |
| 6. | Pre-requisite: NIL          |                        |            |            |      |

9. Objective: To introduce global climate, past and present records and interpretations

10. Details of Course:

| <b>S</b> . | Particulars   | Contact |
|------------|---|---------|
| No         |   | Hours   |
| 1          | Earth as a unique planet, origin, evolution, differentiation and geologic history | 4       |
| 2          | Composition and residence time of components in atmosphere, hydrosphere,          | 6       |
|            | biosphere and lithosphere, present and past climate, reconstructing the past      |         |
| [·         | global circulation of atmosphere, historical evidences, tools interpreting        | 1 1     |
|            | climate changes in the past   |         |
| 3          | Earth's climate archives, data and models, climate variability, factors           | 5       |
|            | controlling climate change, plate tectonics and climate change, greenhouse        |         |
|            | gases and climate, astronomical control   |         |
| 4          | Impacts of climate change, case histories, greenhouse and icehouse histories,     | 6       |
|            | humans and climate change, human response to climate, climate in the future       |         |
| 5          | Climate models, impact of climate on agriculture and industry, nature and         | 7       |
|            | hazard of atmospheric extreme events, case studies, IPCC protocols, Global        | [       |
|            | and Indian scenarios  |         |
|            | Total   | 28      |

| S. | Name of Books/ Authors  | Year of     |
|----|---|-------------|
| No |   | Publication |
| 1  | Monroe J.S. and Wicander R, "The Changing Earth", Brooks Cole Publ. | 2009        |
| 2  | Oliver J.E. and Hidore J.J, "Climatology", Pearson Education Publ.  | 2003        |
| 3  | Kearey P.and Vine F.J, "Global Tectonics", Blackwell Science        | 2001        |
| 4  | Ruddima W.F, "Earth's Climate", Freeman Publ.                       | 2001        |
| 5  | Arhens C.D, "Essentials of Meteorology", Brooks Cole Publ.          | 2001        |
| 6  | Turco R.P, "Earth Under Siege", Oxford University Press             | 1997        |

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE

# NAME OF THE DEPARTMENT: EARTH SCIENCES

| 1. | Subject Code: IES-03                   | Course: Fundamentals of Petroleum               |
|----|--|---|
| 2. | Contact Hours : L- 2 T-1               | P - 0   |
| 3. | Examination Duration (Hrs): Theory:    | 2 ctical: 0                                     |
| 4. | Relative Weight age: CWS 25 PR         | S 0 MTE 25 ETE 50 PRE 0                         |
| 5. | Credits : 3 6. Semester: Be            | oth 7. Subject Area: BGSEC                      |
| 8. | Pre-requisite: Nil                     |   |
| 9. | Objective: To introduce modes of forma | tion, accumulation and exploration of petroleum |

10. Details of Course:

| S. | Particulars   | Contact |
|----|---|---------|
| No |   | Hours   |
| 1  | Definition, physical and chemical properties; classification of petroleum     | 3       |
| 2  | Biogenic and abiogenic theories of origin of petroleum; distribution of       | 3       |
|    | petroleum reserve through time and space; classification of sedimentary rocks |         |
| 3  | Source rock, kerogen, maturation, oil/gas windows                             | 5       |
| 4  | Primary and secondary migration; reservoir rocks; porosity, permeability and  | 5       |
|    | mechanics of fluid flow   |         |
| 5  | Seal and different types of trap, total petroleum system                      | 6       |
| 6  | Petroleum exploration   | 4       |
| 7  | Petroleum provinces with special reference to India                           | 2       |
|    | Total   | 28      |

| S. | Name of Books/ Authors   | Year of     |
|----|--|-------------|
| No |  | Publication |
| 1  | Bjorlykke, K. (ed.), "Petroleum Geoscience: From Sedimentary         | 2010        |
|    | Environments to Rock Physics", Springer-Verlag/                      |             |
| 2  | Blackwell, Gluyas, J and R Swarbrick "Petroleum Geoscience"          | 2004        |
| 3  | Selley R. C, "Elements of Petroleum Geology" 2nd Edition, Academic   | 1998        |
|    | Press.   |             |
| 4  | Magoon, L B and Dow W. G. (ed.), "The petroleum System" AAPG         | 1994        |
|    | Memoir 60  |             |
| 5  | Tissot, B. P. and Welte, D. H, "Petroleum Formation and Occurrence", | 1984        |
|    | Springer-Verlag  |             |

#### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE

## NAME OF THE DEPTT/ CENTRE: Earth Sciences

# 1. Subject Code: IES-04 Course Title: Planetary Geosciences

2. Contact Hours : L-2 P - 0 T-1 3. 2 Examination Duration (Hrs): Theory: **Practical:** 0 4. Relative Weightage: CWS PRE 25 PRS MTE ETE 50 **n** 0 25 6. Semester: Spring/Autumn 5. Credits : 3 Subject Area: BGSEC 7.

8. Pre-requisite: Nil

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- 9. Objective: To provide insight into geophysical and geological attributes of planets and satellites
- 10. Details of Course:

| S.       | Contents  | Contact |
|----------|---|---------|
| No       |   | Hours   |
| 1        | Solar system, planets and natural satellites, exploration of solar system, basic  | 2       |
| <u> </u> | vala and summary of spacecrait missions   |         |
| 2        | artificial satellites, remote sensing and radar altimetry   | 3       |
| 3        | Planetary geology, geological aspects of earth - like planets of solar system,<br>Role of remote sensing techniques including understanding of surface<br>morphology of planets | 5       |
| 4        | Spherical and ellipsoidal harmonic analysis, toroidal and poloidal functions, physical significance   | 5       |
| 5        | Gravity potential mapping of different planets, multipole expansion of magnetic potential and physical significance. MAGSAT and SEASAT results for earth                        | 4       |
| 6        | Inference of presence of water pockets using magnetic resonance sounding in terrestrial planets and moons   | 4       |
| 7        | Planetary magnetism, magneto-variation data inversion for reconstructing planet's electrical conductivity variation. Internal dynamo theories and core dynamics.                | 3       |
| 8        | Heat flux, thermal structure, mantle convection. Understanding of source for plate tectonics.   | 2       |
|          | Total   | 28      |

| S  | Name of Books/ Authors   | Year of     |
|----|--|-------------|
| No |  | Publication |
| 1  | Faure, G. and Mensing, T.M.,"Introduction to planetary science", Springer                              | 2007        |
| 2  | Cole, G.H.A. and Woolfron, M.M, Planetary science: The science of planets and stars', CRC Press        | 2002        |
| 3  | Imke de Pater and Lissauer, J.J., "Planetary sciences", Cambridge University Press                     | 2001        |
| 4  | Backus, G., Parker, R.L. and Constable, C, "Foundations of Geomagnetism"<br>Cambridge University Press | 1996        |
| 5  | Greeley, R. and Batson, R.M., "Planetary mapping" Cambridge University Press                           | 1990        |
| 6. | Littman, M, "Planets beyond", John Wiley & Sons  | 1990        |

### INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAN   | E OF THE DEPARTMENT: EARTH SCIENCES  |         |
|-------|--|---------|
| 1. Su | bject Code: IES-05 Course Title: Glaciology  |         |
| 2.    | Contact Hours : L: 2 T: 1 P: 0   |         |
| 3.    | Examination Duration (Hrs): Theory 2 Practical 0   |         |
| 4.    | Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50   | PRE 0   |
| 5.    | Credits : <b>3</b> 6. Semester: <b>Spring/Autumn</b> 7. Subject Area: <b>BGSE</b> (  | 0       |
| 8.    | Pre-requisite: Nil   |         |
| 9.    | Objective: To impart knowledge of glaciers, processes and impacts of climate.  |         |
| 10.   | Details of Course:   |         |
| S.    | Contents   | Contact |
| No    |  | Hours   |
| 1.    | Snow deposition, mineralogy of ice, metamorphism of ice, glaciers and their classifications geographical distribution of glaciers glacio-hydrological regimes of | 5       |
|       | India  |         |
| 2.    | India<br>Principles of mass balance and different techniques of glacier mass balance.  | 4       |

|    | assessment of impact of climate changes.  | · · |
|----|---|-----|
| 4. | Glacier motion/flow, various physical processes (erosion, transportation and deposition of sediments), changes in glaciated area through time, active processes within glaciers | 4   |
| 5. | Melt water/runoff generation, hydrograph separation to delineate melt water<br>contribution in surface flow and groundwater, sources of moisture for glacier<br>accumulation.   | 5   |
| 6. | Basic techniques for glacier expedition, rescue, hazard recognition and avoidance   | 4   |
|    | Total   | 28  |

# 11. Suggested Books:

14.

| S. | Name of Authors/ Books/ Publishers  | Yr of Pub. |
|----|---|------------|
| 1. | Frederic P. Miller, Agnes F. Vandome and John McBrewster, "Glaciology: Glacier,<br>Earth science, Geophysics, Geology, Physical geography, Climatology,<br>Meteorology, Hydrology, Biology, Ecology" McBrewster | 2010       |
| 2  | Shi Yafeng "Collectanea of the Studies on Glaciology, Climate and<br>Environmental Changes in China",   | 2008       |
| 3. | Bryn Hubbard and Glasser N. F, "Field Techniques in Glaciology and Glacial Geomorphology" Wiley Pub.  | 2005       |
| 4. | Aber J. S.and Croot D G. "Glaciotectonic Landforms and Structures<br>(Glaciology and Quaternary Geology)", Springer   | 1989       |
| 5. | Shumskiy P A, "Dynamic Glaciology", Amerind Publishing Co   | 1978       |

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# PROPOSED CHANGES IN THE TEACHING SCHEMES OF THE DEPTT.

# Teaching Scheme of B.Tech. (E&C) and IDD (ECW)

- DE-I Add following new course EC-344 Fundamentals of Microelectronics – syllabus enclosed. Delete the following course EC-342 VLSI Technology
- DE-II Add following existing course EC-546 MOS Device Physics and Modeling

DE-III

Add following existing courses EC-502 Device and Circuit Simulation -EC-545 Semiconductor Materials and Devices EC-542 Semiconductor Microwave Devices and Applications

DE-IV Add following existing course EC-547 Compound Semiconductors and RF Devices

DE-V Add following existing courses EC-541 VLSI Physical Design EC-548 Analog VLSI Circuit Design EC-549 VLSI Technology

## Teaching Scheme of IDD (ECW)

- 1. Course Code EC-562 to be changed to EC-630, since both are same courses. Further the weigtage of this course in IDD programme should be changed to VWS-100 as it is in the existing M.Tech. programme.
- 2. Course EC-631 in IV year Autumn Semester to be replaced by existing course EC-531 Microwave Engineering under MSC category.
- **PRE-I**

Add following existing courses EC-539 Fibre optic systems

EC-542 Semiconductor microwave devices and applications.

PRE-II to IV Add EC-631 RF Receiver Design for Wireless Applications

## Teaching Scheme of B.Tech. (E&C/CSE)/IDD(ECW)/IDD(CSI)

Post scripts 'N' to be dropped from all PG courses listed in UG/IDD schemes

### Teaching Scheme of M. Tech. (CSE)

Add following new course to the list of Programme Electives for M. Tech. (CSE) EC-658 Cyber Security – syllabus enclosed.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

# NAME OF DEPT/CENTRE: Dept. of Electronics and Computer Engineering

| 1. Subject Code: EC-344         | Course Title: • Foundat | ions of Microe | lectronics . |
|---------------------------------|-------------------------|----------------|--------------|
| 2. Contact Hours:               | L: 3                    | T: 0           | P: 0         |
| 3. Examination Duration (Hrs.): | Theory 3                | Practical      | 0            |
| 4. Relative Weight: CWS         | 15 PRS 00 M             | TE 35 ETE      | 50 PRE 00    |
| 5. Credits: 3 6. 1              | Semester: Spring        | 7. Subject     | Area: PEC    |

# 8. Pre-requisite: EC242 and EC301

9. Objective: To build a broad foundation of VLSI circuit design.

# 10. Details of the Course:

| SI.<br>No. | Contents  | Contact<br>Hours |
|------------|---|------------------|
| 1.         | <b>VLSI Process integration:</b> Overview of unit process: Fabrication technology of passive components; CMOS IC fabrication process.   | 6                |
| 2.         | Advanced MOS Device Fundamentals: SPICE LEVEL 3 MOSFET<br>model; Short channel effects; Sub threshold current model; Tunneling<br>currents in MOSFET; MOS capacitances and complete small signal<br>model; Recent advances in MOSFET – structure-strained Si, high-k<br>dielectric and metal gate | 8                |
| 3.         | CMOS Combinational Logic Gates: Static and dynamic behavior of<br>CMOS inverter; Power and energy estimation; Static CMOS family;<br>Complementary Pass Transistor Logic; Dynamic logic circuits; Cross-<br>coupled CMOS logic circuits; CMOS buffer design.                                      | 10               |
| 4.         | CMOS Sequential and Memory Circuits: Timing concepts in sequential circuits; Static latches and flip-flop; Registers; Timing analysis; CMOS SRAM cell operation.  | 8                |
| 5.         | Advanced CMOS Analog Circuits: Overview of CMOS Op-amp<br>design; Bandgap references: supply and temperature independent<br>biasing; LC Oscillator and VCO; Design of CMOS ADC and DAC;<br>Introduction to CMOS PLL.  | 10               |
|            | Total   | 42               |

15/11/11

-99-

# 11. Suggested Books:

| SI.<br>No. | Name of Authors / Books / Publishers  | Year of<br>Publication<br>/Reprint |
|------------|---|------------------------------------|
| 1.         | Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G.  | . 2010                             |
| x          | Meyer., "Analysis and Design of Analog Integrated Circuits," 5 <sup>th</sup> ed. Wiley India.   |                                    |
| 2.         | Behzad Razavi, "Design of Analog CMOS Integrated Circuits<br>by," Tata Mc-Graw Hill   | 2001                               |
| 3.         | M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic,<br>"Digital Integrated Circuits : A Design Perspective," 2 <sup>nd</sup> ed.,<br>Prentice Hall India | 2009                               |

2015/11/11

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| NAME OF DEPT/CENTRE: Electronics and Computer Engineer |              |             | ing       |     |              |
|--|--------------|-------------|-----------|-----|--------------|
| 1. Subject Code: EC - 658                              | Course Title | : Cyber Se  | curity    | •   |              |
| 2. Contact Hours:                                      | L: 3         | T: 0        | P: 0      |     |              |
| 3. Examination Duration (Hrs.):                        | Theory       | 0 3         | Practical | 0   |              |
| 4. Relative Weight: CWS 15                             | PRS 00       | MTE 35      | ETE 50    |     | 00           |
| 5. Credits: 0 3 6. Sen                                 | nester Autu  | <br>imn Spi | ring Bo   | )íh | •<br>• • • • |

7. Pre-requisite: EC - 356 or equivalent

8. Subject Area: PEC

9. Objective: To introduce the students to the security aspects of various elements of cyberspace protection.

10. Details of the Course:

| SL. | Contents   | Contact |
|-----|--|---------|
| No. |  | Hours   |
| 1.  | Introduction: Cyber security overview: Use of information technology         | 8.      |
| ĺ . | to attack and amplify attacks on various elements of critical                |         |
|     | infrastructure; Cyber Crime: Fraud and abuse, threat, vulnerability;         |         |
| -   | Consequence models to identify and protect critical assets.                  |         |
| 2,  | Threats in Cyberspace: 5-levels of threats and vulnerabilities: Home         | 9 ·     |
|     | users, small business, critical infrastructure, national and global level    |         |
|     | issues; Cyber flaws; Large scale criminal activities: Internet crime, denial |         |
| }   | of service, extortion, phishing, botnet reselling, spam, spyware, virus,     |         |
|     | worms, trojan, probes, scans and malware; Publicity of cyber                 |         |
|     | vulnerabilities; Information warfare: Denning theory; playgrounds and        |         |
| •   | battlegrounds; corporate espionage; monitoring; hacking and identity         |         |
|     | theft.   |         |
| .3. | Cyber Infrastructure Protection: Critical infrastructure protection:         | 9       |
|     | Motives and capabilities of current e-terrorist groups and bots; Attacks     |         |
|     | on cyber-infrastructure: Server management and firewalls: Security for       |         |
|     | VPN and next generation networks: IP security: transport layer security:     |         |
|     | Introduction to cyber forensics: Generic forensic model and framework:       |         |
| 4   | evidence for computer exploitation crimes in large scale systems:            |         |
|     | Community cyber security maturity model: Emergence response                  |         |
|     | community cycor security maturity motion, Emergence response                 |         |
|     | plaining, mugation and recovery memocologies.                                |         |

(3. S.A.

| 4. | Wireless Cyber Space protection: Insecurity of 802.11; 802.1X      | Ÿ  |
|----|--|----|
|    | architecture and access control; Bluetooth security; Mobile device |    |
|    | security and authentication; Group key management; Key management  |    |
|    | and packet filtering in sensor networks.                           |    |
| 5. | Cyberspace and IPR Issues: Overview of IPR; Cyber Laws: Copyright  | 7  |
|    | law; Trademarks and cyberspace.                                    |    |
|    | Total  | 42 |

# 11. Suggested Books:

| Sl.<br>No. | Name of Books / Authors  | Year of<br>Publication |
|------------|--|------------------------|
| 1.         | Graham, J., Olson, R. and Howard, R., "Cyber Security Essentials", 1 <sup>st</sup> Ed., Taylor and Francis, CRC. | 2010                   |
| 2.         | Earle, A., "Wireless Security Handbook", 1 <sup>st</sup> Ed., Auerbach<br>Publications.                          | 2006                   |
| 3.         | Howard, R., "Cyber Fraud: Tactics, Techniques and Procedures",1 <sup>st</sup> Edition, Taylor and Francis, CRC.  | 2009                   |
| 4.         | Gordon, L., Loeb, M., "Managing Cyber Security Resources", 1 <sup>st</sup><br>Ed., Tata McGraw-Hill              | 2010                   |

1
Program Code:YYIDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]Department:MTDepartment of Metallurgical and Materials EngineeringYear:I

|             |                 | Teaching Scheme                 |                                       |                       | Co<br>Hour           | ontac<br>rs/We | t<br>eek   | Exa<br>Durat | m<br>ion  | Relative Weight (%) |     |     |      |            |  |
|-------------|-----------------|---------------------------------|---------------------------------------|-----------------------|----------------------|----------------|------------|--------------|-----------|---------------------|-----|-----|------|------------|--|
| S. No.      | Subject<br>Code | <b>Course Title</b>             | Subject<br>Area                       | Credits               | Ŀ                    | <b>T</b> .     | <b>P</b> . | Theory       | Practical | CWS                 | PRS | MTE | ETE  | PRE        |  |
|             | 1               | Seme                            | ster-I (Aut                           | tumn                  | )                    |                |            |              |           |                     | • • | I   |      |            |  |
| 1.          | MA-101          | Mathematics-I                   | BSC                                   | 4                     | 3                    | 1              | 0          | 3            | 0         | 25                  | -   | 25  | 50   | -          |  |
| 2.          | PH-101          | Physics-I                       | BSC                                   | 5                     | 3                    | . 1            | 2          | 3            | 2         | 15                  | 15  | 15  | 40   | 15         |  |
| 3.          | EE-101          | Electrical Science              | ESC                                   | 4                     | 3                    | 1              | 2/2        | 3            | 0         | 15                  | 15  | 30  | 40   | _          |  |
|             | EC-101A         | Computer Systems & Programming  |                                       |                       |                      |                |            |              |           |                     | · [ |     | · [  |            |  |
| 4.          | EC-101B         | Fundamentals of Object Oriented | ESC                                   | 4                     | 3                    | 0              | 2          | 3.           | 0         | 15                  | 15  | 30  | 40   | -          |  |
|             | · ·             | Programming                     |                                       |                       |                      |                | · ·        |              | •••       |                     |     |     |      |            |  |
| 5.          | MI-102          | Manufacturing Techniques        | ESC                                   | 3                     | 2                    | 0              | 2          | 2            | ·:0       | 15                  | 15  | 30  | 40   | _          |  |
| 6.          | BT-101          | Fundamentals of Biotechnology   | GSC                                   | 2                     | 2                    | 0              | 0          | 2            | 0         | .15                 | . – | 35  | 50   | _          |  |
| 7.          | HS-101          | Technical Communication         | HSSMC                                 | 2                     | 1                    | 0              | 2          | 2            | 0         | 25                  | -   | 25  | 50 · | · <b>-</b> |  |
| · .         | •••.            | Total                           | · · · · · · · · · · · · · · · · · · · | 24                    | 17                   | · 4            | 7          |              | •         |                     |     |     |      | •          |  |
|             |                 |                                 |                                       |                       |                      |                |            |              | ·.        |                     |     | •   |      | _          |  |
|             | ·               | Sem                             | ester-II (S                           | pring                 | )                    |                |            | • •          | •         |                     |     | •   |      |            |  |
| 1.          | MA-102          | Mathematics-II                  | BSC                                   | 4                     | 3                    | 1              | 0          | 3            | 0         | 25                  | -   | 25  | 50   | ÷          |  |
| 2.          | CY-101          | Chemistry                       | BSC                                   | . 5                   | 3                    | · 1            | 2          | 3            | 2         | 15                  | 15  | 15  | 40   | 15         |  |
| · <u>3.</u> | EC-102          | Fundamentals of Electronics     | ESC                                   | <b>4</b> <sup>·</sup> | 3                    | 1              | 2/2        | 3            | 0         | 15                  | 15  | 30  | 40   | -          |  |
| 4.          | CE-101          | Engineering Graphics            | ESC                                   | 4                     | 2                    | 0              | 4          | 3            | · 0       | -                   | 25  | 25  | 50   | -          |  |
| 5.          | MI-101          | Thermodynamics                  | ESC                                   | 3                     | 2                    | 1              | 0          | 2            | 0         | 25                  | -   | 25  | 50   | -          |  |
| 6.          | CE-102          | Environmental Studies           | GSC                                   | 2                     | <b>2</b> <sup></sup> | 0              | 0          | .2           | 0         | 15                  | · - | 35  | 50   | -          |  |
| . 7.        | HS-102          | Behavioral Science              | HSSMC                                 | 2                     | 2                    | 0              | 0          | 2            | 0         | 15                  | -   | 35  | 50   |            |  |
|             |                 | Tota                            | 1                                     | 24                    | 17                   | 3              | 9          |              | •         |                     |     |     |      |            |  |

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Appendix 'K' Item No. Senate/ 43.2.28

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## Program Code:

YY IDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]

Department: MT Department of Metallurgical and Materials Engineering

11

Year:

04

|        |                 | Teaching Scheme                          |                 |         | Co<br>Hou | ontao<br>rs/W | ;t<br>eek | Exa<br>Dura | am<br>tion | Re  | lative     | Weig | ght (የ | %)  |
|--------|-----------------|--|-----------------|---------|-----------|---------------|-----------|-------------|------------|-----|------------|------|--------|-----|
| S. No. | Subject<br>Code | Course Title                             | Subject<br>Area | Credits | L         | т             | Р         | Theory      | Practical  | CWS | PRS        | MTE  | ETE    | PRE |
| I      | -               | Semes                                    | ster- III (A    | utum    | n)        | 1             |           |             | •          |     |            |      |        |     |
| 1.     | CE-201          | Computer Aided Graphics                  | ESC             | 2       | 1         | 0             | 2         | 2           | 0          | -   | 25         | 25   | 50     | -   |
| 2.     | HS-201          | Economics                                | HSSMC           | 3       | 2         | 1             | 0         | 2           | 0.         | 25  | -          | . 25 | 50     | -   |
| 3.     | MI-201A         | Solid Mechanics                          | ESC             | 4       | 3         | 1             | 0         | 3           | 0.         | 25  |            | 25   | 50     | -   |
| 4.     | MT-201          | Introduction to Engineering Materials    | DCC             | - 3     | 2         | 1             | 0         | 2           | 0          | 25  | -          | 25   | 50     | -   |
| 5.     | MT-211          | Metallurgical Thermodynamics and         | DCC             | 4       | 3         | 1             | 0         | 3           | -0         | 25  | - · .      | 25   | 50     | -   |
|        |                 | Kinetics                                 |                 | . ·     |           | -             |           |             |            |     |            |      |        |     |
| 6.     | MT-221          | Structural and Chemical Characterization | DCC             | 4       | 3         | 1             | 0         | 3           | 0          | 25  | -          | 25   | 50     | -   |
| 7.     | MT-220          | Materials Characterization Lab II        | DCC             | ÷ 2     | 0.        | 0             | 3         | 0.          | 3 ·        | -   | 25         | 25   | ·_     | 50  |
|        |                 | Total                                    |                 | 22      | 14        | 5             | 5         | - · .       | ·          |     |            |      |        |     |
|        |                 |  |                 |         |           |               |           |             |            |     | *          |      |        |     |
|        |                 | Seme                                     | ester-IV (S     | prin    | <b>g)</b> |               |           |             |            | ·   | · .        |      |        |     |
| 1.     | PH-201          | Physics-II                               | BSC             | 3       | 3         | 0             | 0         | 3           | . 0        | 15  | -          | 35   | . 50   |     |
| 2.     | BM-201          | Managements concepts and practices       | HSSMC           | • 3     | 2         | 1             | 0         | 2           | 0          | 25  |            | 25   | 50     | -   |
| 3.     | CH-201          | Energy Resources and Conversion          | GSC             | 2.      | 2         | 0             | · 0 .     | 2           | 0          | 15  |            | 35   | 50     | -   |
| 4.     | MT-212          | Transport Phenomena                      | DCC             | .4      | 3 ·       | • 1 .         | 0         | 3.          | 0          | 25  |            | 25   | 50     | -   |
| 5.     | MT-222          | Phase Transformation                     | DCC             | . 4     | 3         | 1             | 0         | 3           | · 0        | 25  | -          | 25   | 50     | -   |
| 6.     | MT-232          | Electronic Materials                     | DCC             | 4       | 3         | 1             | 0         | • 3         | 0          | 25  | <b>-</b> · | 25   | 5.0    | -   |
| 7.     | MT-210          | Materials Characterization Lab I         | DCC             | ÷ 2     | 0         | Ö             | 3         | · ·0        | 3          | -   | 25         | 25   |        | 50  |
|        | · · · ·         | Total                                    |                 | 22      | 16        | 4             | - 5       |             |            |     | -          |      |        |     |

# Program Code:

О 5 YY IDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]

Department:

MT III Department of Metallurgical and Materials Engineering

Year:

|        |                                     | Teaching Scheme                   | ۰.              |         | Co<br>Hou | ontac<br>rs/W         | ct<br>eek | Exam<br>Duration |                  | Relative Weight (%) |                |     |             | )                |
|--------|-------------------------------------|-----------------------------------|-----------------|---------|-----------|-----------------------|-----------|------------------|------------------|---------------------|----------------|-----|-------------|------------------|
| S. No. | Subject<br>Code                     | Course Title                      | Subject<br>Area | Credits | L         | T                     | Р         | Theory           | Practical        | CWS                 | PRS            | MTE | ETE         | PRE              |
|        |                                     |                                   | Semester- \     | / (Au   | tumr      | 1)                    |           |                  |                  |                     |                |     |             |                  |
| 1.     | MT-311                              | Mechanical Behaviour of Materials | DCC             | 4       | 3         | 1                     | 0         | .3               | 0                | 25                  | <del>.</del> . | 25  | 50          | -                |
| 2.     | MT-321                              | Iron and Steel Making             | DCC             | 4       | 3         | 1'                    | . 0       | 3                | · 0 <sup>.</sup> | 25                  | -              | 25  | 50          | -                |
| 3.     | 3. MT-331 Metal Casting and Joining |                                   |                 | 4       | 3         | <b>0</b> <sup>°</sup> | . 2       | 3                | 0                | 15                  | 15             | 30  | <b>40</b> . | -                |
| 4.     | 4. MT-320 Materials Processing Lab  |                                   | DCC             | . 2     | 0         | 0                     | 3.        | 0                | 3                |                     | 25             | 25  | ·· -        | 50               |
| 5.     | MT-IE1 Institute Elective-I         |                                   | BGSEC           | 3       | 2         | 1                     | 0         | 2                | 0                | 25                  | -              | 25. | 50          | -                |
| 6.     | MT-IE2                              | Institute Elective-II             | HSSMEC          | 3       | 3         | 0                     | 0         | 3                | Ò                | 15                  | -              | 35  | .50         | -                |
|        |                                     | Total                             |                 | 20      | 14        | 3                     | 5         |                  |                  |                     |                |     | : -         |                  |
|        |                                     |                                   |                 |         |           |                       | •         |                  |                  |                     | ÷.,            |     | • :         |                  |
|        |                                     |                                   | Semester-       | VI (S   | pring     | <b>)</b>              | ·         |                  |                  | ,                   |                |     |             |                  |
| 1.     | MT-312                              | Metal Forming                     | DCC             | 4       | 3         | 1                     | 0         | 3                | 0                | 25                  | -              | 25  | 50          | <b>-</b> '.      |
| 2.     | MT-322                              | Non-Ferrous Metallurgy            | DCC             | 4       | 3         | 1                     | 0         | 3                | 0                | 25                  | - <sup>.</sup> | 25  | 50          | . <b>-</b> . · ] |
| 3.     | MT-332                              | Ceramic and Polymeric Materials   | DCC             | 4       | 3         | 0                     | 2         | 3                | 0                | 15                  | 15             | 30  | 40          | - ·              |
| 4.     | MT-310                              | Mechanical Testing Lab            | DCC             | 2       | 0         | 0                     | 3         | 0                | 3                | -                   | 25             | 25  | 7.          | 50               |
| 5.     | MT-390                              | Communication Skills              | DCC             | 2       | 0         | 0                     | .2        | 0                | 0                | 100                 | -              |     | -           | ·                |
| .6.    | MT-IE3                              | Institute Elective-III            | BGSEC .         | 3       | 3         | 0                     | 0.        | . 3              | .0               | 15                  | -              | 35  | 50          | -:               |
| 7.     | MT-IE4                              | Institute Elective-IV             | HSSMEC          | 3       | 3         | 0                     | 0         | 3                | 0                | 15                  | · -            | 35  | 50          |                  |
|        |                                     | Total                             | -               | 22      | 15        | 2                     | 7         |                  |                  | •                   |                |     |             |                  |

# Program Code: YY IDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]

Department: MT Department of

Year:

106-

| · IV |
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|------|

| Department of | Metallurgical and | Materials | Engineering |
|---------------|-------------------|-----------|-------------|
|               |                   |           |             |

| •      |                 | Teaching Scheme                                    |                 |         | Co<br>Hou  | ontac<br>rs/W | eek.       | Exa<br>Dura | am<br>tion | Relative Weight (%) |     |       |     |          |
|--------|-----------------|--|-----------------|---------|------------|---------------|------------|-------------|------------|---------------------|-----|-------|-----|----------|
| S. No. | Subject<br>Code | Course Title                                       | Subject<br>Area | Credits | L          | <b>.T</b>     | Р          | Theory      | Practical  | CWS                 | PRS | MTE   | ETE | PRE      |
| · . ·  | Semester- VII ( |  |                 |         |            |               |            |             |            |                     |     |       |     |          |
| 1.     | MT-411          | Environmental Degradation of<br>Materials          | DCC             | 4       | 3          | 0.            | 2          | . 3         | 0          | 15                  | 15  | 30    | 40  | · _      |
| 2.     | MT-481          | Training Seminar                                   | DCC             | 2       | 0          | 0             | 2          | • 0         | 0          | ·                   | 100 | -     | -   | -        |
| 3.     | MT-503          | Modelling, Simulation and Computer<br>Applications | MSC             | . 4     | 3          | 0             | 2          | 3           | 0          | 15                  | 15  | 30    | 40  |          |
| 4.     | MT-511          | Thin Films Technology                              | MSC             | 4       | 3.         | 0             | 2          | 3           | 0.         | 15 .                | 15  | 30    | 40  | <u> </u> |
| 5.     | MT-ELE1         | Departmental Elective-I                            | DEC             | 4       | 3          | 1             | <b>0</b> · | 3           | 0          | 25                  | -   | 25    | 50  | -        |
| · 6.   | MT-ELE2         | Departmental Elective-II                           | DEC             | 4       | 3 :        | 1             | 0          | . 3         | 0          | 25                  |     | .25   | 50. | -        |
|        |                 | Total  |                 | 22      | 15         | 1             | 8.         |             |            |                     |     |       |     |          |
| • •    |                 |  |                 | :       |            |               |            |             |            |                     |     | · · . | ·   |          |
| 1.     | MT-412          | Heat Treatment Practices                           | DCC             | 4       | 3          | 0             | 2          | 3           | 0          | 15                  | 15  | 30    | 40  | - :      |
| 2.     | MT-562          | Micro-fabrication Technology                       | MSC             | 4       | 3          | 1             | 2/2        | 3           | 0          | 15                  | 15  | 30    | 40  | -        |
| 3.     | MT-564          | Microsensors, MEMS and Smart<br>Devices            | MSC             | 4       | 3          | 1             | 0          | 3           | 0          | 25                  | -   | 25    | 50  | -        |
| 4.     | MT-410          | Electronic and Magnetic Materials<br>Lab           | MSC             | 2       | <b>_</b> 0 | 0             | 3          | 0           | 3          | •                   | .25 | 25    |     | 50       |
| 5.     | MT-ELE3         | Departmental Elective-III                          | DEC             | 4       | 3          | 1             | 0          | 3           | 0          | 25                  | -   | 25    | 50  | -        |
| 6.     | MT-EL5          | Institute Elective-V                               | ESEC            | 4       | 3          | 1             | 0          | . 3         | 0          | 25                  |     | 25    | 50  | -        |
|        |                 | Total  | · .             | 22      | 15         | 4             | 7          |             | · .        |                     |     |       |     |          |

| Program Code: |  |
|---------------|--|
| Department:   |  |

V

YY IDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]

MT Department of Metallurgical and Materials Engineering

Year:

107-

|        |                 | Teaching Scheme  |                                       |         | C<br>Hou     | ontac<br>ırs/W | :t<br>eek | Exa<br>Dura | am<br>tion | Re           | lative | Wei | ght (%           | %)      |
|--------|-----------------|------------------|---------------------------------------|---------|--------------|----------------|-----------|-------------|------------|--------------|--------|-----|------------------|---------|
| S. No. | Subject<br>Code | Course Title     | Subject<br>Area                       | Credits | <br>  L      | T              | Ρ         | Theory      | Practical  | CWS          | PRS    | MTE | ETE              | PRE     |
|        |                 | S                | emester- VI                           | l (Aut  | umn)         | )              |           |             |            |              |        |     |                  |         |
| 1.     | MT-601          | Seminar          | SEM                                   | 2       | 0            | 0              | 2         | 0           | 0          | 100          | -      | -   |                  | -       |
| 2.     | MT-602          | Research Project | RP                                    | 4       | 0            | 0              | . 4       | 0 :         | 0          | . <u>-</u> · | 100    | -   | -                | -       |
| 3.     | MT-603          | Dissertation     | DIS                                   | 0       | 0            | 0              | 0         | Ó           | . 0        | -            | · _`   | -   | -                |         |
|        |                 | Total            |                                       | 6       | 0            | .0             | 6         | · · ·       |            | -            |        | · ; |                  |         |
|        |                 |                  | · · · · · · · · · · · · · · · · · · · |         | · . ·        | ••             |           | <u>.</u> .  |            | <u>.</u>     |        | 1   | · · · ,          | <u></u> |
|        |                 | Ş                | Semester-V                            | lll (Sp | ring)        |                |           |             |            |              |        |     | . <sup>1</sup> . |         |
| 1.     | MT-603          | Dissertation     | DIS                                   | 20      | 0            | .0             | 0         | 0           | 0          | -            | 100    |     | · -              |         |
|        |                 | Total            |                                       | 20      | : <b>0</b> . | 0              | · 0·      |             |            |              |        |     | ]:               |         |

Program Code: YY IDD [B.Tech. (Metallurgical and Materials Engg.) and M.Tech. (Materials Engg.)]

Department:

#### Autumn Semester Electives (MT-ELE1 and MT-ELE2)

| 1       X-ray Diffraction Techniques         3       Electron Microscopy         5       Secondary Steel Making         4       Hydro and Electro Metallurgy |
|--|
| <ul> <li>3 Electron Microscopy</li> <li>5 Secondary Steel Making</li> <li>4 Hydro and Electro Metallurgy</li> </ul>  |
| 5 Secondary Steel Making<br>Hydro and Electro Metallurgy   |
| Hydro and Electro Metallurgy   |
| a i yaro ana mouo mouningy   |
| 1 Ultra-fine Grained Material  |
| 3 Electro Ceramics   |
| Nanomaterials Synthesis and Applications   |
| 7 Silicon Technology and Devices   |
| 9 Magnetism and Magnetic Materials   |
| 1 Carbon Materials Technology  |
| 3 Opto-electronic Materials  |
| <ul> <li>Magnetism and Magnetic Materials</li> <li>Carbon Materials Technology</li> <li>Opto-electronic Materials</li> </ul>                                 |

#### Spring Semester Electives (MT-ELE3)

| 1    | MT 514 | Powder Metallurgy                          |
|------|--------|--|
| 2    | MT 516 | Principles of Materials Selection          |
| 3    | MT 518 | Theory of Metal Forming                    |
| 4    | MT 520 | Inspection and Quality Control             |
| 5    | MT 522 | Composite Materials                        |
| 6    | MT 526 | Failure Analysis                           |
| 7    | MT 528 | Tribology of Engineering Materials         |
| 8    | MT 542 | Biomaterials                               |
| · 9. | MT 556 | Surface Engineering and Coating Technology |
| 10   | MT 558 | Energy Storage Materials                   |
| 11   | MT566  | Computational Materials Science            |

MT Department of Metallurgical and Materials Engineering

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|        |                      | Teaching Scheme                 |                    |               | Co<br>Hou   | ontao<br>rs/W | :t<br>eek | Exa<br>Dura | ım<br>tion | Rel | ative       | Wei                    | ght ( | %)        |
|--------|----------------------|---------------------------------|--------------------|---------------|-------------|---------------|-----------|-------------|------------|-----|-------------|------------------------|-------|-----------|
| S. No. | Subject Course Title |                                 |                    | Credits       | L           | т             | P         | Theory      | Practical  | CWS | PRS         | MTE                    | ETE   | PRE       |
|        |                      | Seme                            | ster-I (Aut        | tumn          | <u>)</u>    |               |           |             |            |     |             |                        |       |           |
| 1.     | MA-101               | Mathematics-I                   | BSC                | 4             | 3           | 1             | 0         | 3           | 0          | 25  | -           | 25                     | 50    | -         |
| 2.     | PH-101               | Physics-I                       | BSC                | 5             | 3           | 1             | 2         | 3           | 2          | 15  | 15          | 15                     | 40    | 15        |
| 3.     | EE-101               | Electrical Science              | ESC                | 4             | 3           | 1             | 2/2       | 3           | 0          | 15  | 15          | 30                     | 40    |           |
|        | EC-101A              | Computer Systems & Programming  |                    |               |             |               |           |             | •          |     | · ·         | •                      | . (   |           |
| 4.     | EC-101B              | Fundamentals of Object Oriented | ESC                | <b>4</b>      | 3           | 0             | 2         | 3           | 0          | 15  | 15          | 30                     | 40    | -         |
|        |                      | Programming                     |                    | I             |             |               |           |             |            | ••• | •           |                        |       |           |
| 5:     | MI-102               | Manufacturing Techniques        | ESC                | 3.            | 2           | 0             | 2         | 2           | 0          | 15  | 15          | 30                     | 40    | -         |
| 6.     | BT-101               | Fundamentals of Biotechnology   | GSC                | 2             | 2           | 0             | 0         | 2           | 0          | 15  | -           | 35                     | 50    | -         |
| 7.     | HS-101               | Technical Communication         | HSSMC              | 2             | 1           | . 0           | 2         | 2.          | 0          | 25  | . +         | 25                     | 50    | -         |
| · ·    |                      | Total                           |                    | . 24          | 17          | 4             | 7         | -           |            |     | ·. ·        |                        | · .   |           |
|        |                      |                                 |                    |               |             |               |           |             |            |     |             |                        |       |           |
|        |                      | Sem                             | ester-II <u>(S</u> | oring         | <u>)</u>    |               |           |             |            | •   |             |                        |       |           |
| 1.     | MA-102               | Mathematics-II                  | BSC                | • 4           | 3           | 1             | 0         | - 3 -       | 0          | 25  | -           | 25                     | 50    |           |
| 2.     | CY-101               | Chemistry                       | BSC                | 5.            | 3           | 1             | 2         | 3           | 2          | 15  | 15          | 15                     | 40    | 15        |
| 3.     | EC-102               | Fundamentals of Electronics     | ESC                | 4             | - 3         | 1             | 2/2       | 3 .         | 0          | 15  | 15          | <b>30</b> <sup>1</sup> | 40    | -         |
| 4.     | CE-101               | Engineering Graphics            | ESC :              | • 4           | 2           | 0             | 4         | 3           | 0          | -   | 25          | 25                     | 50    | -         |
| 5.     | MI-101               | Thermodynamics                  | ESC                | 3             | 2           | 1             | 0.        | . 2         | 0_         | 25  |             | 25                     | 50    | <u> </u>  |
| 6.     | CE-102               | Environmental Studies           | GSC                | 2             | 2           | 0             | 0         | 2.          | · 0        | 15  |             | 35.                    | .50   | <b></b> _ |
| 7.     | HS-102               | Behavioral Science              | HSSMC              | $\frac{2}{2}$ | 2           | 0             | 0         | 2           | 0          | 15  | <u> -</u> . | 35                     | 50    |           |
| - ·    | -                    | Total                           | l                  | 24            | <u>  17</u> | . 3           | 9         |             |            |     | <u> </u>    |                        |       |           |

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| Teaching Scheme |                 |   |                 |         |            | Contact Exam<br>Hours/Week Duration |              |        |           | Relative Weight (%) |     |       |            |                        |
|-----------------|-----------------|---|-----------------|---------|------------|-------------------------------------|--------------|--------|-----------|---------------------|-----|-------|------------|------------------------|
| S. No.          | Subject<br>Code | Course Title                              | Subject<br>Area | Credits | . <b>L</b> | т                                   | P            | Theory | Practical | CWS                 | PRS | MTE   | ETE        | PRE                    |
|                 | • .             | Semes                                     | ster- III (Au   | utum    | n)         |                                     |              |        |           |                     |     |       |            |                        |
| 1.              | CE-201          | Computer Aided Graphics                   | ESC             | 2       | 1          | 0                                   | 2            | 2      | 0         | -                   | 25  | 25    | 50         | -                      |
| 2.              | HS-201          | Economics                                 | HSSMC           | 3       | 2          | 1                                   | 0            | 2      | 0         | 25                  | ·   | 25    | 50         |                        |
| -3.             | MI-201A         | Solid Mechanics                           | ESC             | 4       | 3          | · 1                                 | 0            | 3      | 0         | 25                  | -   | 25    | 50         | -                      |
| 4.              | MT-201          | Introduction to Engineering Materials     | DCC             | 3       | 2          | 1                                   | 0            | 2      | 0         | 25                  | -   | 25    | 50         | -                      |
| .5.             | MT-211          | Metallurgical Thermodynamics and Kinetics | DCC             | 4       | 3          | 1                                   | 0            | 3      | 0         | 25                  | -   | 25    | 50         | ·                      |
| 6.              | MT-221          | Structural and Chemical Characterization  | DCC             | 4       | 3          | 1                                   | 0            | 3      | 0         | 25                  | -   | 25]   | 50         | -                      |
| <sup>.</sup> 7. | MT-210          | Materials Characterization Lab I          | DCC             | 2       | 0          | 0                                   | <sup>3</sup> | 0      | 3         | -                   | -25 | 25    | . <b>1</b> | <b>50</b> <sup>·</sup> |
|                 |                 | Total                                     |                 | 22      | • 14       | 5                                   | 5            |        |           |                     |     |       |            |                        |
|                 |                 |   |                 |         |            |                                     |              |        |           |                     |     | · · · |            |                        |
|                 |                 | Seme                                      | ester-IV (S     | Sprin   | g) 🕺       |                                     |              |        | •         |                     |     |       |            |                        |
| 1.              | PH-201          | Physics-II                                | BSC             | . 3     | , 3        | 0                                   | 0            | . 3    | 0         | 15                  |     | 35    | 50         | -                      |
| _ 2.            | BM-201          | Managements concepts and practices        | HSSMC           | 3       | 2_         | 1                                   | 0            | 2      | 0         | 25                  |     | 25    | 50         | -                      |
| 3.              | CH-201          | Energy Resources and Conversion           | GSC             | 2       | 2          | 0.                                  | 0            | 2      | 0         | 15                  | -   | 35    | 50         |                        |
| · <b>4</b> .    | MT-212          | Transport Phenomena                       | DCC             | 4       | 3          | 1                                   | 0            | 3      | · 0       | .25                 |     | 25    | 50         | -                      |
| 5.              | MT-222          | Phase Transformation                      | DCC             | 4       | 3          | 1 .                                 | 0            | 3      | · 0       | 25                  | -   | 25    | <u>50</u>  | -                      |
| 6.              | MT-232          | Electronic Materials                      | DCC             | 4       | . 3        | 1                                   | 0            | .3     | 0         | . 25                | -   | 25    | 50         | · -                    |
| 7.              | MT-220          | Materials Characterization Lab II         | DCC             | 2       | 0          | 0                                   | 3            | 0      | 3         |                     | 25  | 25    | -          | 50                     |
| ,               |                 | Total                                     | ·               | 22      | 16         | 4                                   | 5            |        |           |                     |     |       |            |                        |

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| Teaching Scheme |                 |                                   |                 |              |            | Contact<br>Hours/Week |          |        | m<br>tion | Relative Weight (%) |            |     |     | )    |
|-----------------|-----------------|-----------------------------------|-----------------|--------------|------------|-----------------------|----------|--------|-----------|---------------------|------------|-----|-----|------|
| S. No.          | Subject<br>Code | Course Title                      | Subject<br>Area | Credits      | L          | Т                     | Ρ        | Theory | Practical | CWS                 | PRS        | MTE | ETE | PRE  |
|                 |                 |                                   | Semester- \     | <u>/ (Au</u> | tumr       | l)                    | •        |        |           |                     |            |     |     |      |
| · 1.            | MT-311          | Mechanical Behaviour of Materials | DCC             | 4            | 3          | : 1                   | .0       | 3      | 0         | 25.                 | -          | 25  | 50  | -    |
| 2.              | MT-321          | Iron and Steel Making             | DCC             | 4            | 3          | 1                     | . 0      | . 3    | ·0·       | 25                  | · -        | 25  | 50  |      |
| . 3.            | MT-331          | Metal Casting and Joining         | DCC             | 4            | 3.         | 0                     | 2        | 3      | 0         | 15                  | 15         | 30  | 40  | -    |
| 4.              | MT-310          | Mechanical Testing Lab            | DCC             | . 2          | 0          | 0                     | 3        | 0.     | 3         | -                   | 25         | 25  |     | 50 : |
| 5.              | MT-IE1          | Institute Elective-I              | BGSEC           | 3            | 2          | 1                     | 0        | 2      | 0         | 25                  |            | 25  | 50  | -    |
| 6.              | MT-IE2          | Institute Elective-II             | HSSMEC          | · 3          | 3          | 0                     | <b>0</b> | 3      | 0         | 15                  | -          | 35  | 50  |      |
|                 | 1               | Total                             | - <sup></sup>   | 20           | 14         | . 3                   | 5.       |        |           | _                   | •          |     |     |      |
|                 |                 |                                   | · · · ·         |              |            |                       | •        |        |           | ·                   | •          |     | •   | •    |
|                 |                 |                                   | Semester-       | VI (S        | pring      | )                     | · · . ·  |        |           |                     |            |     |     | · ·  |
| .1.             | MT-312          | Metal Forming                     | DCC             | 4            | 3          | 1                     | 0        | 3      | 0         | 25                  |            | 25  | 50  | '    |
| 2.              | MT-322          | Non-Ferrous Metallurgy            | DCC .           | 4            | <u>3</u> . | 1                     | 0        | 3      | . 0       | 25                  | -          | 25  | 50  | -    |
| 3.              | MT-332          | Ceramic and Polymeric Materials   | DCC             | _ 4          | 3          | 0                     | 2.       | 3      | 0         | 15                  | -15        | 30  | 40  | -    |
| 4.              | MT-320          | Materials Processing Lab          | DCC             | 2            | 0          | 0                     | 3        | · 0    | . 3       |                     | 25         | 25  | -   | 50   |
| 5.              | MT-390          | Communication Skills              | DCC             | 2            | 0          | 0                     | 2        | 0      | 0         | 100                 | -          | -   | -   | _    |
| 6.              | MT-IE3          | Institute Elective-III            | BGSEC           | 3            | 3          | 0                     | 0        | 3      | 0         | 15                  | -          | 35  | 50  | -    |
| <sup>·</sup> 7. | MT-IE4          | Institute Elective-IV             | HSSMEC          | 3            | .3         | 0                     | 0        | 3_     | 0         | 15                  | <u>``-</u> | 35  | 50  |      |
|                 | · .             | Total                             |                 | 22           | 15         | 2                     | 7        | ·      |           | •                   | · .        |     |     |      |

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| Year:         | • |  |

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|        |                 |  |                 | Co<br>Hou | ontac<br>rs/W | itact Exam<br>Week Duration Relative W |     |        |           |     | Weig     | Weight (%)                                   |     |     |
|--------|-----------------|--|-----------------|-----------|---------------|--|-----|--------|-----------|-----|----------|--|-----|-----|
| S. No. | Subject<br>Code | Course Title                           | Subject<br>Area | Credits   | E.            | T                                      | Ρ   | Theory | Practical | CWS | PRS      | MTE  | ETE | PRE |
|        |                 | Se                                     | mester- VI      | l (Aut    | umn)          |  |     |        |           |     |          |  |     |     |
| 1.     | MT-411          | Environmental Degradation of Materials | DCC             | 4         | 3             | 0、                                     | 2   | 3      | 0         | 15  | 15       | 30   | 40  | -   |
| 2.     | MT-ELE1 ·       | Departmental Elective-I                | DEC             | 4         | 3 ·           | 1                                      | 0   | 3      | 0         | 25  | 1        | 25   | 50  | 1   |
| 3.     | MT-ELE2         | Departmental Elective-II               | DEC             | 4.        | 3             | 1                                      | 0   | 3      | 0         | 25  | <u> </u> | 25   | 50  | -   |
| 4.     | MT-EL5          | Institute Elective-V                   | ESEC            | 4         | 3             | 1                                      | · 0 | 3      | · 0       | .25 |          | 25   | 50  |     |
| 5.     | MT-481          | Training Seminar                       | DCC             | 2.        | 0             | 0                                      | 2   | 0      | 0         | -   | 100      | -  | - · | -   |
| 6.     | MT-491          | Minor Project                          | DCC             | 2         | 0             | 0                                      | 4   | 0      | 0         | -   | 100      |  | · _ |     |
| 7.     | MT-500          | Major Project                          | DCC             |           | 0             | 0                                      | 3   | 0      | 0         | -   | -        | _  | -   | -   |
|        |                 | Total                                  |                 | 20        | 12            | 3                                      | 11  |        |           |     |          | 1  |     |     |
| · _ ·  | ·               |  |                 |           |               |  |     |        |           | 1   |          | <u>.                                    </u> | · . | · · |
|        | •               | S                                      | emester-V       | III (Sp   | pring)        | •                                      |     |        |           |     |          | ;  |     |     |
| 1.     | MT-412          | Heat Treatment Practices               | DCC             | 4         | 3             | 0                                      | 2   | 3      | 0         | 15  | 15       | 30   | 40  | -   |
| 2.     | MT-ELE3         | Departmental Elective-III              | DEC             | 4         | 3             | 1                                      | 0   | 3      | 0         | 25  |          | 25   | 50  | -   |
| 3.     | MT-ELE4         | Departmental Elective-IV               | DEC             | 4         | · 3·          | 1                                      | 0   | 3      | 0         | 25  | -        | . 25   | 50  | : - |
| 4.     | MT-EL6          | Institute Elective-VI                  | ESEC            | . 4       | 3             | 1                                      | 0   | 3      | 0.        | 25  | -        | 25   | 50  | -   |
| 5.     | MT-500          | Major Project                          | DCC             | 8         | 0             | Ċ Ö                                    | 12  | 0      | 0         | 100 | -:       | 0  | -   | -   |
|        |                 | Total                                  |                 | 24        | 12            | 3                                      | 14  |        |           |     | •        | ···  |     |     |

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## Autumn Semester Electives (MT-ELE1 and MT-ELE2)

|    |        | · · · · · · · · · · · · · · · · · · ·    |
|----|--------|--|
| 1  | MT-511 | Thin Film Technology                     |
| 2  | MT-521 | X-ray Diffraction Techniques             |
| 3  | MT-523 | Electron Microscopy                      |
| 4  | MT-525 | Secondary Steel Making                   |
| 5  | MT-527 | Hydro and Electro Metallurgy             |
| 6  | MT-529 | Advances in Materials Joining            |
| 7  | MT-531 | Ultra-fine Grained Material              |
| 8  | MT-533 | Electro Ceramics                         |
| 9  | MT-535 | Nanomaterials Synthesis and Applications |
| 10 | MT-537 | Silicon Technology and Devices           |
| 11 | MT-539 | Magnetism and Magnetic Materials         |
| 12 | MT-541 | Carbon Materials Technology              |
| 13 | MT-543 | Opto-electronic Materials                |

Spring Semester Electives (MT-ELE3 and MT-ELE4)

| 1  | MT 514 | Powder Metallurgy                          |
|----|--------|--|
| 2  | MT 516 | Principles of Materials Selection          |
| 3  | MT 520 | Inspection and Quality Control             |
| 4  | MT 522 | Composite Materials                        |
| 5  | MT 526 | Failure Analysis                           |
| 6  | MT 528 | Tribology of Engineering Materials         |
| 7  | MT 542 | Biomaterials                               |
| 8  | MT 556 | Surface Engineering and Coating Technology |
| 9  | MT 558 | Energy Storage Materials                   |
| 10 | MT 562 | Micro-fabrication Technology               |
| 11 | MT 564 | Microsensors, MEMS and Smart Devices       |
| 12 | MT 566 | Computational Materials Science            |

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## Appendix 'L' Item No. Senate/43.3.3

| Code | Name of the Programme                      | Existing seats |     | Revised             | Increase/<br>Decrease |         |      |
|------|--|----------------|-----|---------------------|-----------------------|---------|------|
|      |  | B.Tech.        | IDD | B.Tech.             | IDD                   | B.Tech. | IDD  |
| R-04 | Biotechnology                              | 48             |     | 50<br>(25+14+7+4)   |                       | +02     |      |
| R-07 | Chemical Engineering                       | 55             |     | 80<br>(40+22+12+6)  |                       | +25     |      |
| R-09 | Civil Engineering                          | 119            |     | 120<br>(61+32+18+9) | •                     | +01     |      |
| R-10 | Computer Science & Engineering             | 48             |     | 75<br>(38+20+11+6)  |                       | +27     |      |
| R-11 | Electrical Engineering                     | 119            |     | 125<br>(63+34+19+9) |                       | +06     |      |
| R-14 | Electronics & Communication<br>Engineering | 55             |     | 55<br>(28+15+8+4)   |                       | 00      |      |
| R-22 | Metallurgical & Materials<br>Engineering   | 95             |     | 90<br>(45+24+14+7)  | 20<br>(10+6+3+1)      | -5      | +20* |
| R-24 | Mechanical Engineering                     | 79             |     | 80<br>(40+22+12+6)  | · ·                   | +01     |      |
| R-33 | Production & Industrial Engineering        | 48             |     | 60<br>(30+16+9+5)   |                       | +12     |      |
| R-34 | Pulp& Paper Engineering                    | 108            |     | 50<br>(25+14+7+4)   |                       | -58     |      |
| R-39 | B.Arch.                                    | 79             |     | 50<br>(25+14+7+4)   |                       | -29     |      |
| R-42 | Applied Mathematics                        |                | 31  |                     | 31<br>(16+8+5+2)      |         | 00   |

## Reallocation/ Revision of seats for the JEE-2012

| R-44  | Integrated M.Sc. (Chemistry)  |          | 31      |                       | 20<br>(10+5+3+2)  | -11  |
|-------|---|----------|---------|-----------------------|-------------------|------|
| R-49  | M.Sc. Physics   |          | 31      |                       | 31<br>(16+8+5+2)  | 00   |
| R-53  | Geological Technology   |          | 31      |                       | 31<br>(16+8+5+2)  | 00   |
| R-54  | Geophysical Technology  |          | 31      |                       | 31<br>(16+8+5+2)  | 00   |
| R-58  | Polymer Science & Technology  |          | 31      |                       | 40<br>(20+11+6+3) | +09  |
| R-69  | Chemical Engineering with M.Tech.<br>in Hydrocarbon Engineering                     |          | 26      |                       | 30<br>(15+8+5+2)  | +04  |
| R-75  | Computer Science & Engineering<br>with M.Tech. in IT                                |          | 26      | -                     | 25<br>(12+7+4+2)  | -01  |
| R-83  | Electrical Engineering with M.Tech.<br>in Power Electronics                         |          | 15      |                       | 15 (8+4+2+1)      | 00   |
| R-85  | Electronics & Communication<br>Engineering with M.Tech in Wireless<br>Communication |          | 18      |                       | 20<br>(10+5+3+2)  | +02  |
| R-114 | Process Engineering with MBA  |          | 31      |                       | 40<br>(20+11+6+3) | +09  |
|       | IDD programme [B.Tech Civil<br>Engineering and M.Tech. Structural<br>Engineering]   |          | 00      |                       | 15<br>(8+4+2+1)   | +15* |
|       | TOTAL   | 853      | 302     | 835                   | 349               |      |
|       | TOTAL SEATS   | EXISTING | i= 1155 | <b>REVISED = 1184</b> |                   |      |

\* Proposed increase in view of the new IDD programme to be started from the session 2012-13.