सीनेट की अड़सठवीं बैठक का कार्यवृत्त

MINUTES OF THE 68th MEETING OF THE SENATE

02 मार्च 2017

2nd MARCH 2017

भारतीय प्रौद्योगिकी संस्थान रूड़की

रूड़की – 247 667 (भारत)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

ROORKEE – 247 667 (INDIA)

भारतीय प्रौद्योगिकी संस्थान रूड़की
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MEETING SECTION
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Minutes of the 68th Meeting of the Senate held on 02.03.2017 in the LHC-002 (Lecture Hall Complex) of the Institute.

Following were present:

1.	Prof. Ajit K. Chaturvedi	Director
2.	Prof. P. K. Ghosh	Deputy Director
3.	Prof. V. Devdas	(Architecture & Planning)
4.	Prof. Ila Gupta	(Architecture & Planning)
5.	Prof. G.S. Randhawa	(Biotechnology)
6.	Prof. Partha Roy	(Biotechnology)
7.	Prof. Bikash Mohanty	(Chemical Engineering)
8.	Prof. Vijay Kumar Agarwal	(Chemical Engineering)
9.	Prof. B. Prasad	(Chemical Engineering)
10.	Prof. Shishir Sinha	(Chemical Engineering)
11.	Prof C.B. Majumdar	(Chemical Engineering)
12.	Prof. P.P. Kundu	(Chemical Engineering)
13.	Prof. Anil Kumar	(Chemistry)
14.	Prof. (Mrs.) Mala Nath	(Chemistry)
15.	Prof. U.P. Singh	(Chemistry)
16.	Prof. M.R. Maurya	(Chemistry)
17.	Prof. K.C. Gupta	(Chemistry)
18.	Prof. Bina Gupta	(Chemistry)
19.	Prof. S.S. Jain	(Civil Engineering)
20.	Prof. C.S.P. Ojha	(Civil Engineering)
21.	Prof. S.K. Ghosh	(Civil Engineering)
22.	Prof. Mahendra Singh	(Civil Engineering)
23.	Prof. M. Parida	(Civil Engineering)
24.	Prof. Praveen Kumar	(Civil Engineering)
25.	Prof. N.K. Samadhiya	(Civil Engineering)
26.	Prof. K.S. Hari Prasad	(Civil Engineering)
27.	Prof. Akhil Upadhyay	(Civil Engineering)
28.	Prof. Z. Ahmad	(Civil Engineering)
29.	Prof. Kamal Jain	(Civil Engineering)
30.	Prof. Ajay Gairola	(Civil Engineering)
31.	Prof. B.R. Gurjar	(Civil Engineering)

32.	Prof. Vipul Prakash	(Civil Engineering)
33.	Prof. Manoj Mishra	(Computer Science & Engineering)
34.	Prof. M.L. Sharma	(Earthquake Engineering)
35.	Prof. Yogendra Singh	(Earthquake Engineering)
36.	Prof. B.K. Maheshwari	(Earthquake Engineering)
37.	Prof. Manish Shrikhande	(Earthquake Engineering)
38.	Prof. D.C. Srivastava	(Earth Sciences)
39.	Prof. D.K. Mukhopadhyay	(Earth Sciences)
40.	Prof. A.K. Saraf	(Earth Sciences)
41.	Prof. (Mrs.) S. Mukhopadhyay	(Earth Sciences)
42.	Prof. Sandeep Singh	(Earth Sciences)
43.	Prof. A.K. Sen	(Earth Sciences)
44.	Prof. Anand Joshi	(Earth Sciences)
45.	Prof. Pramod Agarwal	(Electrical Engineering)
46.	Prof. S.P. Singh	(Electrical Engineering)
47.	Prof. S.P. Srivastava	(Electrical Engineering)
48.	Prof. N.P. Padhy	(Electrical Engineering)
49.	Prof. Biswarup Das	(Electrical Engineering)
50.	Prof. G.N. Pillai	(Electrical Engineering)
51.	Prof. M.V. Kartikeyan	(Electronics & Communication Engg.)
52.	Prof. Himanshu Joshi	(Hydrology)
53.	Prof. D.S. Arya	(Hydrology)
54.	Prof. Pashupati Jha	(Humanities & Social Sciences)
55.	Prof. D.K. Nauriyal	(Humanities & Social Sciences)
56.	Prof. (Mrs.) Renu Rastogi	(Humanities & Social Sciences)
57.	Prof. Sukh Pal Singh	(Humanities & Social Sciences)
58.	Prof. (Mrs.) Rashmi Gaur	(Humanities & Social Sciences)
59.	Prof. Nagendra Kumar	(Humanities & Social Sciences)
60.	Prof. S.P. Singh	Paper Technology)
61.	Prof. Y.S. Negi	(Paper Technology)
62.	Prof. Dharam Dutt	(Paper Technology)
63.	Prof. S.C. Sharma	(Paper Technology)
64.	Prof. S. Rangenekar	(Management Studies)
65.	Prof. (Mrs.) Rama Bhargava	(Mathematics)
66.	Prof. R.C. Mittal	(Mathematics)
67.	Prof. V.K. Katiyar	(Mathematics)
68.	Prof. Roshan Lal	(Mathematics)
69.	Prof. (Mrs.) Sunita Gakkhar	(Mathematics)
70.	Prof. Kusum Deep	(Mathematics)
71.	Prof. N. Sukavanam	(Mathematics)
72.	Prof. S.C. Sharma	(Mechanical & Industrial Engg.)
73.	Prof. Dinesh Kumar	(Mechanical & Industrial Engg.)
74.	Prof. Akhilesh Gupta	(Mechanical & Industrial Engg.)
75.	Prof. P.K. Sahoo	(Mechanical & Industrial Engg.)
76.	Prof. S.K. Nath	(Metallurgical & Materials Engg.)
77.	Prof. Anjan Sil	(Metallurgical & Materials Engg.)

78. Prof. B.S.S. Daniel (Metallurgical & Materials Engg.)
79. Prof. Ujjwal Prakash (Metallurgical & Materials Engg.)
80. Prof. Rajesh Srivastava (Physics)
81. Prof. Vir Singh (Physics)
82. Prof. (Mrs.) Tashi Nautiyal (Physics)
83. Prof. Davinder Kaur Walia (Physics)
84. Prof. G.D. Varma (Physics)
85. Prof. M.L. Kansal (WRD&M)
86. Prof. Ramesh Chandra (Institute Instrumentation Centre)
87. Prof. R.P. Saini (Alternate Hydro Energy Centre)
88. Prof. M.P. Sharma (Alternate Hydro Energy Centre)
89. Dr. A.K. Sharma, Associate Dean, Academic Studies
90. Dr. R.K. Peddiniti, Associate Dean (Academic Research
91. Dr. C. Jayakumrar, Librarian, M.G. Central Library
92. Dr. Vipul Rastogi, Associate Professor, Department of Physics
93. Dr. Barjeev Tyagi, Associate Professor, Department of Electrical Engineering
94. Dr. Manish Mishra, Associate Professor, Dept. of Mech. & Indl. Engineering
95. Dr. Umesh Sharma, Associate Professor, Department of Civil Engineering
96. Dr. K.R. Justin Thomas, Associate Professor, Department of Chemistry
97. Mr. Prashant Garg, Registrar & Secretary, Senate

At the outset, Registrar, Secretary, Senate welcomed Prof. Ajit K. Chaturvedi, Director and Chairman, Senate for chairing his first meeting and thanked to the outgoing Chairman, Senate Prof. Pradipta Banerji for his valuable contributions.

The Chairman welcomed the members to the 68th meeting of the Senate.

Before taking up the agenda, the Chairman thanked the under-mentioned outgoing Senate members and recorded its appreciation for their valuable contributions in the meetings of the Senate:

1. Prof. (Mrs.) Ritu Barthwal, Department of Biotechnology
2. Prof. Ravindra Nath, Department of Physics
3. Prof. S.P. Sharma, Department of Mathematics

The Senate noted the communications received from the following members for not attending the current meeting:

1. Prof. Dharmendra Singh, Dept. of Electronics & Communication Engineering
2. Prof. R.P. Singh, Department of Biotechnology
3. Prof. (Mrs.) Pushplata, Department of Architecture & Planning
4. Prof. Pradeep Bhargava, Department of Civil Engineering
5. Prof. Deepak Khare, Dept. of Water Resource Development & Management
6. Prof. P.K. Gupta, Department of Civil Engineering
7. Prof. Ajay Kumar Singh, Department of Paper Technology

8. Prof. R. Krishnamurthi, Department of Earth Sciences
9. Prof. B.K. Gandhi, Department of Mechanical & Industrial Engineering
10. Prof. K.L. Yadav, Department of Physics
11. Prof. N.K. Goel, Department of Hydrology
12. Prof. Debashish Ghosh, Dept. of Electronics & Communication Engineering
13. Dr. R. Balasubramanian, Head, Institute Computer Centre
14. Prof. Ramasare Prasad, Department of Biotechnology
15. Dr. Rajat Agarwal, Department of Management Studies
16. Dr. Arun Kumar, Alternate Hydro Energy Centre

The Agenda was then taken up:

Item No. 68.1: To confirm the minutes of the 66th meeting and 67th (emergent) meeting of the Senate held on 11.08.2016 and 23.09.2016, respectively.

The comments were received from Prof. Kamal Jain and Prof. S.K. Ghosh on the minutes of 66th meeting regarding Chairman of ODC of Ph.D. viva voce. The matter was reconsidered and after discussion, it was decided that ODC be chaired by either HoD or his/her nominee. As no other comments were received on the minutes as recorded of 66th and 67th meetings are confirmed.

Item No. 68.2: To receive a report on the actions taken to implement the decisions taken by the Senate in its 66th and 67th (emergent) meeting held on 11.08.2016 and 23.09.2016, respectively.

The Senate noted the actions taken on the said minutes.

Item No. 68.3: To reconsider the views/comments with reasons received from the various Heads of Departments regarding completion of degree requirement of B.Tech. in 3½ years instead of 4 years - fees in advance.

The Senate considered the recommendations of IAPC regarding completion of degree requirement of B.Tech. in 3½ years instead of 4 years and accepted the following:

(a) The students having CGPA more than 9.00 at the end of the 2nd year may be considered to be allowed to complete the degree requirement in 3½ years.

(b) There will be no rescheduling of classes by any department.

(c) The project duration will not be relaxed. The student has to start the project in 3rd year spring semester to complete it in one year.

(d) The request to complete the degree in 3½ years will be considered on the merit of the case by the Dean (Academics) on the recommendation of HoD.

It was also decided that this provision of completing the degree requirements, one semester before, be extended to other programmes, wherever possible.

Item No. 68.4: To consider the correction in admission criteria for M.Tech. (Bioprocess Engineering) as proposed by Biotechnology Department

The Senate considered the correction in admission criteria for M.Tech. (Bioprocess Engineering) as recommended by IAPC and decided to approve the same with minor corrections as given in **Appendix 'A'**.

Item No. 68.5: To consider the proposal of giving same rank to students having same SGPA for change of branch.

The Senate considered the recommendation of IAPC of giving same rank to students having same SGPA for change of branch and did not accept the same.

Item No. 68.6: To consider the proposal of students not to grade NCC and other proficiencies.

The Senate considered the recommendation of IAPC not to include grade of NCC and other proficiencies in CGPA calculation and did not accept the same.

Item No. 68.7: To consider the policy for awarding 'O' grade.

The Senate considered the recommendation of IAPC regarding policy of awarding 'O' grade and after discussion it was decided that a committee be constituted to review the grading system.

Item No. 68.8: To consider the Research Areas recommended by various Departments/ Centres to be printed in the Ph.D. degree.

The Senate considered the Research Areas as proposed by different departments/centres and recommended by IRC, to be printed in the Ph.D. degree. After deliberations decided to approve the same with minor corrections as given in **Appendix 'B'**. Further, decided that the research areas of rest of the departments/centres be considered in the next meeting. It was also decided that Dean (Academics) will propose 2 to 3 options of Ph.D. degree formats for the consideration of the Senate.

Item No. 68.9: To consider minor change in short-listing candidates for Ph.D. admission.

The Senate considered the minor changes as recommended by IRC in short-listing candidates for Ph.D. admission and did not accept the same.

Item No. 68.10: To consider the proposal of extending M.Tech. to Ph.D. switchover programme to every department.

The Senate considered the recommendation of IAPC of extending switchover from M.Tech. to Ph.D. programme to every department having M.Tech. programme and decided to approve the same.

Item No. 68.11: To consider the proposal from Department of Management Studies to include the clause of "need of full time candidature" in the rules of outside Ph.D. supervision.

The Senate considered the proposal from Department of Management Studies and the recommendation of IAPC to include the clause of "Full-Time Ph.D. students of other Institutes/Universities" in the guidelines for supervision of Ph.D. students of other Institutes/ Universities. During discussion several other related issues were raised by the members and after discussion the proposal was not accepted.

Item No. 68.12: To consider the modified educational qualification for admission to Ph.D. Programmes at Saharanpur campus.

The Senate considered the proposal of Saharanpur campus and the recommendations of IRC regarding modified educational qualifications for admission to Ph.D. programmes at Saharanpur campus and accepted the same as given in **Appendix 'C'**. It was also decided that faculty members of HSS, ECE and MS will be included in the Ph.D. admission selection committee of respective departments at Roorkee campus.

Item No.68.13: To consider the minor corrections in the Ph.D. Ordinances & Regulations regarding thesis evaluation.

The members were informed that some changes as given in **Appendix 'D'** were approved by the then Director as Chairman, Senate regarding thesis evaluation. During discussion, few related issues were raised by the members. After discussion, it was decided that no further changes be made and the entire matter be reviewed by a Committee.

Item No. 68.14: To consider the revised curriculum structure of following M.Tech. programmes as proposed by the Department of Physics.

1. **M.Tech. (Solid State Electronics Materials) (Revised)**
2. **M.Tech. (Photonics) (New)**

The Senate considered the revised curriculum structure of existing PG programme and new PG programme as proposed by the Department of Physics and recommended by IAPC and decided to approve the following:

1. M.Tech. (Solid State Electronics Materials) - Revised
2. M.Tech. (Photonics) - New

The structures of the above programmes are given in **Appendix 'E'**. Further decided that the eligibility for the admission in these programmes will be as below:

M.Sc. (Physics/Electronics/Applied Physics/Photonics/ Engineering Physics)

B.Tech.(Engineering Physics/Electronics/Communication/ Electrical/ Instrumentation/Materials/Metallurgy/ Nanotechnology)

Item No. 68.15: To consider the proposal of MHRD to join NATIONAL ACADEMIC DEPOSITORY.

The Senate considered the proposal of MHRD to join NATIONAL ACADEMIC DEPOSITORY as recommended by IAPC and decided to approve the same.

Item No. 68.16: To consider the letter from Department of Physics seeking corrigendum saying that B.Tech. (Engineering Physics) programme involves multi-disciplinary courses and coordinated by the Department of Physics.

The Senate considered the request from Department of Physics seeking amendment in UG Ordinances and Regulations regarding B.Tech. (Engineering Physics) programme as a programme of the Department of Physics. After discussion it was decided that this did not need any change in the UG Ordinances & Regulations as even now there are few electives taught by engineering departments. In future, with the increase of faculty in engineering departments, core courses may also be shared by engineering departments.

Item No. 68.17: To consider the proposal of Department of Bio-Technology for exchange of course No. BTN-511 and BTN-524 of M.Sc. Biotechnology programme from autumn semester to spring semester.

The Senate considered the request of Department of Bio-Technology and the recommendation of IAPC for exchange of course BTN-511: Computer Applications from Autumn Semester to Spring Semester and BTN-524: Communication from Spring Semester to Autumn Semester of M.Sc. Biotechnology 1st Year and decided to approve the same.

Item No. 68.18: To consider the new and revised courses proposed by Centre of Excellence in Disaster Mitigation & Management

The Senate considered the syllabi of the following programme core courses and electives as proposed by the Centre of Excellence in Disaster Mitigation and Management and recommended by IAPC. It was decided to approve the same:

1. DMN-610: Industrial Disasters and Safety.
2. DMN-503: Managerial and Legal Aspects of Disasters
3. DMN-608: Man-made and Biological Disasters

The syllabi of the approved courses are given in **Appendix 'F'**.

It was further decided that an agenda item be brought in the next Senate to delegate this power of the Senate to IAPC.

Item No. 68.19: To consider the recommendations of DAPC of Electrical Engineering Department for exchange of course EEN-211 with the course MT-105 of II Year and the syllabi of new programme electives.

The Senate considered the proposal of Department of Electrical Engineering as recommended by IAPC of exchanging the courses of B.Tech. (Electrical) 2nd Year as below and decided to approve the same:

EEN-211: Control Systems	Autumn Semester to Spring Semester
MTN-105: Electrical and Electronic Materials	Spring Semester to Autumn Semester

The Senate also considered the syllabi of the following programme electives as proposed by the Department of Electrical Engineering and recommended by IAPC and decided to approve the same:

1. EEN-657: Digital Control of Power Converters
2. EEN-740: Communication Techniques in Smart Grid
3. EEN-741: Control and Management of Smart Grid
4. EEN-742: Power Converter Topologies in Smart Grid

The syllabi of the approved courses are given in **Appendix 'G'**.

Item No. 68.20: To consider the subjects with revised codes received/proposed by the Department of Humanities & Social Sciences.

The Senate considered the revised syllabus of the core course and the syllabi of pre-Ph.D. courses as proposed by the Department of Humanities & Social Sciences and recommended by IAPC. The Senate decided to approve the following:

1. HSN-501: Technical Communication
2. HSN-902: Understanding Personality
3. HSN-903: Advances in Social Psychology
4. HSN-906: Advances in Development Economics
5. HSN-908: Research Methodology in Social Sciences
6. HSN-910: Econometric Methods
7. HSN-911: Research Methodology in Language & Literature
8. HSN-912: Principles of Literature
9. HSN-913: The Art of Fiction
10. HSN-914: Poetry: Major Trends and Critical Appreciation
11. HSN-916: Sociological Theories
12. HSN-917: Sociology of Indian Society
13. HSN-918: Sociology of Science

The syllabi of the approved courses are given in **Appendix 'H'**.

Item No.68.21: To consider the Programme Elective Courses proposed by the Department of Electrical Engineering under category-1 and category-2.

The Senate considered the following programme electives as proposed by the Department of Electrical

Engineering under Category-1 and Category-2 and recommended by IAPC and decided to approve the same:

Category-1:

1. EEN-365: Numerical Methods for Electrical Engineering
2. EEN-366: Computational Electromagnetics

Category-2:

1. EEN-672: Smart Grid
2. EEN-673: Power Plant Engineering

The syllabi of the approved courses are given in **Appendix 'I'**.

Item No. 68.22: To consider the syllabi of following programme elective courses for the students of MBA proposed by the Department of Management Studies:

(i) BM-685: International Economics
(ii) BM-686: Investment Valuation
(iii) BM-687: Retail Management

The Senate considered the syllabi of the following programme elective courses for the students of MBA as proposed by the Department of Management Studies and recommended by IAPC. The Senate decided to approve the same:

1. BMN-685: International Economics
2. BMN-686: Investment Valuation
3. BMN-687: Retail Management

The syllabi of the approved courses are given in **Appendix 'J'.**

Item No. 68.23: To consider the correction in the syllabi of MAN-903: Theory of Differential Equations as L-3 T-0 P-0 of 3 credits in place of L-3 T-1 P-0 of 4 credits as approved by the Senate.

The Senate considered the following modifications suggested by the Department of Mathematics and

recommended by IAPC for the course MAN-903: Theory of Differential Equations and decided to approve the same. The modified credits and L-T-P loading are given below:

Credits : 4
Load : L-3 T-1 P-0

Item No. 68.24: To consider the syllabi of few courses proposed by the Department of Mathematics to be included in the basket of Pre-Ph.D. courses.

The Senate considered the syllabi of the following courses as proposed by the Department of Mathematics and recommended by the IAPC to be included in the basket of Pre-Ph.D. courses and decided to approve the same:

1. MAN-905: Advanced Statistical Inference
2. MAN-906: Theory of Integro-Differential Equations
3. MAN-907: Regularization Theory for Inverse Problems
4. MAN-908: Selected topics on Differential Subordination
5. MAN-909: Selected topics in Geometric Function Theory
6. MAN-910: Theory of Hardy Spaces
7. MAN-911: Selected topics in q- Hypergeometric Series
8. MAN-912: Selected Topics in Nature Inspired Optimization Techniques
9. MAN-913: Sobolev Spaces and Applications
10. MAN-914: Stochastic Partial Differential Equations

The syllabi of the approved courses are given in **Appendix 'K'.**

Item No. 68.25: To consider and approve the Academic Calendar for the Academic Session 2017-18.

The Senate considered the proposal of Dean (Academics) to reintroduce mid-semester breaks in both the semesters without extending the semester on either side and decided to approve the same. It was also decided that to maintain the minimum working days, few Saturdays be converted to working days, if required. Accordingly, the Senate considered the Academic Calendar for the Academic Session 2017-18 as recommended by the Academic Calendar Committee and decided to approve the same as given in **Appendix 'L'**.

Item No. 68.26: To consider award of the Ph.D. Degrees to the students who have completed the requirements for the award of the Ph.D. Degree in various disciplines w.e.f. October 2016 to till date.

The Senate considered the award of the Ph.D. Degrees to the students who have completed the requirements for the same in various disciplines w.e.f. October 3, 2016 till date and approved.

The list of the Ph.D. Degrees is given in **Appendix 'M'.**

Item No. 68.27: To report the modified clause 27 of Academic Programmes Ordinances and Regulations 2016 on Unfair means and Plagiarism.

The Senate noted the modified clause 27 of Academic Programmes Ordinances and Regulations 2016 on Unfair means and Plagiarism as approved by the earlier Chairman, Senate and given in **Appendix 'N'**.

Item No. 68.28: To report the institution of Usha Annual Award scholarship.

The Senate noted the award of Scholarship in the name of Usha Annual award of Rs. 10000/- to a student of M.Tech. (AHEC) 1st year for obtaining the highest grade in Small Hydro Power Planning & Management Course.

It was also decided that, in future, more details of the award be reported to the Senate.

Item No. 68.29: To consider the letter F.No. 24-1/2016-TS.1(sectt.) dated 28.11.2016 regarding Tuition fee for International students.

The Senate considered the letter from MHRD regarding tuition fee for International students and recommendation of the IAPC and decided to approve the following:

"The foreign students selected for admission in the IITs through the JEE (Advanced)/GATE examination shall be charged annual tuition fee of Rs.6 lakh per year. They may also be considered for any suitable fellowship."

It was also decided that they may be considered for any scholarship at par with Indian students.

Item No. 68.30: To consider switchover from M.Tech. to Ph.D. programmes for students from NIT Uttarakhand under Teacher Trainee Scheme.

The Senate considered the recommendations of the IRC regarding provision of switching from M.Tech. to Ph.D. programmes for the students of NIT Uttarakhand under Teacher Trainee Scheme and decided to approve the following:

Necessary provisions be made in the MoU so that the candidates under this scheme be given TWO years leave for doing the course work both for the M.Tech. and for the Ph.D, if required. In case, the desired modification is not feasible, the MoU be terminated.

It was also decided that the candidates having CGPA ≥7.500 as below be given one time exception to switchover to Ph.D. programme:

1. Candidates, who have already completed M.Tech., be allowed to register as part-time Ph.D. candidate w.e.f. spring semester 2016-17 and the course work requirement be waived-off.

2. Candidates, who have completed one semester of M.Tech. dissertation, be allowed to register for Ph.D. as part-time candidate in autumn semester 2017 without any course work requirement after they finish their M.Tech.

3. Candidates, who are in M.Tech. 1st Year be allowed to switchover to Ph.D. without any course work requirement if the CGPA at the end of 1st Year is more than 8.50 else they will have to complete M.Tech. first and then only they can be admitted in Ph.D. programme.

Item No 68.31: To revise the number of seats in B.Tech./B.Arch./IDD and Integrated M.Sc. for the year 2017.

The Senate considered the letter from MHRD regarding revision of seats in view of minimizing the vacancies in CFTs and the number of vacant seats in various UG programmes in last three years and decided to modify the number of seats as given in **Appendix 'O'.**

The requests were made on the floor of the house to restart the following programmes of science departments and the Senate decided to approve the same with 20 seats in each:

1. Integrated M.Sc.(Physics)
2. Integrated M.Sc.(Chemistry)

It was also decided that these programmes will start from 2017-18 session.

Item No. 68.32: To reconsider the proposal of Joint Supervision of Doctor of Philosophy (Ph.D.)

The Senate reconsidered the proposal of Joint Supervision of Doctor of Philosophy (Ph.D.) in view of increasing need for collaborative work as practiced across the world and decided to approve the same. However, not more than two supervisors from the same department will be allowed to supervise the thesis jointly.

Item No. 68.33: To report that the Director has approved the revised Institute fee to be charged from the candidates in Ph.D., PG(Engineering) and M.Sc. programme for the 2017 onwards and the number of seats in PG(Engineering)

The Senate noted the following approval on revision of fee to be charged from the candidates in Ph.D. and PG (Engineering) and M.Sc. programme from 2017 onwards and the number of seats in PG (Engineering):

1. From 2017 onwards, the fee at PG level including Ph.D. be kept at par with other IITs, as it was in 2015.

2. Admission in PG (Engineering) shall be done with MHRD assistantship and there will be no admission in self-finance category. Admission to sponsored category will be done over and above MHRD seats as decided by the Department/Centre from time to time.

3. The GATE qualified students admitted in PG in 2016 under self-finance category be also given MHRD fellowship w.e.f. the beginning of the next academic session.

The Senate further decided that the fee for the students admitted in 2016 in PG under self-finance and sponsored categories and in Ph.D. under MHRD and sponsored categories will be the same as it was in 2015, w.e.f. 2017-18 session.

Item No. 68.34: To report that the Director has approved Increase of Intake of Ph.D. Students with MHRD assistantship and seats under PMRF scheme.

The Senate noted the increase of intake of Ph.D. students with MHRD assistantship as recommended by Dean (Academics) and the guidelines issued by the MHRD regarding 48 additional seats allotted to IIT Roorkee under PRMF scheme. The revised numbers of seats are given in **Appendix 'P'**. It was also reiterated that number of Ph.D. seats under MHRD assistantships will be increased every semester till the number reaches 2500.

Item No.68.35: To report that the Director has approved the increase of Intake of PG Students under M.Tech. (Teaching Assistantship) and additional seats as per the guidelines issued by MHRD.

The Senate noted the intake of PG Students under M.Tech. (Teaching Assistantship) and additional 96 seats as per the guidelines issued by MHRD. The modified number of seats are given in **Appendix 'Q'.**

Item No. 68.36: To consider the panel of Senate's Nominees on the Selection Committees for Group 'A' Academic positions.

The Senate considered the panel of Senate's Nominees on the Selection Committees for Group 'A' Academic

positions and decided that the same be approved for the following Departments/Centres as given in **Appendix 'R'**:

1. Alternate Hydro Energy Centre
2. Architecture. & Planning Department
3. Biotechnology Department
4. Chemical Engineering Department
5. Chemistry Department
6. Civil Engineering Department
7. Earthquake Engineering Department
8. Earth Sciences Department
9. Computer Science & Engineering Department
10. Electrical Engineering Department
11. Electronics & Communications Engineering Department
12. Hum. & Social Sciences Department
13. Hydrology Department
14. Management Studies
15. Mathematics Department
16. Mechanical & Industrial Engineering Department
17. Physics Department
18. Water Resources Development & Management Department
19. Saharanpur Campus

(ii) Applied Sciences & Engineering
(iii) Polymer & Process Engineering
(iv) Paper Technology

20. Metallurgical & Materials Engineering Department

Item No 68.37: To consider the proposal of inducting students in Academic Bodies.

The Senate considered the proposal of inducting students in Academic Bodies and decided that students' representatives be invited in different academic bodies as below:

1. Senate
   (i) General Secretary, Students' Affairs Council
   (ii) General Secretary Academic Affairs (UG)
   (iii) General Secretary Academic Affairs (PG)
   (iv) Executive Committee of the Students' Senate will nominate a Ph.D. student. In case the General

Secretary Academic Affairs (PG) is a Ph.D. student, the Executive Committee of the Students' Senate will nominate an M.Tech. Student.

2. DAPC
   (i) One final year students' representative from UG
   (ii) One students' representative from PG
   (iii) One students' representative from Ph.D.

3. CAPC
   (i) One final year students' representative from PG
   (ii) One students' representative from Ph.D.

4. DRC/CRC
   (i) One students' representative from Ph.D.

It was also decided that students' representatives from UG, PG and Ph.D. in DAPC/CAPC, DRC/CRC will be elected by the UG, PG and Ph.D. students, respectively of the concerned Departments/Centres. The tenure of these representatives will be for one academic session.

These representatives are allowed as permanent invitees only and will be permitted during that part of agenda in which academic matters regarding UG, PG & Research are to be discussed. They will leave the meeting during discussion on confidential matters.

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

Appendix-A

Department of Biotechnology
Indian Institute of Technology Roorkee

	Existing	Proposed revision
Eligibility	B.E./B.Tech or equivalent Degree in Biochemical Engineering, Bioprocess Engineering, Chemical Engineering, Chemical Technology, Food Technology, Agricultural Engineering, Biomedical Engineering, Bioengineering, Biotechnology or in allied field.	B.E./B.Tech or equivalent Degree in Chemical Engineering/ Biochemical Engineering/ Bioprocess Engineering/ Chemical Technology/ Food Technology/ Agricultural Engineering/ Biomedical Engineering/ Bioengineering/ **Polymer Engineering/ Polymer Technology/ Plastic Technology/ Paper Technology/ Ceramic Technology/ Petrochemical Engineering/Textile Engineering/**Biotechnology or in allied field **with maths in +2 level(X+2 level).**
Necessary Requirements	a) Percentage marks and/or CGPA etc. at B.E./B.Tech or equivalent degree level must as per Institute's criterion, b) Candidates must qualify GATE.	a) Percentage marks and/or CGPA etc. at B.E./B.Tech or equivalent degree level must be as per Institute's criteron, b) Candidates must qualify GATE. **NO CHANGE**
Gate Discipline accepted	CH, BT, AG, XE	CH, BT, AG, XE, **TF**
Main Gate Discipline	**CH, BT**	**CH**
Allied Gate Discipline	**AG, XE**	**BT, AG, XE, TF**
Total Seat	15	08
Number of seat in main GATE Discipline	**12(Gen-6, OBC-3, SC-2, ST-1)**	**3(Gen-1, OBC-1, SC-1)**
Number of seat in allied GATE Discipline	**3(Gen-1, OBC-1, SC-1)**	**5(Gen-2, OBC-1, SC-1, ST-1)**

Appendix-B

List of Broad Research Entities to be Printed on Degree

S.No.	Department	Research Areas
1.	AHEC	• Small Hydro Power • Solar Energy • Modelling of IRES & HEC • Biofuels • Environmental Management of Water Bodies
2.	MIED	• Production Engineering • Machine Design Engineering • Thermal Engineering • Industrial Engineering • Welding Engineering • CAD, CAM and Robotics
	Biotechnology	• Biotechnology
4.	Hydrology	• Surface Water Hydrology • Ground Water Hydrology • Watershed Hydrology • Environmental Hydrology
5.	Chemical Engg.	• Transfer Process and Fluid Dynamics • Design, Modelling and Simulation • Reaction Engineering and Catalysis • Environmental and Energy Engineering • Polymers and Hydrocarbons • Materials Science and Bioengineering • Process Optimization and Control
6.	Physics	• Physics
7.	Management Studies	• Marketing Management • Information Systems • Operations Management • Human Resource Management • Financial Management & Accounting
8.	Earthquake Engg.	• Structural Earthquake Engineering • Geotechnical Earthquake Engineering • Engineering Seismology • Seismic Vulnerability and Risk • Seismic Hazard Assessment • Seismic Soil-Structure Interaction • Soil Dynamics • Structural Dynamics
9.	WRDM	• Water Resources Development Management • Irrigation Water Management
10.	Nanotechnology	• Nanotechnology
11.	Architecture & Planning`	• Architecture • Planning • Industrial Design
12.	Humanities &	• Economics

	Social Sciences	• English • Fine Arts • Psychology • Sociology
13.	Civil Engineering	• Civil Engineering
14.	Chemistry	• Chemistry
15.	Computer Science	• Computer Science
16.	Mathematics	• Mathematics
17.	Electronics & Communication	• Electronics & Communication
18.	Paper Technology	• Paper Printability • Paper Chemistry • Bleaching • Pulp & Paper Engineering • Sustainable Packaging • Packaging Design and Development • Packaging Process • Smart Packaging • Eco-friendly Packaging
19.	Polymer & Process Engineering	• Polymer Engineering • Polymer Materials • Process Control • Molecular Modelling & Simulation
20.	Electrical Engineering	• Power Electronics • Electrical Machines & Drives • Power System Engineering • Instrumentation & Measurement • Signal & Image processing • Control Systems

Appendix-C

Educational Background for Ph.D. for Department of Applied Sciences & Engineering, Paper Technology and Polymer and Process Engineering in IIT Roorkee Saharanpur Campus

(a) Department of Applied Science & Engineering:

(i) M.Sc. in Mathematics, Applied Mathematics, Operations Research, Physics, Materials, Nanomaterials, Nanoscience, Nanotechnology or its Equivalent Degree (with Mathematics as one subject at bachelor's level).

(b) Department of Pulp & Paper Engineering:

(i) B.E./B.Tech/M.E./M.Tech in Pulp & Paper, Chemical, Mechanical, Enviornmental, Biotechnology, Materials Science, Packaging, Printing, Food or its equivalent degree.

(ii) M.Sc. in Chemistry, Materials Chemistry, Industrial Chemistry, Environmental, Biotechnology, Botany, Food, Packaging, Pharma, Microbiology or its equivalent Degree.

(c) Polymer and Process Engineering:

(i) B.E./B.Tech/M.E./M.Tech in Polymer, Chemical, Paper, Packaging, Industrial, Rubber, Chemical Technology (Oil, Petrochemicals, Paints, Food, Pharmaceutical, etc.), Process, Environmental, Biotechnology, Nanotechnology, Materials Science and Metallurgical, or its equivalent degree.

(ii) M.Sc. in Chemistry, Polymer, Polymer Chemistry, Materials Chemistry, Industrial Chemistry, Medical, Microbiology, Botany, Packaging with Mathematics at B.Sc. level or its equivalent degree.

Appendix-B

Existing	Modified	Remark
R.9.3. The Dean, Academics will, on the basis of the recommendations of the examiners will take one of the following actions:	R.9.3. The Dean, Academics will, on the basis of the recommendations of the examiners will take one of the following actions:	
i) If all the examiners recommend acceptance of the thesis, their recommendations shall be accepted.	i) If all the examiners recommend acceptance of the thesis, their recommendations shall be accepted.	No Change.
ii) If out of three external examiners, **two external examiners (Foreign and one of the Indian)** have sent the report in time and recommend the acceptance of the thesis and all internal examiners also recommend acceptance of the thesis, their recommendation may be accepted. However, the academic section shall wait till the last date of sending the reports by all external examiners from the date of dispatch of Ph.D. thesis (i.e., 8 weeks) and after that give at least one reminder to examiner to send the report in next 4 weeks.	ii) If out of three external examiners, **two external examiners (Foreign and one of the Indian)** have sent the report in time and recommend the acceptance of the thesis~~and all internal examiners also recommend acceptance of the thesis,~~ their recommendation may be accepted. However, the academic section shall wait till the last date of sending the reports by all external examiners from the date of dispatch of Ph.D. thesis (i.e., 8 weeks) and after that give at least one reminder to examiner to send the report in next 4 weeks.	Modified as now there is no internal examiner.
iii) If the report of one out of two external examiners (received till last date) is negative, the report of third examiner is must.	~~iii) If the report of one out of two external examiners (received till last date) is negative, the report of third examiner is must.~~	Dropped.
iv) In case reports have come from both the Indian examiners, any one of them may be included in the examination board for viva-voce examination.	iv) In case reports have come from both the Indian examiners and both have given the same recommendations, any one of them may be included in the examination board for viva-voce examination. However, if the recommendations of Indian examiners are different, the one who	Modified.

	has raised the queries or asked to revise the thesis as per suggestions made by him/her and presents during oral defence shall be included in the examination board.	
v) If majority of the external examiners recommend rejection, their decisions would be accepted. The candidate may, however, be allowed to resubmit the thesis at least after one year, provided the title of the thesis remains unchanged. Normal procedure will be followed for the evaluation of the resubmitted thesis. In case of resubmission of the thesis, a fresh fee for the examination shall be paid by the candidate. No candidate shall be allowed to resubmit the same thesis more than once.	v) If any of the examiners recommends rejection, his/her decision would be accepted. The candidate may, however, be allowed to resubmit the thesis at least after one year, provided the title of the thesis remains unchanged. Normal procedure will be followed for the evaluation of the resubmitted thesis. In case of resubmission of the thesis, a fresh fee for the examination shall be paid by the candidate. No candidate shall be allowed to resubmit the same thesis more than once.	Modified.
vi) If more than one examiner recommends rejection, the candidate's replies to the comments made by the examiners shall be sent to these examiners and their clear verdict sought. The examiners may then recommend acceptance, rejection or revision of the thesis. In case the thesis is accepted, sub-clause 3(i) above will be applicable. In case of recommendation for revision, sub-clause 3(vii) below will apply. However, if these examiners still recommends rejection, alternate examiners would be appointed from the panel of the examiners recommended by SRC by the Dean, Academics. In such cases sub-clause 4(viii) will apply.	vi) If one or more examiners recommend rejection, the candidate's replies to the comments made by the examiners shall be sent to these examiners and their clear verdict sought. The examiners may then recommend acceptance, rejection or revision of the thesis. In case the thesis is accepted, sub-clause 3(i) above will be applicable. In case of recommendation for revision, sub-clause 3(vii) below will apply. However, if these examiners still recommends rejection, alternate examiners would be appointed from the panel of the examiners recommended by SRC by the Dean, Academics. In such cases sub-clause 4(viii) will apply.	Modified.

vii) In case some examiners recommend revision of the thesis, the thesis would be revised normally within one year, if the candidate so desires. The revised version of the thesis with new date of submission on thesis would be sent to all the examiners for their recommendations. If the candidate does not agree for revision, he may ask for appointment of another examiner(s) under sub-clause 4(viii) below.	vii) In case some examiners recommend revision of the thesis, the thesis would be revised normally within one year, if the candidate so desires. The revised version of the thesis with new date of submission on thesis would be sent to all the examiners for their recommendations. If the candidate does not agree for revision, he may ask for appointment of another examiner(s) under sub-clause 4(viii) below.	No Change.
viii) A new examiner, if appointed, shall be Indian or Foreign depending on whether the thesis was rejected/to be revised on the recommendation by an Indian or a foreign examiner in the first instance. The reports of all the examiners will be sent to the new examiner without revealing the identity of the previous examiners, along with the response of the candidate, if any, to the grounds for such recommendation as given in the detailed comments. The thesis shall be deemed to be acceptable if majority of the examiners including the new examiner recommend acceptance. If the newly appointed examiner recommends revision, the thesis would be suitably revised and resubmitted at least after 3 months and sent for examination to all the examiners except the ones in whose place the new examiner was appointed. In case the newly appointed examiners recommend rejection or their recommendations for revision is not accepted by the candidate, the thesis would be rejected. The candidate may then avail the benefit of sub-clause 3(v) above.	viii) A new examiner, if appointed, shall be Indian or Foreign depending on whether the thesis was rejected/to be revised on the recommendation by an Indian or a foreign examiner in the first instance. The reports of all the examiners will be sent to the new examiner without revealing the identity of the previous examiners, along with the response of the candidate, if any, to the grounds for such recommendation as given in the detailed comments. The thesis shall be deemed to be acceptable <u>if all the examiners including</u> the new examiner recommend acceptance. If the newly appointed examiner recommends revision, the thesis would be suitably revised and resubmitted at least after 3 months and sent for examination to all the examiners except the ones in whose place the new examiner was appointed. In case the newly appointed examiners recommend rejection or their recommendations for revision is not accepted by the candidate, the thesis would be rejected. The candidate may then avail the benefit of sub-clause 3(v) above.	Modified.

ix) If the majority of examiners recommend revision of the thesis, the candidate may revise the thesis accordingly and resubmit it within a period of one year for the evaluation by the same set of examiners.	~~ix) If the majority of examiners recommend revision of the thesis, the candidate may revise the thesis accordingly and resubmit it within a period of one year for the evaluation by the same set of examiners.~~	Dropped.
x) If there is no clear majority opinion and there are recommendations for rejection by some and also, revision of the thesis by some others, the candidates may revise the thesis and resubmit it within a period of one year, for evaluation by the same set of examiners.	x) If ~~there is no clear majority opinion and~~ there are recommendations for rejection by some and also, revision of the thesis by some others, the candidates ~~may~~shall revise the thesis and resubmit it within a period of one year, for evaluation by the same set of examiners.	Modified.
xi) Any doubt arising out of following the procedure laid down in clause R.9.3 shall be referred to the Director for a decision.	xi) Any doubt arising out of following the procedure laid down in clause R.9.3 shall be referred to the Director for a decision.	No Change.
xii) In case of ambiguous recommendations by the examiner, Dean, Academics will approach the examiner for a clear recommendation. In case clear recommendation is not forthcoming, the matter may be referred to the Director for his decision.	xii) In case of ambiguous recommendations by the examiner, Dean, Academics will approach the examiner for a clear recommendation. In case clear recommendation is not forthcoming, the matter may be referred to the Director for his decision.	No Change.
xiii) In case any examiner gives comments to be incorporated in the thesis and also states that the revised thesis need not be sent again to him / her, the revised thesis will not be sent to the examiner. The supervisor(s) shall certify that the comments have been incorporated, before the viva-voce examination.	~~xiii) In case any examiner gives comments to be incorporated in the thesis and also states that the revised thesis need not be sent again to him / her, the revised thesis will not be sent to the examiner. The supervisor(s) shall certify that the comments have been incorporated, before the viva-voce examination.~~	Dropped in view of clause R.9.2 (b) (iii) included in the revise rules.

Department of Physics
Indian Institute of Technology Roorkee

Details of Proposed New M. Tech. Program and Revised Existing M. Tech. Program

Program Names : (i) M. Tech. (Solid State Electronic Materials) (*Revised*)
(ii) M. Tech. (Photonics) (*New*)

Proposed Intake : M. Tech. (Solid State Electronic Materials) = 09
M. Tech. (Photonics) = 09

Eligibility

M. Sc. (Physics/Electronics/Applied Physics/Photonics/Engineering Physics)
B. Tech. (Engineering Physics/Electronics/Communication/Electrical/Instrumentation/Materials/Metallurgy/Nanotechnology)

PROGRAM : M.Tech. (**Solid State Electronic Materials**)
DEPARTMENT : Department of Physics

Teaching Scheme				Contact Hours/Week				Exam Duration (Hrs.)		Relative Weights (%)				
S. No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
1st Year			**I Semester (Autumn)**											
1.	PHN-701	Numerical Analysis and Computational Techniques	PCC	3	2	0	2	3	3	20	20	20	40	0
2.	PHN-703	Fabrication and Characterization Techniques	PCC	3	3	0	0	3	0	25	0	25	50	0
3.	PHN-707	Laboratory Work in Solid State Electronic Materials	PCC	3	0	0	6	0	6	0	50	0	0	50
4.	PHN-709	Semiconductor Device Physics	PCC	4	3	1	0	3	0	25	0	25	50	0
5.	PHN-xxx	Programme Elective –I (Group A)	PEC	4	-	-	-	-	-	-	-	-	-	-
		Sub Total		**17**										
			II Semester (Spring)											
1.	PHN-xxx	Programme Elective-II (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
2.	PHN-xxx	Programme Elective-III (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
3.	PHN-xxx	Programme Elective-IV (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
4.	PHN-xxx	Programme Elective-V (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
5.	PHN-700	Seminar	SEM	2	-	-	-	-	-	-	-	-	-	-
6.	PHN-700A	Industrial/Lab Training	ILT	2	-	-	-	-	-	-	-	-	-	-
		Sub Total		**20**										
2nd Year			**III Semester (Autumn)**											
1.	PHN-701A	Dissertation Stage-I	DIS	12	-	-	-	-	-	-	-	-	25	-
		Sub Total		**12**										
			IV Semester (Spring)											
1.	PHN-701B	Dissertation Stage-II	DIS	18	-	-	-	-	-	-	-	-	75	-
		Sub Total		**18**										
		TOTAL CREDITS		**67**										

List of PECs

Teaching Scheme				Contact Hours/Week				Exam Duration (Hrs.)		Relative Weights (%)			
S. No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE
Group-A													
1.	PHN-713	Optical Electronics	PEC	4	3	1	0	3	0	25	0	25	50
2.	PHN-715	Analog Integrated Circuit Design	PEC	4	3	1	0	3	0	25	0	25	50
3.	PHN-717	Digital Signal Processing	PEC	4	3	1	0	3	0	25	0	25	50
Group-B													
1.	PHN-718	Thin Film Technology	PEC	4	3	1	0	3	0	25	0	25	50
2.	PHN-719	Radiation Detection and Measurements	PEC	4	3	1	0	3	0	25	0	25	50
3.	PHN-720	Advance Characterization Techniques	PEC	4	3	1	0	3	0	25	0	25	50
4.	PHN-721	Nanoscience and Nanotechnology	PEC	4	3	1	0	3	0	25	0	25	50
5.	PHN-722	Functional Properties of Materials	PEC	4	3	1	0	3	0	25	0	25	50
6.	PHN-723	Engineered materials for Device Application	PEC	4	3	1	0	3	0	25	0	25	50
7.	PHN-724	Semiconductor Micro-electronic Technology	PEC	4	3	1	0	3	0	25	0	25	50
8.	PHN-725	Nano-electronics and -photonics	PEC	4	3	1	0	3	0	25	0	25	50
9.	PHN-726	Solar Photovoltaic and Energy Storage	PEC	4	3	1	0	3	0	25	0	25	50
10.	PHN-727	Advance Fuel Cell and Battery Technology	PEC	4	3	1	0	3	0	25	0	25	50
11.	PHN-728	MEMS and NEMS	PEC	4	3	1	0	3	0	25	0	25	50
12.	PHN-729	Advanced Ceramics and Composites	PEC	4	3	1	0	3	0	25	0	25	50

PROGRAM : M.Tech. (**Photonics**)
DEPARTMENT : Department of Physics

S. No.	Subject Code	Course Title	Subject Area	Teaching Scheme: Credits	L	T	P	Contact Hours/Week: Theory	Practical	Exam Duration (Hrs.): CWS	PRS	MTE	ETE	Relative Weights (%): PRE
1st Year			**I Semester (Autumn)**											
1.	PHN-701	Numerical Analysis and Computational Techniques	PCC	3	2	0	2	3	3	20	20	20	40	0
2.	PHN-703	Fabrication and Characterization Techniques	PCC	3	3	0	0	3	0	25	0	25	50	0
3.	PHN-711	Laboratory Work in Photonics	PCC	3	0	0	6	0	6	0	50	0	0	50
4.	PHN-713	Optical Electronics	PCC	4	3	1	0	3	0	25	0	25	50	0
5.	PHN-xxx	Programme Elective –I (Group A)	PEC	4	-	-	-	-	-	-	-	-	-	-
		Sub Total		**17**										
			II Semester (Spring)											
1.	PHN-xxx	Programme Elective-II (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
2.	PHN-xxx	Programme Elective-III (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
3.	PHN-xxx	Programme Elective-IV (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
4.	PHN-xxx	Programme Elective-V (Group B)	PEC	4	-	-	-	-	-	-	-	-	-	-
5.	PHN-700	Seminar	SEM	2	0	0	0	0	0	0	0	50	50	0
6.	PHN-700A	Industrial/Lab Training	ILT	2	0	0	0	0	0	0	0	0	100	0
		Sub Total		**20**										
2nd Year			**III Semester (Autumn)**											
1.	PHN-701A	Dissertation Stage-I	DIS	12	-	-	-	-	-	-	-	-	25	-
		Sub Total		**12**										
			IV Semester (Spring)											
1.	PHN-701B	Dissertation Stage-II	DIS	18	-	-	-	-	-	-	-	-	75	-
		Sub Total		**18**										
		TOTAL CREDITS		**67**										

List of PECs

S. No.	Subject Code	Course Title	Subject Area	Teaching Scheme: Credits	Contact Hours/Week: L	T	P	Exam Duration (Hrs.): Theory	Practical	Relative Weights (%): CWS	PRS	MTE	ETE	PRE
Group – A														
1.	PHN-709	Semiconductor Device Physics	PEC	4	3	1	0	3	0	25	0	25	50	0
2.	PHN-715	Analog Integrated Circuit Design	PEC	4	3	1	0	3	0	25	0	25	50	0
3.	PHN-717	Digital Signal Processing	PEC	4	3	1	0	3	0	25	0	25	50	0
Group – B														
1.	PHN-730	Guided-wave Optical Components & Devices	PEC	4	3	0	3	3	0	15	25	20	40	0
2.	PHN-719	Radiation Detection and Measurements	PEC	4	3	0	3	3	0	15	25	20	40	0
3.	PHN-731	Optical Communication System	PEC	4	3	1	0	3	0	25	0	25	50	0
4.	PHN-732	Optical Networks	PEC	4	3	1	0	3	0	25	0	25	50	0
5.	PHN-733	Solid State Lighting	PEC	4	3	1	0	3	0	25	0	25	50	0
6.	PHN-734	Display Technology	PEC	4	3	1	0	3	0	25	0	25	50	0
7.	PHN-726	Solar Photovoltaic and Energy Storage	PEC	4	3	1	0	3	0	25	0	25	50	0
8.	PHN-725	Nano-electronics and photonics	PEC	4	3	1	0	3	0	25	0	25	50	0
9.	PHN-735	Photonic Sensors	PEC	4	3	1	0	3	0	25	0	25	50	0
10.	PHN-736	Photonic Analysis and Design	PEC	4	2	0	4	2	3	15	15	20	20	30
11.	PHN-737	Silicon Photonics	PEC	4	3	1	0	3	0	25	0	25	50	0
12.	PHN-738	Quantum Photonics	PEC	4	3	1	0	3	0	25	0	25	50	0

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Centre of Excellence in Disaster Mitigation & Management**

1. Subject Code: **DMN-610** Course Title: **Industrial Disasters and Safety**

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. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **Nil**

9. Objective of Course: To impart knowledge of various safety issues in Industry and analysis of industrial disaster particularly fire and explosion

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** Occupational Safety, Health and Environmental Safety Management – Principles & practices. Accident Prevention: Principle, Definition, Incident, accident, injury, dangerous, occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes etc. Theories/ Models of accident occurrences. Principles of accident Prevention. Accident and Financial implication.	5
2.	**Safety in Different types of Industries:** Chemical Industry, Construction Industry, Transport Industry, Mechanical Industry, Textile Industry, Plastic Industry. Preventive maintenance, periodic checks for safe operation. Associated hazards and their prevention. Safety in maintenance and use of machines.	5
3.	**Planning for Safety:** Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Strategic planning and tools of implementation, Management by objectives and its role in Safety. Policy formulation and implementation. Safety Committee: Structure and functions, Monitoring for Safety, Employee Participation, Education and training towards safety	6

4.	**Designs for Industrial Safety:** Plant Design and Housekeeping, Role of preventive maintenance in safety and health. Importance of standards and codes of practice for plant and equipment. Industrial Lighting & Illumination, Ventilation and Heat Stress, Recommended values for air changes required for various areas as per Factories Act, 1948 and National Standards. IS: 3103-1975-Code of practice for Industrial Ventilation, National Building Code Part VIII. Noise and Vibration, Electrical Hazards, Chemical Hazards. Bureau of Indian Standards on Safety and Health: 14489 –1998 and 15001-2000, ILO and EPA Standards.	10
5.	**Law and Legislation for Safety:** ILO Convention and Recommendation concerning Occupational Health & Safety, The Factories Act, 1948 (Amended) and Rules, Indian Boilers Act, 1923 with allied Regulations, 1961. Indian Electricity Act, 2000 and Rules, Indian Explosives Act, 1984 and Rules. Petroleum Act and Rules. Gas Cylinders Rules. Calcium Carbide Rules. The Insecticides Act and Rules. Radiation Protection Rules. Hazardous Material Transportation Rules. Static and Mobile (Unfired) Pressure Vessel Rules, 1981 as amended in 2000. The Dock Workers (Safety, Health & Welfare) Act 1996. The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	6
6	**Fire Safety :** International Standards of fire safety norms for Industrial, warehouses and residential areas. Indian norms of fire safety, Analysis of fire and explosion, Individual and societal risk analysis, case discussions of industrial disasters due to fire and explosion.	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Books /Publisher	Year of Publication /Reprint
1.	C. R. Asfahl & D. W. Rieske, "Industrial Safety And Health Management", Pearson Higher Education	2010
2.	W. Hammer & D. Price, "Occupational Safety Management and Engineering", Prentice Hall	2001
3.	B. O. Alli, "Fundamental Principles of Occupational Health and Safety", ILO	2008
4.	L. M. Deshmukh, "Industrial Safety Management", Tata Mc-Graw Hill Publishing	2005
5.	D. Peterson, "Techniques of Safety Management: A Systems Approach" Mc-Graw Hill Tokyo	2003
6	Masellis M. (Eds.), "The Management of Burns and Fire Disasters Perspective 2000", Kluwer Academic Publisher	1995

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Centre of Excellence in Disaster Mitigation & Management**

1. Subject Code: **DMN-503** Course Title: **Managerial and Legal Aspects of Disasters**

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. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **Nil**

9. Objective of Course: To understand the application of various principles of management in disaster mitigation and better management of post disaster situations

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Principles of Management:** Introduction of management, functions of management, roles and responsibilities of different levels of management. Structure of Management for disaster handling in India. Application of planning, organizing, controlling, motivation in disaster management.	5
2.	**Disaster Management Principles and Practices**: Consider most important factors that need attention for the implementation of disaster mitigation and management programmes, legislation, key factors, principles and ethics, consideration for effective planning, controlling, co-coordinating, monitoring and implementing disaster mitigation and management programmes.	8
3.	**Project Management:** Understanding basics of project management, Work breakdown structure, cost breakdown structure, organization breakdown structure, role of human resource in disaster projects, nature of project activities in pre and post disasters situations.	5
4.	**Supply Chain Management** : Understanding difference between commercial supply chains and disaster (humanitarian) supply chains, drivers of supply chains, different strategies of supply chain in different phases of disasters, use of information technology in humanitarian supply chain, select case studies	8

5.	**Strategic Disaster Management**: Understanding the application of the principles and 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.	8
6.	**Information Technology in Disaster Management:** Understanding the link between information and decision-making. Understanding and classifying information systems that can have an impact on the dynamic disaster environment	4
7.	**Legal Issues in Disaster Management :** Structure of legal framework in India for disaster management, insurance for disasters, right to compensation, rehabilitation laws, state vs centre issues, involvement of corporate through CSR. Case studies	4
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors / Books /Publisher	Year of Publication /Reprint
1.	Sharma V.K., "Disaster Management", Medtech	2013
2.	Kovacs G., Spens K.M., "Relief Supply Chain Management for Disasters: Humanitarian, Aid and Emergency Logistics", IGI Global	2011
3.	Rapp R.R., "Disaster Recovery Project Management : Bringing order from chaos" , Purdue University Press	2011
4.	Sahay B.S., Gupta S., Chandra V. (Eds.), "Managing Humanitarian Logistics" Springer	2016
5.	Relevant India Acts and Rules, Government of India.	

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Centre of Excellence in Disaster Mitigation & Management**

1. Subject Code: **DMN-608** Course Title: **Man-made and Biological Disasters- Detection and Mitigation**

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

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

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

5. Credits: **4** 6. Semester: **Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **Nil**

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

10. Details of Course:

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

List of Experiments:

1. General laboratory practices and biosafety issues while handling bacterial pathogens.
2. Growth and maintenance of bacterial strains under standard laboratory conditions.

3. Media preparation and sterilization techniques for biosafety.
4. Microbial enumeration techniques – Raising bacterial inoculum, Pour plating, streaking, colony counting.
5. Studying bacterial morphology and colony characteristics. Staining techniques and microscopic examination.
6. Growth profiling of model bacterial strain under laboratory conditions.
7. Antibiotic sensitivity profiling of bacterial pathogens.
8. Hazardous xenobiotic (e.g pesticide) analysis using analytical techniques – HPLC.

11. Suggested Books:

Sl. No.	Name of Authors/Book/Publisher	Year of Publication
1.	Grey M. and Spaeth K., The Bioterrorism Sourcebook, McGraw Hill	2006
2.	Yousef A. K., et.al., Biology, Pathogenicity, Epidemiology, and Biodefense, Wiley-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
6.	Roy, D. and Cullimore, "Practical manual of groundwater microbiology:, CRC Press.	2008
7.	Goldman E., Lorrence, H. "Greenpractical handbook of microbiology", CRC Press.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-657** Course Title: **Digital Control of Power Converters**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Power Electronic Converters**

9. Objective: To familiarize students with the use of digital control theory in Power Electronic Converters for modelling and their design.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Review of Converters and Digital Control Systems**: Multi-quadrant operation of converters, Digital Power Electronics- pump circuits and conversion technology, pumping energy, stored energy, energy factor, time constants; Digital signals and coding, sample-and-hold circuits, ADC, DAC, reconstruction of sampled signals, zero, first and second-order hold systems.	5
2.	**Mathematical Modeling of Digital Power Electronics:** ZOH for AC/DC controlled rectifiers, transfer functions for DC/AC PWM inverters, DC/DC converters and AC/AC converters.	5
3.	**Digitally controlled AC/DC rectifiers:** Mathematical modeling for AC/DC rectifiers - single-Phase and three-phase half-wave and full-wave rectifiers, three-phase bridge controlled AC/DC rectifier,	6
4.	**Digital Controlled DC/AC Inverters:** Mathematical modeling for DC/AC PWM inverters, Three-phase full-bridge PWM VSI, Three-phase full-bridge PWM CSI, Multilevel PWM inverter.	7

S. No.	Contents	Contact Hours
5.	**Digitally Controlled DC/DC Converters:** Mathematical modeling for power DC/DC converters, soft-switching converters, resonant power converters.	5
6.	**Digitally Controlled AC/AC Converters:** Modeling for power AC/AC (AC/DC/AC) converters, single-phase and three-phase AC/AC voltage controllers, SISO, TISO and TITI cyclo-converters, AC/DC/AC PWM converters, Matrix converters.	7
7.	**Stability Analysis of Power Controllers:** Introduction, Pl control for AC/DC rectifiers, Pl control for DC/AC inverters and AC/AC (AC/DC/AC) converters, PID control for DC/DC converters.	4
8.	**Energy Factor Application in AC and DC Motor Drivers:** Introduction, Energy storage in motors, A DC/AC voltage source, An AC/DC current source, AC motor drives, DC motor drives.	3
	Total	42

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Dubey G. K., "Power Semiconductor Controlled Drives", Prentice-Hall International Editions.	2001
2.	Mohan N., Underland T.M., Robbins W.P., "Power Electronics – Converters, Applications and Design", John Wiley & Sons Inc., New York.	2004
3.	Kazmierkpwski Marian P., Krishnan R., Blaabjerg F., "Control in Power Electronics – Selected Problems", Academic Press, New York.	2002
4.	Holmes D.G., Lipo T.A., "Pulse Width Modulator For Power Converters – Principles and Practice", IEEE Press, John Wiley & Sons, Inc.	2003
5.	Luo Fang Lin and Ye Hong, "Advanced DC/DC Converters", CRC Press.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-740** Course Title: **Communication Techniques in Smart GRID**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Communication**

9. Objective:

To familiarize students with the communication standards and techniques used in control of Smart Grid.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Smart Infrastructure and Information System:** Smart infrastructure; Information metering and measurement, smart metering, smart appliances, smart monitoring and measurement, sensors, PMUs; Information management, data modelling, information analysis, integration and optimization.	10
2.	**Smart Communication Technologies:** Wired communication: Power line communication; Fiber-optic communication; Wireless communication: Wireless mesh network; cellular communication system; cognitive radio; IEEE 802.15, satellite communications; microwave or free space optical communication; End-to-end technologies.	8
3.	**System Security and Privacy:** Security and privacy in Smart Metering, information transmission; Communications Model; Security Functions; Security Threats; Authentication and Access Control	7
4.	**Communication Standards and Protocols:** IEC 61850; DNP3 and IEC 60870-5; IEEE C37.118; IEC 61968-9 and Multi Speak; ANSI C12.19, ANSI C12.18, ANSI C12.21, and ANSI C12.22; High-Reliability Protocols Time Synchronization Protocols;	10

S. No.	Contents	Contact Hours
5.	**Communication Challenges:** Security attacks, impact evaluation; Harnessing Technology Complexity; Legacy Integration, Migration, and Technology Life Cycle; Communications Service Planning and Evolution Trends; Cybersecurity for Wireless Networks; Management and Organization Challenges	7
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Borlase, Stuart, ed, "Smart Grids: Infrastructure, Technology, and Solutions", CRC Press.	2012
2.	Momoh, James, "Smart Grid: Fundamentals of Design and Analysis", Vol. 63,. John Wiley & Sons.	2012
3.	Fang X., Misra S., Xue G. and Yang D., "Smart Grid - The New and Improved Power Grid: A Survey", IEEE Communications Surveys & Tutorials, Vol. 14, No. 4, pp. 944-980.	2012
4.	Komninos N., Philippou E. and Pitsillides A., "Survey in Smart Grid and Smart Home Security: Issues, Challenges and Countermeasures", IEEE Communications Surveys & Tutorials, Vol. 16, No. 4, pp. 1933-1954.	2014
5.	Greer, C., et al., "Nist framework and roadmap for smart grid interoperability standards, release 3.0", US National Institute of Standards and Technology, Tech. Rep.	2014
6.	The Smart Grid Interoperability Panel Cyber Security Working Group, "Introduction to NISTIR 7628 Guidelines for Smart Grid Cyber Security, "http://www.nist.gov/smartgrid/upload/nistir-7628-total.pdf.	-

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-741** Course Title: **Control and Management of Smart Grid**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Power System and Power Electronics**

9. Objective:

To familiarize students with the architectures of AC and DC Smart Grids and their control.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Microgrid:** Definition; Drivers; Benefits and integration standards; Types of microgrids- AC, DC and Hybrid microgrids.	5
2.	**Microgrid Management Techniques:** Centralised; Decentralised and Hierarchal control methods; Decentralised control: Multi Agent System (MAS); Hierarchal control: Primary; Secondary; Tertiary control.	7
3.	**AC Microgrid:** Structure; control objectives: Grid forming, Grid-feeding, Grid supporting; parallel operation of inverters: Droop and non-droop methods.	10
4.	**DC Microgrid:** Architectures; Control Methods: droop, Adaptive Droop, DC Bus signalling (DBS), Power Line Signalling (PLS), Distributed control techniques; Standardisation issues.	10
5.	**Hybrid AC/DC Microgrid:** Architectures: AC-coupled, DC-coupled and AC-DC-coupled hybrid microgrid; Power management; interlinking converter control strategies.	10
	Total	42

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Colloca L. and Miller F. G., "Smart Grids: Infrastructure, Technology, and Solutions", CRC Press.	2013
2.	Hatziargyriou N., "Microgrids: Architectures and Control", Wiley.	2014
3.	Jackson A., Justo J., Mwasilu F., Lee J., and Jung J., "AC-Microgrids vs DC-Microgrids with Distributed Energy Resources□: A Review," Renew. Sustain. Energy Rev., Vol. 24, No. 144356002, pp. 387- 405.	2013
4.	Borlase, Stuart, ed, "Smart Grids: Infrastructure, Technology, and Solutions", CRC Press.	2012
5.	Keyhani A., Marwali M. N., and Dai M., "Integration of Green and Renewable Energy in Electric Power Systems", Hoboken, NJ, USA: John Wiley & Sons, Inc.	2009
6.	IEEE Transactions on Smart Grid	-

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-742** Course Title: **Power Converter Topologies in Smart Grid**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Power System and Power Electronics**

9. Objective:

To familiarize students with the concept of Smart Grid and its elements.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** An Overview on Distributed Generation and Smart Grid Concepts and Technologies; Challenges of the Current Energy Scenario: The Power Electronics Contribution; Advances in Power Semiconductor Technology: SiC devices.	5
2.	**Power Conversation Systems for Renewable Energy:** Wind Power Conversion systems- Basic Control Variables for Wind Turbines, power converters for wind turbines, controls and grid requirements for modern wind turbines: Photovoltaic Energy Conversion Systems- Power curves and maximum power point of PV systems, grid-connected PV system configurations, control of grid-connected PV Systems; AC-Link Universal Power Converters - Hard switching, soft switching ac-link universal power converters, applications.	12
3.	**Electric and Plug-In Hybrid Electric Vehicles:** Hybrid electric vehicle topologies, plug-in hybrid electric vehicles, EV and PHEV charging infrastructures, power electronics for PEV charging.	5
4.	**Universal Operation of Renewable Energy Systems:** Distributed power generation systems, overview of the control structure, control of power converters for grid-interactive distributed power generation systems	10

S. No.	Contents	Contact Hours
5.	**AC–DC–AC Converters for Distributed Power Generation Systems:** Bidirectional AC–DC–AC topologies, pulse-width modulation for AC–DC–AC Topologies; Control Algorithms for AC–DC–AC Converters.	**10**
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Abu-Rub, Haitham, Mariusz Malinowski, and Kamal Al-Haddad, "Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications", John Wiley & Sons.	**2014**
2.	Wu, Bin, et al., "Power Conversion and Control of Wind Energy Systems", John Wiley & Sons.	**2011**
3.	Keyhani A., Marwali M. N., and Dai M., "Integration of Green and Renewable Energy in Electric Power Systems", Hoboken, NJ, USA: John Wiley & Sons, Inc.	**2009**
4.	Editor: Stuart Borlase, "Smart Grids: Infrastructure, Technology, and Solutions", CRC Press.	**2012**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN - 501** Course Title: **Technical Communication**

2. Contact Hours: **L: 1** **T: 0** **P: 02**

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

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

5. Credits: **2** 6. Semester: **Both** 7. Subject Area: **English**

8. Pre-requisite: **Nil**

9. Objective: The course aims at making students job-ready by honing their soft skills and corporate behavior required to meet the challenges of the work place.

10. Details of Course:

S. No.	Contents	Contact Hours	Practical Contact Hours
1.	Technical Communication : Scope, Process and Barriers	2	2
2.	Written Forms of Communication : Structures and steps involved in writing/drafting Projects/ Technical Reports (Analytical, Feasibility Report), using different style sheets,Technical Proposals, Technical Descriptions, Letters, Memos, Minutes, MOUs	4	8
3.	Oral Forms of Communication: Group Discussion techniques, Brainstorming, Oral Presentation (Objective, Audience, Technique and Time Awareness), Meetings, Telephoning, Video Conferencing .	3	8
4.	Preparing CV/Resume, (Entry level, Functional and Skill-based)	2	2
5.	Job Interviews: Types (Personal, Telephonic, Interview through Video Conferencing): Techniques, Common type of questions, Answering Techniques, Failure and Success factors, Behavioral traits etc.	3	8
	Total	14	28

11. Suggested Books:

S.No.	Author/Book/Publisher	Year of Publication
1	Markel, Mike. Technical Communication. Bedford: St. Martin's.	2012
2	Crystal, David. Language and the Internet, Cambridge: CUP	2001
3	Gerald J. Alred, Charles T. Brusaw & Walter E. Oliu. The Handbook of Technical Writing, Seventh Edition [Hardcover], New YORK: St. Michael' Press	2010
4	Holtz, Shel, Corporate Conversation: A Guide to Crafting Effective and Appropriate Internal Communications, New Delhi: PHI	2007
5	R.A. Kelly, The Use of English for Technical Students, HARRAP	1970 (Revised Edition)
6	Lucas, Stephen. The Art of Public Speaking, McGraw-Hill Companies	1995
7	Leland Bown. Effective Business Report Writing, 2 ed., Prentice-Hall, Englewood Cliffs, New Jersey.	1963 (Revised Edition)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN -902** Course Title: **Understanding Personality**
2. Contact Hours : **L: 03** **T: 01** **P: 0**
3. Examination Duration (Hrs.): **Theory : 3** **Practical : 0**
4. Relative Weightage: **CWS : 25** **PRS: 0** **MTE : 25** **ETE: 50** **PRE: 0**
5. Credits: **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **HSS**
8. Pre-requisite: **Nil**
9. Objective of the Course: To introduce the students with different theories of personality and methods of personality assessment.
10. Details of Course:

S. No.	Particulars	Contact Hours
1	**Approaches to study of personality**: An introduction	4
2	**Major techniques of personality assessment:** Inventories, the interview projective techniques, the script, observational and behavioral assessment, and the case study	4
3	**Personality theories:** Trait, type, psychoanalytic, humanistic, self, social learning and cognitive theories. Writing a test report	8
4	**Administration of major personality tests**: Interpretation of test responses (with discussion). TAT and other psychometric tests	15
5	**Psychometric properties of tests**: response sets	3
6	**The Rorschach inkblot test**: Theory and interpretation	4
7	**Determinants of personality**: Biological factors and socialization (child reading antecedents and sociocultural influences)	4
	Total	**42**

11. Suggested Books:

Sl.No.	Title	Year
1	Hall, C. S., Lindzey, G. and Campbell, J. B. Theories of personality. New York: J.Wiley and Sons	1998
2	Pervin, L. A. and John, O. P. (eds.), Handbook of personality: theory and research, 2nd edn, New York: Guilford Press	1999
3	London, H & Exner, J.E. Dimensions of personality. New York: J.Wiley and Sons	1978
4	Cronbach, L. J. Essentials of psychological testing. Oxford: Harper	1960

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN -903** Course Title: **Advance Course in Social Psychology**
2. Contact Hours : **L: 03** **T: 01** **P: 0**
3. Examination Duration (Hrs.): **Theory : 3** **Practical : 0**
4. Relative Weightage: **CWS : 25** **PRS: 0** **MTE : 25** **ETE: 50** **ETE: 0**
5. Credits: **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **HSS**
8. Pre-requisite: **Nil**
9. Objective of the Course: To develop rigorous and in-depth understanding of research and theories of social psychology.
10. Details of Course :

S. No.	Particulars	Contact Hours
1	**Social Psychology as a Branch of Psychology**: Its historical background, major features of contemporary social psychology	6
2	**Methods Adopted in Social Psychology:** Experimental and non-experimental approaches, Qualitative research methods	6
3	**Helping Behavior and Recipient Reactions:** Determinants and major models	4
4	**Attitudes**: Attitude formation, measurement and change; The major attitude scales; Attitude change theories/models; The dynamics of persuasion: communicator, message, audience, and contextual factors	8
5	**Social influence:** Social facilitation, Social loafing, Social poer, Conformity and Compliance, Obedience to authority	8
6	**Distributive and procedural justice**: Major concepts and theories; Determinants of allocation rules, preferences, allocator, recipient, resource and situational characteristics, Rule preference in procedural justice.	6
7	**Cooperation and Competition in Game Like Settings**: Coalition formation: the major models	4
	Total	**42**

11. Suggested Books:

Sl.No.	Title	Year
1	Baron, R. A., & Byrne, D. R. *Social Psychology* (Tenth). New Delhi: Prentice-Hall of India.	2004
2	Raven, B.H. & Rubin, J.Z. *Social Psychology: People in Groups.* Whiley	1976
3	Krech,D., Crutchfield, R.S. & Ballachey, E.L. *Individual in Society.* New York, McGraw-Hill	1962
4	Advances in Experimental Social Psychology (relevant volumes)	

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN-906** Course Title: **Advancement in Development Economics**

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

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

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

5. Credits: **4** 6. Semester: **Autumn/Spring** 7.Subject Area: **HSSMEC**

8. Pre-requisite: **Nil**

9. Objective: To familiarize the students with latest development approaches, theories and issues.

10. Details of Course:

S. No.	Contents	Contact hours
1	**Introduction:** Basic concepts of economic growth and development; The cultural and political contexts of development; Beyond GDP.	3
2	**Theories of Economic Growth and Development**: Classical, Neo-classical and New Theories.	5
3	**Poverty and Inequality:** Concepts of poverty; measurement of poverty; growth and poverty; inequality and development; Measurement of inequality	5
4	**Population and Development:** Population Growth and Development; Theory of Demographic Transition; Low Level Equilibrium Trap; Strategies for Converting Demographic Advantage into Dividend.	5
5	**Market and State** : Resource allocation, market mechanism and role of the state; equity and growth approach to social development	4
6	**Development and Environment:** Trade-off between development and environment; Market-based approach to environmental analyses; Property rights; Environmental valuation.	6
7	**Trade and Development:** Trade, investment, and development; Multilateral and bilateral economic cooperation and global governance of national economic policies; International trade and the environment: Effects of trade liberalization on the environment; Sustainable development agenda; Use of trade agreements to protect the environment.	5

8	**Urbanization and Rural-Urban Migration**: Urbanization and development; Growth of urban informal sector and its implications; Migration and development; Harris-Todaro model of migration; Causes and consequences of rural-urban migration.	4
9	**Rural Development:** Concepts, determinants and policies; Decentralized planning and Panchayati Raj Institutions	5
	Total	**42**

11. Suggested Books:

S. No.	Name of Books/Author/Publisher	Year of Publication/ Reprint
1	A.P. Thirlwall, Growth and Development, , Macmillan Press	2005
2	M.P. Todaro, Economic Development in the Third World, Orient Longman	2012
3	K. Staudt, Managing Development, Sage Publications	1991
4	Subrata Ghatak, Introduction to Development Economics, Routledge, 4 edition	2003
5	Ray, Debraj, Development Economics, Princeton University Press	1998
6	K. Singh, Rural Development: Principles, Policies and management, Sage Publications	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN -908** Course Title: **Research Methodology in Social Sciences**
2. Contact Hours : **L: 03** **T: 01** **P: 0**
3. Examination Duration (Hrs.): **Theory : 3** **Practical : 0**
4. Relative Weightage: **CWS : 25** **PRS: 0** **MTE : 25** **ETE: 50** **ETE: 0**
5. Credits: **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **HSS**
8. Pre-requisite: **Nil**
9. Objective of the Course: To develop rigorous and in-depth understanding of philosophical, technical and practical aspects of doing research in social sciences
10. Details of Course:

S. No.	Particulars	Contact Hours
1	**Nature of Social Sciences Research:** Historical development of research in social sciences; Ideological basics of research: Positivism; Constructivism; Objectivism; Phenomenon; Paradigm; Theory; Model	3
2	**Research Process, Design and Measurement:** Literature review; Locating research gaps and writing research proposal; Research design; Error variance; Generalizability; Internal and external validity; Survey research; Cross sectional and longitudinal research design; Measurement: Concepts, Constructs, Variable – latent and manifest variables; Approaches to measurement: Operational definition, Sociometry, Scaling; Scaling techniques – rating and ranking scales; Sources of error in measurement; Scale construction; Construction of composite indices; Reliability and validity	7
3	**Data Collection and Sampling Techniques:** Data Collection: Primary data; Questionnaires; Schedules; Secondary data; Case study method; FGDs; Sampling: Probability and non-probability samples; Sampling techniques	5
4	**Quantitative and Qualitative Research Methods** **A. Quantitative Research Methods:** Measures of central tendency and variability; Basics of probability and randomness; Types of distribution; Basics of inferential statistics: Sampling distribution; Central limit theorem; *z*-score; *t*-score; Hypothesis testing: Significance testing; Type-I and type-II errors; Power of a test; Effect size and confidence interval; Correlation; Regression – Univariate and Multivariate: OLS and other methods, Parameters of model fit; Analysis of variance; Methods of	9+10+4 =23

	data reduction: Principal components and factor analysis; Social network analysis **B. Qualitative Research Methods:** Ethnography; Narrative research; Phenomenology; Grounded theory; Content analysis; Observational methods	
5	**Interpretation and Report Writing:** Meaning of interpretation; Techniques of interpretation; Precautions in interpretation; Significance of report writing; Different steps in writing report; Layout of the research report	4
	Total	**42**

11. Suggested Books:

Sl.No.	Title	Year
1	Kothari, C. R. *Research methodology: methods and techniques.* Vasa	2004
2	Meyers, L. S., Gamst, G., & Guarino, A. J. *Applied multivariate research: Design and interpretation.* Thoussand Oaks: Sage Publication	2012
3	Minium, E.W., King, B.M., & Bear, G. *Statistical Reasoning In Psychology And Education.* John Wiley, New York	1993
4	Creswell, J. W. *Qualitative inquiry and research design: Choosing among five traditions.* Sage Publication	2013
5	Blaug, M. *The methodology of economics.* Cambridge University Press	1992

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN-910** Course Title: **Econometric Methods**

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

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

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

5. Credits: **4** 6. Semester: **Autumn/Spring** 7.Subject Area: **HSSMEC**

8. Pre-requisite: **Nil**

9. Objective : To equip students with basic econometric tools and techniques useful for economic analysis.

10. Details of Course :

S. No.	Contents	Contact hours
1	**Introduction:**Nature and meaning of econometrics, structure of economic data, approaches to econometric model building	1
2	**Simple and Multiple LinearRegression Models**:Formulation, Estimation and Evaluation-Model with one and *k* Independent Variables, Assumptions of CLRM, estimation methods (OLS and ML methods), Gauss-Markov theorem (BLUE), Test of hypotheses- individual coefficients, R^2 and the Adjusted R^2, overall significance,Criteria for Model Selection	7
3	**Functional Forms and Model Specification**: Regression models with quadratic effects, log-transformation and non-linear equations; Test of restrictions imposed on the relationship of more parameters-Chow test, Wald test, LR test, Ramsay's RESET, Bera-Jarque test of normality of errors, Hausman specification test	5
4	**Violations in CLRM:** Heteroskedasticity, Multicollinearity and Autocorrelation- consequences, detection and remedies; specification error, omitted variables, errors in measurement	8
5	**Dummy Variables**: Meaning and Uses of Dummy Variables; Dummy Variable Trap; Tests for structural stability: The dummy variable approach and Chow test for structural stability	4
6	**Qualitative and Limited Dependent Models**: Linear probability model(LPM)- estimation and limitations,Logit andProbit models, Censored and truncated regression, MLE estimation-Tobit model, Applications	5

7	**Dynamic Econometric Models-** Autoregressive and Distributed lag (ADL) relationships- specification and problems in OLS estimation, partial adjustment and adaptive expectations method, Exogeneity tests, Wu-Hausman test	4
8	**Simultaneous Equation Systems**: Structural and reduced form models, simultaneous equation bias,identification problem and estimation methods- 2SLS; Problem of Endogeneity- causes and solution; Instrumental Variables estimation	4
9	**Introduction to Panel Data**: Balanced vs. unbalanced panel, Fixed effects model, random effects model, fixed vs. random effects- Wu Hausman test	4
	Total	**42**

11. Suggested Books:

S. No.	Name of Books/Author/Publisher	Year of Publication/ Reprint
1	Basic Econometrics, Gujarati, N.D., Porter and Gunasekar, McGraw Hill, 5th Ed.	2011
2	Introductory Econometrics: A Modern Approach, J.M. Wooldridge, Cengage, 2nd Ed.	2014
3	Introduction to Econometrics, J.H. Stock and M.W. Watson, AddisonWesley	2010
4	Mostly Harmless Econometrics, J.B. Angrist and J.Pischke, Princeton University Press	2009
5	Econometric Analysis, Greene, Prentice Hall, 5th Ed.	2007
6	Microeconometrics using Stata, Cameron and Trivedi,Stata Press, Revised Ed.	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN -911** Course Title: **Research Methodology in Language & Literature**

2. Contact Hours : **L: 03** **T: 01** **P: 0**

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

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

5. Credits: **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **Language & Literature**

8. Pre-requisite: **Nil**

9. Objective of Course: To familiarize fresh scholars with the tools and norms of serious writing like Ph.D. Dissertation, to make them know the difference between descriptive and argumentative writing focused on a single topic for detailed and substantial discussions.

10. Details of course :

S.No	Particulars	Contact Hours
1.	**Theoretical Background**: Meaning, Nature and Scope of Research; Difference between writing a popular article and research paper; a book and a dissertation	08
2.	**Methodology and Approaches**: Selection of Research Topic; Plan of Work, Thesis Statement and its Feasibility; Survey of different critical approaches, Selection of a particular approach, Micro and Macro analysis	08
3	**Material Collection**: Proper use of library and Internet, Primary and Secondary Sources, Reliability of Sources	06
4	**Preparatory Steps**: Writing of Synopsis, Literary Survey; Collection, Listing and Organization of Material, Note making, Use of Note Cards and Reference Cards.	10
5	**Mechanics of Writing**: Single and Multi Tier Division of Chapters, Writing of the Main Chapters, Preparation and Presentation of Conclusions, Preparation of References, Working Bibliography, Indexing, Use of MLA Style Sheet, Plagiarism	10
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	*Methods of Literary Criticism and Analysis*, A.N.Bogdanov & L.G.Yudkevitch	Latest edition
2.	*The Craft of Research*, Booth and Colomb	1995
3.	*Methodology and Methods of Linguistic Research*, I.P.Ranspopov	1976
4.	*Literary Research Guide*, J.L.Harner	1998
5.	*The Art of Literary Research*, R.D.Altick & J.J.Fenstermaker	1993
6.	*Handbook of Literary Research*, R.H.Miller	1995
7.	*Research Methods for English Studies, Gabriele Griffin*	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code **HSN- 912** Course Title: **Principles of Literature**

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

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

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

5. Credits: 4 6. Semester: **Autumn/ Spring** 7. Subject Area: **Language and Literature**

8. Pre-requisite: **Nil**

9. Objective of Course: To clarify the concept of Literature and its Principles to new scholars; to lay a strong foundation in them for complex literary understanding.

10. Details of course:

S.No	Particulars	Contact Hours
1.	**Conceptual Background**: Appreciation of Literature, Literary Sensibility, Literature and Life, Literature and Society, Truth and Morality in Literature	08
2.	**Theories of Literary Appreciation**: Art for Art's sake, Psychological Appreciation of Literature, Freud and Jung, Archetypal Criticism, New Criticism and Structuralism, Reader Response Criticism	12
3	**Recent Approaches to Literary Appreciation**: The Post-War Scenario and Social Changes, Feminist Readings of the Texts, Post Structuralism, Deconstruction, Postmodernism, Post colonialism	10
4	**Practical Criticism**: Analysis and Discussion of Literary Texts by students from the point of view of a particular analytical approach.	12
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	*Theory of Literature*, Wellek and Warren	1999
2.	*Literary Theory: An Introduction*, Terry Eagleton	1983
3.	*Contemporary Literary Criticism,* Davis and Schleifer	1989
4.	*A Glossary of Literary Terms*, M.H.Abrams	2000
5.	*Modern Literary Theory: A Reader*, Rice, Philip & Wagh, Patricia	1989
6.	*The Critical Examination - An Approach to Literary Appreciation at an Advanced Level (Language skills), Robinson, David, Peet, Malcolm*	1999
7.	*Literature and Ourselves*, New York: HarperCollins College Publishers, Gloria Henderson, William Day & Sandra Waller	Latest edition

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN- 913** Course Title: **The Art of Fiction**

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

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

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

5. Credits: 4 6. Semester: **Autumn/ Spring** 7. Subject Area: **Language and Literature**

8. Pre-requisite: **Nil**

9. Objective of Course: To acquaint the scholars with the different crafts and techniques adopted by novelist and to familiarize them with the major currents in the history of novel.

10. Details of course :

S.No	Particulars	Contact Hours
1.	**Background Survey**: Fiction as a Genre, The Meaning of Fiction, Fact in Fiction, Types of Fiction, Difference between novel and short story	08
2.	**Development of the Novel**: Story-telling and Novel, The Four Wheels of the Novel, Epistolary Techniques, Novel in the 19th Century	08
3	**Science and Novel**: Impact of Science & Technology on the Novel, Changing Social Realities and their Reflection in the Novel, Science Fiction	08
4	**Modern Novel**: Concept of Modernity in Novel, the changing concept of Time, Stream of Consciousness techniques, the changing art of characterization.	08
5.	**Structural Pattern**: Narrative Techniques, Plot and Structure, Various theories for interpretation.	05
6.	**Novel as a Global Art Form**: Development of a Novel as an art form in Europe, America and India; influence of localized tendencies and movements	05
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	*The Art of the Novel*, Milan Kundera	1995
2.	*The Aspects of the Novel*, E.M.Forster	1990
3.	*The Craft of Fiction*, Lubbock, Percy	1957
4.	*Character and the Novel*, Harvey, W.J.	1965
5.	*The Rhetoric of Fiction*, Booth, Wayne C.	Latest edition
6.	*In Theory*, Aijaj Ahmed	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN- 914** Course Title: **Poetry: Major Trends and Critical Appreciation**

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

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

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

5. Credits: 4 6. Semester: **Autumn/ Spring** 7. Subject Area: **Language and Literature**

8. Pre-requisite: **Nil**

9. Objective of Course: To make the scholars know and appreciate the finer sensibilities of poetry, to equip them with the critical nuance to evaluate poems properly for in-depth research.

10. Details of course :

S.No	Particulars	Contact Hours
1	**Various Concepts of Poetry**: What constitutes Poetry, Literature and Poetry, Poetic Sensibility and Appreciation, Poetic Use of Language	08
2.	**Early stages of Development**: The beginning of Poetry as a Literary Form; Rise of Lyric, Sonnet and other poetic forms in the 16th Century.	08
3	**Poetry in the 17th Century**: Elizabethan and Metaphysical poetry, Jacobean and Caroline Poetry, revival of Epic Poetry.	08
4	**Poetry in 18th& 19th Centuries**: Neoclassical poetry, Pre-Romantics, French Revolution and The Great Romantic Movement, Victorian Poetry, Reflections of Social Changes	08
5	**Modern Poetry**: Major Poets in 20th Century, Revival of Blank Verse, Reawakened interests in Tradition and Mythology, Imagery and Symbolism, Modern American and Indian English Poetry	10
	Total	**42**

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication
1.	*The Romantic Imagination,* C.M.Bowra	1998
2.	*The Modern Writer and His World*, G.Fraser	Latest edition
3.	*The Truth of Poetry,* M.Hamburger	2009
4.	*Poetry Today,* Anthony Thwaite	1985
5.	The Marginalization of Poetry: Language Writing and Literary History by Bob Perelman	Latest edition

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **HSN-916** Course Title: **Sociological Theories**
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**
5. Credits: **4** **6.** Semester: **Both** **7.** Subject Area: **DEC**
8. Pre – requisite: **Nil**
9. Objective: The course provides an advanced understanding and an in-depth discussion of classical and modern sociological theories
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction to the Social Theory:** Historical and political context; structure of sociological theory	6
2	**Founding Fathers:** August Comte – law of three stages, hierarchy of sciences Emile Durkheim – division of labour, social fact, religion and society	8
3	**Economy and Society:** Karl Marx: class, alienation, class struggle, historical materialism, social change Max Weber: social action, protestant ethic and spirit of capitalism, bureaucracy, power and authority, ideal type	8
4	**Structural Functionalism**: Talcott Parsons: structural functionalism, AGIL, pattern variables Robert K Merton: middle range theory, functions & dysfunctions, anomie	8
5	**Action Theory:** Symbolic interactionism, ethnomethodology and dramarturgy	6
6	**Structure and Agency:** Structuration theory of Anthony Giddens, post modernism and post structuralism	6
	Total	**42**

11. Suggested Books:

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

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

Subject Code: **HSN-917** Course Title: **Sociology of Indian Society**

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

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

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

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

8. Pre – requisite: **Nil**

9. Objective: The course provides an advanced understanding of Indian social system.

10. Details of the course:

S. No.	Contents	Contact Hours
1	**Introduction to Indian Society:** Types of culture, culture and civilization; basis of Indian social organisation, *ashram* system and *purusharthas*	6
2	**Development of Sociology in India:** Approaches to the study of Indian society - indological approach, structural functional approach, subaltern approach, civilization/perspective approach; impact of the British rule on Indian society	8
3	**Social Institutions:** Caste, family and kinship and marriage - nature, different types and characteristics; recent trends	8
4	**Religion:** Origin and evolution of religion; marxist, weberian and functionalist perspectives on religion	6
5	**Social Stratification and Change**: Theories of stratification; caste system; jajmani system; sankritization; westernization and modernization	8
6	**Social Movements:** Nature of social movements; reform movements; peasant/agrarian movements; tribal movements; dalit movements; new social movements	6
	Total	**42**

11. Suggested Books:

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

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

Subject Code: **HSN-918** Course Title: **Sociology of Science**

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

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

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

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

8. Pre – requisite: **Nil**

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

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction to Sociology of Science**: Development of modern science; the industrial and french revolutions and their technological and scientific implications	8
2	**Social Significance of Science and Technology**: Contextual nature of science; scientist as indexical and analogical reasoner	8
3	**Robert Merton's approach to science**: Ethos of science; matthew effect in science; thomas theorem and matthew effect	8
4	**Perspectives on scientific knowledge:** Karl Marx, Emile Durkheim, Karl Manheim's sociology of knowledge, Thomas Kuhn's structures of scientific revolutions and Karl Popper's theory of falsification	8
5	**Recent trends in Sociology of Science:** Science and technology in developing and developed countries, Indian context, information technology and globalisation, Manuel Castell's network society, internet and social inequality	10
	Total	**42**

11. Suggested Books:

S. No.	Author/Book/Publisher	Year of Publication
1	Box, S. and Cotgrove, S., "Science, Industry and Society: Studies in the Sociology of Science", Routledge, New York.	2008
2	Bucchi, M., "Science in Society: An Introduction to Social Studies of Science", Routledge, New York.	2004
3	Kuhn, T., "Structure of Scientific Revolutions", Chicago University Press, Chicago.	1996
4	Merton, R. K., Social Theory and Social Structure, Amerind, New York.	1981
5	Pattnaik, Binay K. "Sociology of Science and Technology in India", Edited Volume, Sage, New Delhi	2013
6	Wenda, K. B., Jennifer C. and Sal R., "Science, Technology, and Society: A Sociological Approach", Willey-Blackwell, Indianapolis.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-365** Course Title: **Numerical Methods for Electrical Engineering**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **None.**

9. Objective: The aim of this course is to provide students with the basic understanding of numerical methods typically used in solution of electrical engineering problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Review of number system, representation of floating numbers, error and accuracy	2
2.	**Solution of Linear Equations;** Direct Methods: Gauss Elimination, Gauss–Jordan Elimination, LU Decomposition, Cholesky Decomposition. Iterative Methods: Direct iteration method, Jacobi and Gauss–Seidel Methods. Basics of Sparse Matrix system and storage. **Computation of Eigenvalues:** Power Method, Inverse Power method, Similarity Transformation (QR and SVD).	10
3.	**Numerical Solution of Nonlinear Equations:** **Solving the Single Nonlinear Equations**: Bisection Method, Secant Method, Newton–Raphson method, multiple roots. Complex Roots of Polynomial Equations by Lin's and Bairstow's Methods, **Solving system of non-linear equations:** Newton Raphson Method, Secant method. Continuation method.	8

S. No.	Contents	Contact Hours
4.	**Approximation of functions:** **Numerical Interpolation:** Piecewise linear interpolation, Newton and Lagrange interpolating polynomials, Aitken interpolation method, Spline interpolation using linear, quadratic and cubic spline. **Regression:** Least squares regression, Non-linear regression, approximation using rational function. Numerical approximation of periodic functions using Fourier Series	8
5.	**Numerical Differentiation:** Approximating the Derivatives of a Function of One Variable using finite differences (Forward, Backward and Centered) schemes. **Numerical Integration:** Trapezoidal Rule, Simpson's Rules (1/3 and 3/8 rules), Romberg Integration, Adams Method, Gauss-Quadrature method.	8
6.	**Numerical solution of Ordinary Differential Equations:** Euler's Methods, Runge-Kutta's Methods, Multi-step Predictor–Corrector Methods	6
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Rosłoniec S., "Fundamental Numerical Methods for Electrical Engineering", Springer-Verlag, Berlin.	2008
2.	Chapra, S. C. and Raymond, P. C., "Numerical methods for Engineers", McGraw-Hill Higher Education, New York, 7th Ed..	2014
3.	Guha S. and Srivastava R., "Numerical Methods for Engineering and Science", Oxford University Press, New Delhi 2nd reprint.	2012
4.	Press W.H. et. al., "Numerical Recipes: The Art of Scientific computing", 3rd Edition, Cambridge University Press, Cambridge.	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-366** Course Title: **Computational Electromagnetics**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Electromagnetic Field Theory**

9. Objective:To introduce students to the computational methods in electromagnetics and their applications in design and analysis of electromagnetic devices

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction to Electromagnetic Fields**: Review of coordinate systems and vector analysis, electric and magnetic fields, boundary conditions, Maxwell's equations, Poynting theorem, wave equation,	6
2.	**Finite Difference Method (FDM):** Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method,	6
3.	**Finite Element Method (FEM):** Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements,	8
4.	**Integral Methods:** Charge simulation method, Method of Moments (MOM), Integral formulation, Green's functions and numerical integration, boundary element method,	6
5.	**Applications:** Low frequency electrical devices, transformers and rotating machines, Static / time-harmonic / transient problems,	10
6.	**Special topics:** Hybrid methods, coupled circuit-field computations, electromagnetic-thermal and electromagnetic-structural coupled computations,	6
	Total	42

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Chari M. V. K. and Salon S. J., "Numerical Methods in Electromagnetism", Academic Press.	2000
2.	Sadiku M. N. O., "Numerical Techniques in Electromagnetics", CRC Press.	1992
3.	Ida N., "Numerical Modeling for Electromagnetic Non-destructive Evaluation", Chapman and Hall.	1995
4.	Hoole S. R. H., "Computer Aided Analysis and Design of Electromagnetic Devices", Elsevier Science Publishing Co.	1989
5.	Jin J., "The Finite Element Method in Electromagnetics", 2nd Ed., John Wiley and Sons.	2002
6.	Silvester P. P. and Ferrari R. L., "Finite Elements for Electrical Engineers", 3rd Ed., Cambridge University Press.	1996

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-672** Course Title: **Smart Grid**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Power System and Protection**

9. Objective:

To impart knowledge of Smart Grid technologies and their applications for building more reliable, efficient, and resilient power system networks.

10. Details of Course:

S.No.	Contents	Contact Hours
1.	**Introduction to Smart Grid:** Concept of conventional and smart grid; concept of resilient and self healing grid; various features and functions of smart grid; smart grid architecture; smart grid elements (electric grid, smart grid control layer and elements, communication infrastructure, smart grid application layer); intelligent distribution grid; smart grid standards and policies.	6
2.	**Smart Grid Components:** Distributed generation resources (wind, solar, fuel cell, biomass, etc.); smart appliances; smart meters, smart storage devices (batteries, flywheels, hydro, compressed air, thermal, etc.); smart grid control elements (sensor, relays, reclosers, smart transformers, phasor measurement units, etc.); Plug-in-Hybrid Vehicles (PHEV); smart home.	6
3.	**Smart Grid Technologies and Operations:** Data acquisition and transfer; state estimation; Fault Detection, Isolation, and Service Restoration; Outage Management; operational tools for smart grid environment; distribution management.	6
4.	**Smart Grid Monitoring, Protection and Control:** Wide Area Monitoring System (WAMS); SCADA; digital relays for smart grid protections; islanding relays; relay co-ordination; Distribution Automation (DA).	6

S.No.	Contents	Contact Hours
5.	**Power Quality and Stability Issues in Smart Grid:** Power quality phenomena; harmonic estimation; power quality conditioner; web-based power quality monitoring and audit; voltage and angle stability issues in smart grid	6
6.	**Smart Grid Communication Infrastructure:** Advanced Metering Infrastructure (AMI); communication technologies for smart grid (Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max, PLCC, Fibre-optics, etc.); Home area Network (HAN) and Neighborhood Area Network (NAN); IP based protocols; cyber security.	6
7.	**Economics and Market Operations in Smart Grid:** Pricing structures; demand side management; demand response; energy efficiency; Transmission Pricing; energy, reserve and ancillary services markets.	6
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Sabonnadière J. C., "Nouredine Hadjsaïd, Smart Grids", Wiley Blackwell .	2012
2	Keyhani A., Marwali M. N., and Dai M., "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.	2009
3.	Editor: Miroslav M. Begovic, Electrical Transmission Systems and Smart Grids, Springer.	2013
4.	Editor: Stuart Borlase, Smart Grids: Infrastructure, Technology, and Solutions, CRC Press.	2012
5.	Northcote J. and Wilson R. G., "Control and Automation of Electric Power Distribution Systems", CRC Press.	2006
6.	Ekanayake J., Jenkins N., Liyanage K., Wu J., and Yokoyama A., "Smart Grid: Technology and Applications, Wiley.	2012
7.	Xiao Y., "Communication and Networking in Smart Grids", CRC Press.	2012
8.	Dugan R.C., McGranghan M.F., Santoso S., and Beaty H.W., "Electrical Power System Quality, McGraw Hill Publication.	2012
9.	Budka, Kenneth C., Deshpandé, Jayant G., and Thottan, Marina, "Communication Networks for Smart Grids", Springer.	2014
10.	Gellings C.W., "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press.	2009
11.	Phadke A.G.and Thorp J.S., "Computer Relaying for Power Systems", Wiley .	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-673** Course Title: **Power Plant Engineering**

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. Semester: **Both** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of Thermodynamics**

9. Objective: To introduce students to the basic details of different types of power plants

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** Energy sources for generation of electric power, present status, major power plants in India.	2
2.	**Thermal Power Plants:** Plant layout, major components: Boilers, Economisers, Super-heaters, Air pre-heaters, fuel and ash handling equipments, High pressure Boilers, steam turbines and their governing systems.	4
3.	**Gas Turbine Power Plants:** Gas turbine power plants, components and layout.	2
4.	**Hydro Power Plants:** Classification of hydro-plants, plant layout, types of hydraulic turbines and their governing systems, pumped storage hydro plants.	4
5.	**Nuclear Power Plants:** Introduction, main components of nuclear power plant, types of nuclear reactors, comparison between Nuclear and Thermal plants.	4
6.	**Non-Conventional Power Plants:** Geothermal power plants, Tidal power plants, Wind power plants, solar power plants.	4
7.	**Major electrical equipments in power plants:** Generators for thermal, hydro, wind and tidal power plants, constructional details of large turbo and hydro generators, types of cooling, excitation systems, generator transformers, generator and transformer earthing systems.	9

S. No.	Contents	Contact Hours
8.	**Electric Power Substations**: Air-insulated substations, components of air-insulated substations, bus arrangements: Single bus, Double bus–double breaker, Main and transfer (inspection) bus, Double bus–single breaker, Ring bus, and Breaker-and-a-half; Gas-insulated substations, components of gas insulated substations; Pole mounted substation, HVDC substation, substation earthing system, Overview of substation automation and SCADA systems,	8
9.	**Power plant instrumentation:** Classification of instruments, pressure gauges, thermometers, liquid level gauges, flow meters, speed measuring instruments, modern SCADA system for power plants	5
	Total	42

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1.	Black & Veatch, "Power Plant Engineering", CBS Publisher.	2005
2.	R. K. Rajput, "A Textbook of Power Plant Engineering", Laxmi Publications Ltd., New Delhi.	2006
3.	El-Wakil, M.M., "Power Plant Technology", McGraw-Hill Book Co.	2002
4.	Nag, P.K., "Power Plant Engineering", Tata MacGraw Hill.	2008
5.	John D. McDonald , "Electric Power Substations Engineering", 3rd Edition, CRC Press.	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE : **DEPARTMENT OF MANAGEMENT STUDIES**

1. Subject Code: **BMN-685** Course Title : **International Economics**
2. Contact Hours: **L: 3** **T: 0** **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: **3** 6.Semester: **Both** 7. Subject Area: **PEC**
8. Pre-requisite: **Nil**
9. Objective : To provide an understanding of the determinants of international trade, BOP and exchange rates, and to discuss their implications and relevance for domestic macroeconomic policies.
10. Details of Course:

Sl. No.	Contents	Contact hours
1	Introduction: Globalization; Trade and Standard of Living; International flow of Goods, Services, Labor and Capital; Current International Economic Problems and Challenges; Theories of International Trade	04
2	The Standard Theory of International Trade: Community Indifference Curves; The Basis for and Gains from Trade; Offer Curves; Terms of Trade	05
3	Factor Endowment and the Heckscher-Ohlin Theory; Factor Price Equalization and Income Distribution; Strategic Trade and Industrial Policies; WTO and The Uruguay and Doha Rounds	05
4	Economic Growth and International Trade: The Small Country Case; The large Country Case; Trade Restrictions and Tariffs: Partial and General Equilibrium Analysis; Theory of Tariff Structure	06
5	Non-Tariff Trade Barriers and New Protectionism: Import Quotas; Political Economy of Protectionism;	05
6	Economic Integration: Customs Unions and Free Trade Areas; Welfare Effects of Customs Unions; Cases of Economic Integration; International Trade and Economic Development	05
7	Balance of Payments; Foreign Exchange Markets; Foreign	06

	Exchange Rates; Spot and Forwards Rates, Currency Swaps, Futures and Options; Foreign Exchange Risks, Hedging and Speculation; Interest Arbitrage	
8	Exchange Rate Determination; Flexible and Fixed Exchange Rates: The Price Adjustment Mechanism; The Income Adjustment Mechanism; The International Monetary System – World Bank and IMF; Past, Present and Future	06
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors/Books/Publisher/Edition	Year of Publication / Reprint
1.	Salvatore, D., International Economics: Trade and Finance, Wiley, 11th Edition	2013
2.	Krugman, P. R. and Obstfeld, M., International Economics: Theory and Policy, Pearson, 8th Edition	2013
3.	Husted, S. & Michael M., International Economics, Pearson, 9th Edition	2013
4.	Jhingan, M. L., International Economics, Vrinda, 6th Edition	2014
5.	Dwivedi, D. N., International Economics: Theory and Policy, Vikas	2013

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **DEPARTMENT OF MANAGEMENT STUDIES**

1. Subject Code: **BMN-686** Course Title: **Investment Valuation**
2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Both** 7. Subject Area: **PEC**
8. Pre-requisite: **Nil**
9. Objective: To impart knowledge of tools, techniques and approaches for valuation of any asset / firm.
10. Details of Course:

S. No.	Contents	Contact hours
1.	**Introduction:** A philosophical basis for valuation, role of valuation, approaches to valuation.	4
2.	**Understanding financial statements**: The basic accounting statement, Asset measurement and valuation, Measuring financial mix, Measuring earnings and profitability, measuring risk, other issues in analyzing financial statements.	4
3.	**Basics of risk and measuring earnings:** What is risk? Equity risk and expected returns, Alternative models for equity risk, A comparative analysis of equity risk models, Models for default risk. Riskless rates and risk premiums. Accounting versus financial balance sheets, Adjusting earnings. From earnings to cash flows.	6
4.	**Firm valuation**: Free cash flows to the firm, The cost of capital approach, Adjusted present value approach, Effect of leverage on present value, Adjusted present value and financial leverage. Dividend discount models	6
5.	**Valuing equity in distressed firms**: Equity in highly leveraged distressed firms, equity as an option, value of equity as an option.	4
6.	**Value enhancement**: Value creating and value neutral actions, ways of increasing value, value enhancement chain, EVA, Cash flow return on investment	6
7.	**Acquisition and takeovers**: Acquisition basics, Value effect of takeovers, Steps in acquisition, Biases and common errors in takeover valuation, Structuring the acquisition.	6
8.	**Valuing startups (New concerns) and private firms**: Estimating value inputs in private firms, Valuation motives and value estimates, Valuing venture capital and private equity stakes.	6
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Damodaran A., "Investment Valuation: Tools & Techniques for Determining the Value of Any Asset", Wiley India Pvt. Ltd., 3rd Edition	2015
2.	Davidson I. & Tippett M , "Principles of Equity Valuation", Routledge, 4th Edition.	2012
3.	Richard A. B., Stewart C.M., "Capital investment and Valuation" McGraw Hill Professional, 6th Edition.	2014
4.	Stimes P.C., "Equity Valuation, Risk and Investment: A Practitioner's Roadmap, John Wiley & Sons, 2nd Edition.	2011
5.	Fabozzi F.J. & Markowitz H.M., "Equity Valuation and Portfolio Management", John Wiley & Sons, 1st Edition,.	2011
6.	Stowe J.D, Robinson T.R., Pinto J.E. & McLeavey D.W., "Equity Asset Valuation Workbook", John Wiley & Sons, 3rd Edition.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **DEPARTMENT OF MANAGEMENT STUDIES**

1. Subject Code: **BMN-687** Course Title: **Retail Management**
2. Contact Hours: **L: 3 T: 0 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: **3** 6. Semester: **Both** 7.Subject Area: **PEC**
8. Pre-requisite: **Nil**
9. Objective: To help students learn the importance of Retail management in the Indian context, current practices and the emergence of online retail.
10. Details of the Course:

S. No.	Contents	Contact Hours
1	**Introduction to Retailing** Introduction : Meaning of Retailing Economic Significance of Retailing Retailing Management Decision Process Types of Retailers : Retailing Environment (Indian vs. Global Scenario) Traditional Vs Organized Retailing in India	4
2	**Retail Marketing Environment** Introduction : Understanding the Retail Environment Difference between a Store/Private Brand and a National Brand Global Scenario of Private Labels :Indian Market Scenario Advantages & Disadvantages of Private Label The Retail Marketing Segmentation	4
3	**Store Location and Layout** Types of Retail Stores Location Factors Affecting Retail Location Decisions Location Based Retail Strategies: Country/Region Analysis, Trade Area Analysis Site Evaluation & Site selection.	4
4	**Retail Marketing Strategies** Target Market and Retail Format Strategy at different levels of Business Building a Sustainable Competitive Advantage Introduction to Internationalisation of Retailing Customer Relationship Management in Retailing	5

5	**Value delivery in Retailing** Target Market and Retail Format Gauging Growth Opportunities Building a Sustainable Competitive Advantage The Strategic Retail Planning Process Differentiation Strategies Positioning Decisions	5
6	**Retail Merchandising** Understanding Merchandising Management Activities of a Merchandiser Retail Merchandising Management Process	5
7	**Retail Pricing** Establishing Pricing Policies Factors Influencing Pricing Pricing Strategies Psychological pricing Mark-up and Mark-down Pricing	5
8	**Retail Distribution** Role of Distribution in Retailing Role of Technology in Managing the retail distribution Drivers of SCM in Retail Factors Influences the Retail Supply Chain	4
9	**E-Tailing** Introduction : E-tailing Role of Technology in Satisfying Market Demand Technology in Retail Marketing Decision Factors Influences the Growth of E-Tailing Future of Electronic Retailing	6
	Total	**42 hrs**

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Retailing, Robert F. Lusch, James R. Carver, Patrick M. Dunne, Cengage, 8th edition	2015
2	Retail Management : A Strategic Approach by Barry Berman, Pearson, 12th edition	2011
3	Retailing Management by Michael Levy & Barton A. Weitz, McGrawHill, 9th edition	2012
4.	Retail Management By J.K.Nayak & Prakash Dash, Cengage(In Press)	2016

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-905** Course Title: **Advanced Statistical Inference**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisite: A basic course on Probability & Statistics

9. Objective: To acquaint the students with mathematical tools of statistical inference.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Principle of Data Reduction: Sufficiency principle, Factorization criterion, minimal sufficiency, Completeness and bounded completeness, Likelihood principle, Equivariance principle.	08
2.	Theory of estimation: Basic concepts of estimation, Point estimation, , methods of estimation; method of moments, method of maximum likelihood; Unbiasedness, Minimum variance estimation, Cramer – Rao bound and its generalization, Rao Blackwell theorem, Existence of U.M.V.U.E estimators.	10
3.	General decision problem: Loss function, Risk function, Non-randomized and Randomized decision rules, Admissibility, Bayes' and Minimax decision rules, Sequential decision rules.	10
4.	Testing of Hypothesis: Critical region and power of the test, Neyman – Pearson lemma, Likelihood ratio principle, Uniformly most powerful tests, Unbiased test, Sequential probability ratio test.	08
5.	Analysis of Variance: one way classification and its extension; simple linear regression analysis with normal distribution.	06
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Rao, C.R.: *Linear statistical Inference and its Application* (Wiley Eastern Ltd), 2nd edition.	2001
2.	Ferguson, T.: *Mathematical Statistics – A Decision Theoretic Approach* (Wiley & Sons).	1967
3.	Berger, J.O.: *Statistical Decision Theory and Bayesian Analysis* (Springer – Verlag).	1985
4.	Lehman, E.L.: *Testing of Statistical Hypothesis.* Wiley Eastern Ltd.	1959
5.	Lehman, E.L.: *Point Estimation*, John Wiley & sons.	1984
6.	G. Casella, R. L. Berger: *Statistical Inference.* 2nd edition, Duxbury Press.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-906** Course Title: **Theory of Integro-Differential Equations**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Ordinary and Partial Differential Equations, Integral Equations and Functional Analysis.

9. Objective: To introduce the concepts of mathematical theory on integro-differential equations.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction**: Local and global existence, integro-differential inequalities, existence of extremal solutions, convergence of successive approximations, continuous dependence, linear variation of parameters, nonlinear variation of parameters, monotone iterative technique, interval analytic method.	10
2.	**Linear Analysis**: Basic properties of linear system, stability of linear convolution systems, stability criteria for general linear systems, stability by method of reduction, stability in variation, Lipschitz stability, asymptotic equivalence, behavior of solutions, impulsive integro-differential systems, periodic solutions .	12
3.	**LyapunovStability:** Method of Lyapunovfunctionals, equations with unbounded delay,perturbed systems, method of Lyapunov functions, Lyapunov functions on product spaces, impulsive integro-differential equation.	10
4.	**Equations in Abstract Spaces:** Existence and uniqueness of first order nonlinear integro-differential equation , existence of maximal and minimal solutions, well-posedness of linear equations, semigroups and resolvent operators, evolution operators and resolvents, asymptotic behavior and perturbations, stability of solutions.	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/ Reprint
1.	V. Lakshmikatham, M. Ram Mohana Rao, *Theory of Integro-Differential Equations,* Gordon and Breach Science Publishers	1995
2.	Vito Volterra, *Theory of Functionals and of Integral and Integro-Differential Equations,* Dover Publications, INC, New York	1958
3.	DonalO'Regan, Maria Meehan, *Existence Theory for Nonlinear Integral and Integro Differential Equations,* Kluwer Academics Publishers	1998
4.	Ravi P. Agarwal, DonalO'Regan, *Integral and Integro-Differential Equations, Theory Methods and Applications,* Gordon and Breach Science Publishers	2000
5.	Jurgen M. Appell, Anatolij S. Kalitvin, Petr P. Zabrejko, *Partial Integral Operators and Integro-Differential Equations*, Marcel Dekker Inc. New York, Basel,	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-907** Course Title: **Regularization Theory for Inverse Problems**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Functional Analysis

9. Objective: The main emphasis of this course is on a functional analytic treatment of inverse problems in the context of operator equations.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** Differentiation, Heat conduction, Signal and Image Processing, Parameter Identification, compressed sensing.	6
2.	**Ill-Posed Linear Operator Equations:** Moore-Penrose Generalized Inverse, Compact Linear Operators: Singular Value Expansion, Spectral Theory and Functional Calculus.	5
3.	**Regularization Operators**: Definition and Basic Results, Order Optimality, Regularization by Projection.	5
4.	**Continuous Regularization Methods:** A-priori Parameter Choice Rules, The Discrepancy Principle, Improved A-posteriori Rules, Heuristic Parameter Choice Rules, Mollifier Methods.	6
5.	**Tikhonov Regularization:** The Classical Theory, Regularization with Projection, Maximum Entropy Regularization, Tikhonov Regularization for Nonlinear Problems: Convergence Analysis, A-posteriori Parameter Choice Rules, Regularization in Hilbert Scales.	11
6	**Iterative Regularization Methods:** Landweber Iteration, Accelerated Landweber Methods, The Nonlinear Landweber Iteration, Newton Type Methods for Nonlinear Problems.	9
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication /Reprint
1.	Engl, H. W., Hanke, M. and Neubauer, A. *"Regularization of Inverse Problems"*, Kluwer Academic Publishers, Dordrecht	1996
2.	Kirsch, A., *"An Introduction to the Mathematical Theory of Inverse Problems"*, Springer (2nd Ed.)	2011
3.	Kaltenbacher, B., Neubauer, A. and Scherzer, O., *"Iterative Regularization Methods for Nonlinear Ill-Posed Problems"*, Walter de Gruyter.	2008
4.	Scherzer, O., Grossauer, H., Lenzen, F., Grasmair, M. and Haltmeier, M., *"Variational Methods in Imaging"*, Springer.	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-908** Course Title: **Selected topics on Differential Subordination**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Basic knowledge of Real and Complex Analysis

9. Objective:To give fundamental knowledge of advanced topics of Differential Subordination.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Preliminaries:** Subordinations, Hypergeometric functions, Classes of functions, Integral operators, Fundamental lemmas, admissible functions and examples, Open door lemma and integral existence theorem.	9
2.	**Applications of First order Differential Subordination:** Briot–Bouquet differential subordination, Analytic integral operators,Subordination preserving integral operators.	8
3.	**Applications of Second order Differential Subordination:** Integral operators preserving functions with positive real parts, Integral operators preserving bounded functions, Averaging integral operators, Hypergeometric functions,Schwarzian and Starlikeness.	8
4.	**Special Differential Subordination:** Conditions for special subclasses of starlike functions, Simple Conditions for starlikeness and convexity, subordination by convex functions, Functions with bounded turning,starlike with respect to symmetric points.	8
5.	**Differential Subordination in Several Complex Variables:** Preliminary lemmas, extensions of the fundamental lemma, Dominant and admissible functions in C^n, Differential Subordination inC^n, Applications in other fields, Harmonic functions,Meromorphic functions, Differential subordination in the upper half plane, extension to Banach spaces.	9
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	S.S.Miller and P.T. Mocanu, *Differential Subordination : Theory and Applications,* Marcel Dekker, New York and Basel.	2000
2.	T. Bulboaca, *Differential Subordinations and Superordinations, Recent Results,*Hous of Scientific Book, Cluj-Napoca, Romania.	2005
3.	Ian Graham and Gabriela Kohr, *Geometric function theory in one and Higher dimensions*, Chapman & Hall, CRC Press, London.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-909** Course Title: **Selected topics in Geometric Function Theory**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Basic knowledge of Real and Complex Analysis

9. Objective:To give knowledge of advanced topics of Geometric function theory.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Elementary theory of Univalent functions:** The Area theorem, Growth and Distortion Theorems, Coefficient Estimates, Convex and Starlike functions, Close to Convex functions,Spirallike functions, Typically Real functions.	9
2.	**Convolution Technique:** Hadamard Product, Dual sets and test sets,Prestarlike functions,Polya Schoenberg conjecture, de la valleepoussin means, Jack's Lemma, Extremal problem.	9
3.	**Subordination:** Basic Principles, Coefficient Inequalities, Sharpened Forms of the Schwartz Lemma,Majorization,Univalent Subordinate Functions.	8
4.	**General Extremal Problems:** Functionals of Linear Space, Representation of Linear Functionals, Extreme Points and Support Points, Properties of Extremal Functions, Extreme Points of S, Extreme Points of $\sum$.	8
5.	**Coefficient Conjectures:** Preliminaries, Proof of the Coefficient Conjecture, Consequences on generalization of the conjecture.	8
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/ Reprint
1.	P.L.Duren, *Univalent Functions*, Springer Verlag, New York.	2001
2.	A.W. Goodman, *"Univalent Functions"*, Vol.1, 11, Polygonal Publishing House, New York.	1983
3.	Ch. Pommerenke, *Univalent Functions*, Vandenhoeck and Ruprecht, Berlin.	1975
4.	St. Ruscheweyh, *Convolutions in Geometric Function Theory*, Presses del'Universite de Montreal, Montreal.	1982
5.	D.J. Hallenback and T.H. MacGregor, *Linear Problems and Convexity Techniques in Geometric Function Theory*, Pitman Publishers, London.	1984

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-910** Course Title: **Theory of Hardy Spaces**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Basic knowledge of Real and Complex Analysis

9. Objective:To give knowledge of advanced topics of Hardy and Hilbert Spaces.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Harmonic and Subharmonic Functions:** Boundary behaviour of Poisson-Stieltjesinterals, Subharmonic functions, Hardy's Convexity theorem, Subordination, Maximal Theorems.	8
2.	**Basic Structure of Hp functions:** Boundary values, Zeros, Mean convergence, Canonical Factorization, Harmonic Majorants.	5
3.	**Conjugate Functions and Taylor Coefficients:** Theorem of M. Riesz, Kolmogorov andZygmund Theorem, Trigonometric Series,Hausdorff-Young inequalities, Theorem of Hardy and Littlewood, Multipliers.	8
4.	**Linear Space:** Quotient Space, Annihilators, Representation of Linear Functionals,Beurling's Approximation theorem, Failure of Hahn-Banach Theorem, Extreme Points.	8
5.	**Interpolation Theory:** The Extremal Problem and its Dual, Uniqueness of Solutions, Counterexamples, Rational Kernels.	6
6.	**Hp Space over General Domains:** Simply connected domains, Jordan domains with rectifiable boundary, Smirnov domains, Domains not of Smirnov type, Multiply Connected Domains.	7
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	P.L. Duren, *Theory of Hp Spaces*, Academic Press, London.	1970
2.	P. Koosis, *Introduction to Hp Spaces*, Cambridge Press, New York, London.	2008
3.	G.B. Folland, *Hardy Spaces*, Springer, New York.	2001
4.	R.A. Martinez Avadeno and P. Rosenthal, *An introduction to Hardy-Hilbert Space*, Springer, New York.	2007
5.	M. Rosenblum and J. Rovnyak, *Topics in Hardy Spaces and Univalent functions*, BirkhauserVerlag, Berlin.	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-911** Course Title: **Selected topics in q- Hypergeometric Series**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Both** 7.Subject Area: **PEC**

8. Pre-requisite: Basic knowledge of Real and Complex Analysis

9. Objective: To give fundamental knowledge of advanced topics of q-hypergeometric series.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	q-Binomial theorem, Heine's transformation formula, q analogue of Gauss's summation formula, Jacobi's triple product identity, theta functions, q analogue of Saalschutz's summation formula, Bailey–Daum summation formula,Karlsson-Minto summation formula, q-gamma and q-beta functions.	10
2.	Summation formulae for terminating very-well poised series, Watson transformation formula,Jackson sum of a terminating very well poised series, Rogers-Ramanujan identities, Bailey's transformation formula.	6
3.	Two-term summation, three-term summation, bibasic summation formula, quadratic, cubic and quartic summation formulae,multibasic hypergeometric series.	6
4.	Watson's contour integration, analytic continuation,Barne's integral, extensions of complex q inside unit disc, Sears's transformation.	5
5.	Bilateral basic hypergoemetric series, Ramanujan's sum, Bailey's sum,Askey-Wilson q-beta integral, orthogonality, q-Racah polynomials, little and big q-Jacobi polynomials, q-ultraspherical polynomials, Askey-Wilson polynomials.	9
6.	Difference equation, Clausen's formula, Poisson kernel, theory of partitions.Generating functions of some standard forms including Boas and Buck type. Sister Celine's techniques for finding pure recurrence relation.	6
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	G.Gasper and M.Rahman, Basic hypergeometric series, Encyclopedia of Mathematics and its applications, Cambridge University Press, New York.	2004
2.	Exton, H., Multiple Hypergeometric Functions and Applications, Halsted Press (Ellis Horwood Limited, Chichester), John Wiley and Sons, New York, London, Sydney and Toronto.	1976
3.	Whittaker, E.T.; Watson, G.N., A Course of Modern Analysis, Fourth ed., Cambridge Univ. Press, Cambridge, London and New York.	2009
4.	E.D. Rainville– Special Functions, MacMillan	1971

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-912** Course Title: **Selected Topics in Nature Inspired Optimization Techniques**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Basic knowledge of Optimization Techniques

9. Objective: To prepare the students to carry out advanced research in designing new nature inspired optimization algorithms.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Review of Deterministic and Probabilistic approaches for solving nonlinear optimization problems, The No Free Lunch Theorem,	2
2.	Evolutionary Algorithms: Darwin's Theory of Evolution, Evolutionary Strategies, Evolutionary Programming, Differential Evolution, Binary and Real Coded Genetic Algorithms. Case studies.	9
3.	Swarm Intelligence: Particle Swarm Intelligence, Artificial Bee Colony Algorithm, Glowworm Optimization, Spider Monkey Optimization, Grey Wolf Optimization, Bat Algorithm. Case studies.	9
4.	Gravitational Search Algorithm, Central Force Optimization, Water Drop Algorithm, Harmony Search Algorithm. Case studies.	4
5.	Methods based on rejection strategies, repair strategies, specialized operators and penalty functions for constrained optimization. Case studies.	6
6.	NP Hard Problems: Traveling Salesman Problem, Time Table Problem, Vehicle Routing Problem, Maximum Clique Problem, Su-Do-Ko.	6
7.	Multi-objective Optimization: convex and non–convex problems, dominance – concepts and properties, Pareto–optimality, solution using Nature Inspired optimization, bi level optimization. Case studies.	6
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication
1.	Xin-She Yang: *"Nature Inspired Optimization Algorithms"*, Elsevier.	2009
2.	K. Deb: *"Multi-Objective Optimization using Evolutionary Algorithms"*, K. Deb, John Wiley and Sons, New Delhi.	2002
3.	K. Deb: *"Optimization for Engineering Design Algorithms and Examples"*, Prentice Hall of India, New Delhi.	1998
4.	M. Gen, and R. Cheng: *"Genetic Algorithms and Engineering Design"*, Wiley, New York.	1997
5.	A. P. Engelbrecht: *"Fundamentals of Computational Swarm Intelligence"*, Wiley & Sons.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-913** Course Title: **Sobolev Spaces and Applications**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Functional Analysis and Partial Differential Equations

9. Objective:To introduce some basic concepts of Sobolev spaces which are further used in theory of partial differential equations.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Sobolev Spaces:** Introduction to distributions, Definitions and Elementary Properties, Approximation by Smooth Functions, Extension Theorems, Imbedding Theorems, Compactness Theorems, Dual Spaces, Fractional Order Spaces and Trace Spaces, Trace Theory	10
2.	**Weak Solutions to Elliptic Boundary Value Problems:** Existence of Weak Solutions, Regularity, Galerkin Method, Maximum Principle, Eigenvalue Problems	10
3.	**Semigroups and Applications**: Unbounded Linear Operators, Strongly continuous Semigroups, HilleYosida Theorem, Contraction Semigroups on Hilbert Spaces, Heat Equation, Wave Equation, Schrodinger Equation, Inhomogeneous Equation	12
4.	**Some Techniques from Nonlinear Analysis:** Fixed Point Theorems, Galerkin Method, Monotone Iterations, Variational Methods, Pohozaev's Identity for Non-existence of solutions	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication
1.	Evans, L. C., *"Partial Differential Equations"*, American Mathematical Society (2nd Ed.)	2014
2.	Kesavan, S., *"Topics in Functional Analysis and Applications"*, New Age International Publishers	2008
3.	Pazy, A., *"Semigroups of Linear Operators and Applications to Partial Differential Equations"*,Springer-Verlag, (2nd Ed.)	1983
4.	Lions, J. L. and Magenes, E., *"Non-Homogeneous Boundary Value Problems and Applications"*, Vol. I, Springer-Verlag	1972
5.	Adams, R. A., "Sobolev Spaces", Academic Press	1975

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **MAN-914** Course Title: **Stochastic Partial Differential Equations**

2. Contact Hours: **L: 3** **T: 0** **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: **3** 6. Semester: **Autumn/Spring** 7.Subject Area: **PEC**

8. Pre-requisite: Ordinary & Partial Differential Equations

9. Objective:To introduce the concepts of mathematical theory on stochastic partial differential equations.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Some examples, Stochastic processes Brownian motions and martingales, Stochastic integrals, Stochastic differential equations of Ito type, Levy processes, Stochastic Differential Equations of Levy Types.	4
2.	Scalar Equations of first order:Generalized Ito's Formula, Linear stochastic Equations, Quasilinear Equations, general Remarks.	5
3.	Stochastic Parabolic Equations: Solution of Stochastic Heat equation, Linear equations with additive noise, Some regularity properties, Stochastic reaction diffusion equations, Parabolic equations with gradient dependent noise, Nonlinear parabolic equations with Levy Type noise.	9
4.	Stochastic Parabolic Equation In the Whole Space: Linear and semi-linear equations, Feyman- Kac formula, Positivity of solutions, Correlation function of solutions.	5
5.	Stochastic Wave Equations: Wave equation with additive noise, Semi-linear wave equations, Wave equations in an unbounded domain, Randomly perturbed hyperbolic systems, The stochastic wave equations in spatial dimension d with d > 1.	9
6.	Stochastic Evolution Equations in Hilbert Spaces: Hilbert-space-Valued martingales, Stochastic integrals in Hilbert-spaces, Ito's Formula, Stochastic evolution equations, Mild solutions, Strong solutions, Stochastic evolution equations of the Second Order.	10
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors/ Books/Publishers	Year of Publication / Reprint
1.	L.C. Evans, *An Introduction to Stochastic Differential Equations,* American Mathematical Society.	2013
2.	R. Dalang, D.Khoshnevisan and C.Mueller, *A Minicourse on Stochastic partial Differential Equations,* Springer (A lecture Notes in Mathematics)	2009
3.	C. Prevot and M. Rockner, *A Concise Course on Stochastic Partial Differential Equations,* Springer	2007
4.	G. D. Prato and J. Zabczyk, *Stochastic Equations in Infinite Dimensions,* Cambridge University Press.	1992
5.	D. W. Stroock and S.R.S. Vardhan, *Multidimensional Diffusion Processes*, Springer.	2006
6.	Pao-Liu Chow, *Stochastic Partial Differential Equations,* Second Edition, CRC Press, Taylor & Francis Group.	2015

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ACADEMIC CALENDAR FOR THE YEAR 2017-18
(Autumn Semester)

S.No.	Details	Autumn Semester	
		Date	Day
1.	Reporting and Registration of New Ph.D. students.	07.07.2017	Friday
2.	Institute reopens and Registration of all new PG students	13.07.2017	Thursday
3.	Registration of all existing students in the Departments/ Centres	14.07.2017	Friday
4.	Re-examination and Second examination on medical grounds (for Spring Semester 2016-17)	14.07.2017 - 17.07.2017	Fri, Sat Monday
5.	Commencement of Classes for Autumn Semester (2017-18) except UG I Yr	17.07.2017	Monday
6.	Reporting and Registrations of all new UG/IMT/IMS students	23.07.2017	Sunday
7.	Orientation programme for all new students and selections of all newly admitted UG/IMT/IMS students for N.C.C./N.S.S./N.S.O. and Language Proficiency test	24.07.2017- 30.07.2017	Monday – Sunday
8.	Registration/Counselling for vacant seats of all PG programmes	24.07.2017	Monday
9.	Closing of admissions	24.07.2017	Monday
10.	Last date for sending the grades of Re-examination	24.07.2017	Monday
11.	Commencement of Classes for UG I Yr	31.07.2017	Monday
12.	Last date of Academic Registration	31.07.2017	Monday
13.	Online subject registration of all new students including proficiency registration	01.08.2017- 04.08.2017	Tuesday - Friday
14.	Uploading of roll lists of registered students	01.08.2017	Tuesday
15.	Last date of addition/deletion of courses	04.08.2017	Friday
16.	Uploading of final course-wise roll lists of registered students including proficiency	07.08.2017	Monday
17.	Assignment of Major projects to all B.Tech. final year students	18.08.2017	Friday
	Holiday (Rakshabandhan)	**07.08.2017**	**Monday**
	Independence Day	**15.08.2017**	**Monday**
	Holiday (Id-ul-Zuha (Bakrid)*)	**02.09.2017**	**Saturday**
18.	Notification to Departments to send list of Institute Elective/ Open Elective/ Departmental Elective (both UG and PG) courses to be offered in Spring Semester 2017-18)	08.09.2017	Friday
19.	Notification to students regarding shortage of attendance by the Departments upto 07.09.2017	08.09.2017	Friday
20.	Mid Term Examination (MTE) for all students	18.09.2017- 21.09.2017	Monday- Thursday
21.	Last date to receive Institute Elective/ Open Elective / Departmental Elective (UG-PG) courses to be offered in Spring Semester 2017-18 from the departments	18.09.2017	Monday

S.No.	Details	Autumn Semester	
		Date	Day
22.	Notification to UG/IDD/IMT/IMS students about Institute Elective/ Open Elective/ Departmental Elective (UG-PG) courses to be offered in Spring semester 2017-18	22.09.2017	Friday
23.	Intimation to parents/guardians in respect of students having short attendance & upload on website	22.09.2017	Friday
24.	**Annual Convocation 2017**	23.09.2017	Saturday
25.	Last date for withdrawal of courses	29.09.2017	Friday
26.	Last date for requesting Second Examination	29.09.2017	Friday
27.	Submission of remaining document(s) by all new students	29.09.2017	Friday
28.	Online subject registration for Institute Elective/ Open Elective/ Departmental Elective (UG-PG) courses by students for next semester	29.09.2017-05.10.2017	Friday - Thursday
	Mid-Semester Break	**02.10.17-06.10.17**	**Monday-Friday**
	Holiday (Dusshera - Vijaya Dashmi)	**30.09.2017**	**Saturday**
29.	**Holiday (Muharram*)**	**01.10.2017**	**Sunday**
	Holiday (Mahatma Gandhi's Birthday)	**02.10.2017**	**Monday**
30.	Last date to display allotted list of Institute Electives/ Open Electives/ Departmental Electives to students for Spring Semester 2017-18	07.10.2017	Saturday
	Holiday (Deepawali)	**19.10.2017**	**Thursday**
	Holiday (Govardhan Puja)	**20.10.2017**	**Friday**
31.	Last date for Finalization and Display of Time Tables for Spring Semester 2017-18 by all Departments and sending to Academic Section	21.10.2017	Saturday
	THOMSO 2017	27.10.2017 29.10.2017	Friday-Sunday
32.	Notification of End Term Examination schedule including seating plan (Institute Core and Elective Courses)	27.10.2017	Friday
33.	Ph.D. Interview	31.10.17-01.11.2017	Tuesday-Wednesday
34.	Online filling of Response Forms and Subject Registration for next semester by all students	01.11.2017-06.11.2017	Wednesday - Monday
35.	Evaluation of Final Year M.Tech./M.Arch./M.U.R.P. / M.Tech.(ES) /IDD/IMT Dissertation	01.11.2017-20.11.2017	Wednesday-Monday
36.	Communication from Chairman, DAPC to Course Coordinators requesting to submit the final list of students having short attendance	02.11.2017	Thursday
	Holiday (Guru Nanak Birthday)	**04.11.2017**	**Saturday**
37.	Online Application for Change of Branch during 2017-18 session by 1st year B. Tech./IMT/IMS students	02.11.2017-09.11.2017	Thursday - Thursday
38.	Display of list of students having short attendance upto 08.11.2017 by the Departments/Centres and to send the Final list to Academic Section	09.11.2017	Thursday

S.No.	Details	Autumn Semester	
		Date	Day
39.	Notification to UG students regarding filling of Departmental Honour and Minor Specialization Courses	09.11.2017	Tuesday
40.	Last date of Teaching	10.11.2017	Friday
41.	Notification of detained students due to shortage of attendance in End Term Exam by the Academic Section	10.11.2017	Friday
42.	End Term Examination (excluding Sunday) Practical examinations, if any, *may be held during last few laboratory days).*	11.11.2017-22.11.2017	Saturday-Wednesday
43.	B.Tech. Project Evaluation Stage-1	23.11.2017 29.11.2017	Thursday-Wednesday
44.	On-line filling of choices for DHC and MSC	23.11.2017 29.11.2017	Thursday-Wednesday
45.	Last date of showing End Term Examination Answer Scripts to students	28.11.2017	Tuesday
46.	Finalization of grades by the Grade Moderation Committee	30.11.2017	Thursday
47.	Display of grades for all courses by the Departments	30.11.2017	Thursday
48.	Last date of sending grades to Academic Section	30.11.2017	Thursday
	Holiday (Id-e-Milad*)	**02.12.2017**	**Saturday**
49.	Winter vacation for students (except for M.Tech/ IDD final year and Ph.D. students)	01.12.2017-02.01.2018	Friday - Tuesday
50.	Last date to contact departments/centres for grade modification, if any, by students	04.12.2017	Monday
51.	Last date for sending modified grades to academic section	05.12.2017	Tuesday
52.	Winter vacation for Teaching Faculty (Faculty members can avail total 65 days of vacation during the winter & summer breaks)	06.12.2017-02.01.2018	Wednesday - Tuesday
53.	Last date for applying for Re-Examination	08.12.2017	Friday
54.	Last date of preparation of Grade sheets and declaration of result	15.12.2017	Friday
55.	Submission of progress report of the Ph.D. students to Academic Section by the Departments/Centres	15.12.2017	Friday
56.	Notification regarding allotment of DHC and MSC	20.12.2017	Wednesday
57.	Finalization of Change of Branch of 1st year B.Tech./ IMT/ IMS students for the session 2017-18	22.12.2017	Friday
	Holiday (Christmas Day)	**25.12.2017**	**Monday**
58.	Reporting and Registration of new Ph.D. students	28.12.2017	Thursday
59.	Institute Reopens for Spring Semester	03.01.2018	Wednesday
60.	Registration of all existing students in the Departments/ Centres	03.01.2018	Wednesday
61.	Re-examination and Second examination on medical ground (for Autumn Semester 2017-18)	04.01.2018-06.01.2018	Thursday-Saturday
62.	Commencement of Classes for all students for Spring Semester 2017-18	04.01.2018	Thursday

*Subject to visibility of Moon.

Teaching days for Autumn Semester 2017-18 (w.e.f. 17.7.2017 to 10.11.2017)

Day	Months						
	July	August	September	October	Nov.	Less for MTE/ THOMSO	Total days
Monday	17,24,31	14,21,28	4,11,**18**,25	9,16,23,30	6	**1**	14
Tuesday	18,25	1,8,22,29	5,12,**19**,26	10,17,24,31	7	**1**	14
Wednesday	19,26	2,9,16,23,30	6,13,**20**,27	11,18,25	1,8	**1**	15
Thursday	20,27	3,10,17,24,31	7,14,**21**,28	12,26	3,9	**1**	14
Friday	21,28	4,11,18,25	1,8,15,22,29	13,**27**	10	**1**	13
Total days	11	21	21	15	7	**5**	**75-5 =70**

Details of Saturday and Sunday used in MTE/THOMSO

MTE (September 18-21, 2017) - 18.09.2017 – Monday
19.09.2017 – Tuesday
20.09.2017 – Wednesday
21.09.2017 – Thursday

THOMSO (October 27-29, 2017) - 27.10.2017 – Friday
28.10.2017 – Saturday
29.10.2017 – Sunday

October 27, 2017 (Friday) – This will be a **Non-Teaching Working Day.**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ACADEMIC CALENDAR FOR THE YEAR 2017-18
(Spring Semester)

S.No.	Details	Autumn Semester	
		Date	Day
1.	Reporting and Registration of new Ph.D. students	28.12.2017	Thursday
2.	Institute Reopens for Spring Semester	03.01.2018	Wednesday
3.	Registration of all existing students in the Departments/ Centres	03.01.2018	Wednesday
4.	Re-examination and Second examination on medical ground (for Autumn Semester 2017-18)	04.01.2018-06.01.2018	Thursday-Saturday
5.	Commencement of Classes for all students for Spring Semester 2017-18	04.01.2018	Thursday
6.	Online subject registration of all new Ph.D. students	08.01.2018-09.01.2018	Monday-Tuesday
7.	Last date for sending the grades of Re-examination	12.01.2018	Friday
8.	Last date of Academic Registration	15.01.2018	Monday
9.	Uploading of roll lists of registered students	17.01.2018	Wednesday
10.	Last date of addition/deletion of courses	17.01.2018	Wednesday
11.	Finalization of Seminar and Dissertation topics of 1st year M.Tech./M.U.R.P./M. Arch. and IDD/IMT 4th year students	19.01.2018	Friday
12.	Uploading of final course-wise roll lists of registered students	22.01.2018	Monday
	Republic Day	**26.01.2018**	**Friday**
	Last date to accept requests for Summer Internship at IITR	31.01.2018	Wednesday
13.	Notification of MTE Schedule	05.02.2018	Monday
	Holiday (Maha Shivratri)	**13.2.2018**	**Tuesday**
	Last date to send the list of recommended candidates for Summer Internship at IITR	16.02.2018	Friday
14.	Notification to students regarding shortage of attendance by the Departments upto 16.02.2018	16.02.2018	Friday
15.	Mid Term Examination (MTE) for all students	19.02.2018-22.02.2018	Monday-Thursday
16.	Annual Hobbies Club Exhibition **SRISHTI- 2018**	24.02.2018-25.02.2018	Saturday – Sunday
17.	Notification to Departments to send list of Institute Elective/ Open Elective/ Departmental Elective (both UG and PG) courses to be offered in Autumn Semester 2018-19	26.02.2018	Monday
	Mid-Semester Break	**26.02.2018-02.03.2018**	**Monday-Friday**
18.	Submission of remaining document(s) by all new students	28.02.2018	Wednesday
19.	Intimation to parents/guardians in respect of students having short attendance & upload on website	28.02.2018	Wednesday
20.	**SCIENCE DAY**	**28.02.2018**	**Wednesday**

S.No.	Details	Autumn Semester	
		Date	Day
21.	Last date to finalize the list of candidates for Summer Internship at IITR	01.03.2018	Thursday
	Holiday (Holi)	**02.03.2018**	**Friday**
22.	Last date for withdrawal of courses	05.03.2018	Monday
23.	Last date for requesting Second Examination on medical ground	05.03.2018	Monday
24.	Last date to receive Institute Elective/ Open Elective / Departmental Elective (UG-PG) courses to be offered in Autumn Semester from the departments	07.03.2018	Wednesday
25.	Notification to UG/IDD/IMT/IMS students about Institute Elective/ Open Elective/ Departmental Elective (UG-PG) courses to be offered in Autumn Semester 2018-19	09.03.2018	Friday
26.	Online subject registration for Institute Elective/ Open Elective/ Departmental Elective (UG-PG) courses by students for next semester	13.03.2018-18.03.2018	Tuesday-Sunday
27.	Last date to display allotted list of Institute Electives/ Open Electives/ Departmental Electives to students for Autumn Semester 2017-18	21.03.2018	Wednesday
28.	**COGNIZANCE – 2018**	23.03.2018-25.03.2018	Friday - Sunday
	Holiday (Rama Navami)	**25.3.2018**	**Sunday**
	Holiday (Mahavir Jayanti)	**29.03.2018**	**Thursday**
	Holiday (Good Friday)	**30.3.2018**	**Friday**
29.	Annual Sports Meet **SANGRAM - 2017**	31.03.2018-01.04.2018	Saturday-Sunday
30.	Ph.D. Interview	03.04.2018-04.04.2018	Tuesday-Wednesday
31.	Notification of End Term Examination Schedule including Seating Plan (Institute Core and Elective Courses)	06.04.2018	Friday
32.	Notification to students regarding switching over from B.Tech. to IDD programme	09.04.2018	Monday
33.	Last date for Finalization of Time Tables by all Departments	09.04.2018	Monday
34.	Seminar presentation of M.Tech. 1st Year	09.04.2018-13.04.2018	Monday – Friday
35.	Online filling of Response Forms and Subject Registration for next semester by all students	16.04.2018-20 .04.2018	Monday - Saturday
36.	Communication from Chairman, DAPC to Course Coordinators to submit the final list of students having short attendance	12.04.2018	Thursday
37.	Viva-Voce Examination for Major Project (Only for B. Tech. 4th year students)	19.04.2018-20.04.2018	Thursday - Friday
38.	Display of list of students having short attendance upto 19.04.2018 by Departments/Centres and to send the Final list to Academic Section	20.04.2018	Friday

S.No.	Details	Autumn Semester	
		Date	Day
39.	Submission of proficiency grades by all concerned Officers-in-Charges to Academic Section	20.04.2018	Friday
40.	Notification of detained students for shortage of attendance in End Term Examination by the Academic Section	23.04.2018	Monday
41.	Last date of Teaching	24.04.2018	Tuesday
42.	End Term Examination (excluding Sunday **but including holidays**) Practical examinations, if any, *may be held during last few laboratory days*	25.04.2018-05.05.2018	Wednesday-Saturday
43.	Notification to UG students regarding filling of Departmental Honour and Minor Specialization Courses	24.04.2018	Tuesday
44.	**Holiday (Buddha Purnima)**	**30.04.2018**	**Monday**
45.	Submission of Final Year M.Tech./ M. Arch./ M.U.R.P./ M.Tech. (ES)/ IDD/IMT Dissertation	30.04.2018 -04.05.2018	Monday - Friday
46.	Notification to PG students to switch over from M.Tech. to Ph.D. programme	01.05.2018	Tuesday
47.	On-line filling of choices for DHC and MSC	02.05.2018-11.05.2018	Wednesday Friday
48.	Last date of showing of End Term Examination Answer Scripts to students	09.05.2018	Wednesday
49.	Finalization of grades by the Grade Moderation Committees	10.05.2018	Thursday
50.	Display of Grades for all courses	10.05.2018	Thursday
51.	Last date for sending Grades to Academic Section	10.05.2018	Thursday
52.	Summer Vacation for Students (except for M.Tech./ IDD Final Year and Ph.D. students)	11.05.2018-12.07.2018	Friday Thursday
53.	Evaluation of Final Year M.Tech./ M. Arch./ M.U.R.P./ M.Tech.(ES)/ IDD/IMT Dissertation and sending grades	11.05.2018-17.05.2018	Friday Thursday
54.	Last date to contact Departments/Centres by students for grade modification, if any	14.05.2018	Monday
55.	Last date for sending modified grades to Academic Section	15.05.2018	Tuesday
56.	Last date for applying for the re-examination of Spring Semester 2017-18	18.05.2018	Friday
57.	Summer Vacation for Teaching Faculty	18.05.2018-12.07.2018	Friday - Thursday
58.	Notification regarding allotment of IDD programme and DHC and MSC	25.05.2018	Friday
59.	Last date for preparation of Grade sheets and declaration of result	31.05.2018	Thursday
60.	Declaration of result of switchover from M.Tech. to Ph.D.	08.06.2018	Friday
	Id-ul-Fiter*	**15.06.2018**	**Friday**

S.No.	Details	Autumn Semester	
		Date	Day
61.	Submission of progress reports of the Ph.D. students to Academic Section by the Departments/Centres	18.06.2018	Monday
62.	Reporting and Registration of New Ph.D. students	06.07.2018	Friday
63.	Institute reopens and Registration of all New PG students	12.07.2018	Thursday
64.	Reporting and Registrations of all New UG/IMT/IMS students	12.07.2018	Thursday
65.	Registration of all existing students in the Departments/ Centres	13.07.2018	Friday
66.	Re-examination and Second examination on medical grounds (for Spring Semester 2017-18)	13.07.2018-16.07.2018	Fri., Sat. Monday
67.	Commencement of Classes for Autumn Semester (2018-19)	16.07.2018	Monday

*Subject to change on visibility of moon.

Teaching days for Spring Semester 2017-18 (w.e.f. 04.1.2018 to 20.4.2018)

Day	Months				Less for MTE/Cogn.	Total days
	January	February	March	April		
Monday	8,15,22,29	5,12,**19**	5,12,19,26	2,9,16,23	**1**	14
Tuesday	9,16,23,30	6,(10),**20**	6,13,20,27	3,10,17,24	**1**	14
Wednesday	10,17,24,31	7,14,**21**	7,14,21,28	4,(7),11,18	**1**	14
Thursday	4,11,18,25	1,8,15,**22**	1,8,15,22	5,12,19	**1**	14
Friday	5,12,19	2,9,16,23	9,(10),16,**23**	6,13, 20	**1**	13
Total days	19	17	20	18	**5**	**74-5 = 69**

Details of days used in MTE and COGNIZANCE

MTE (February 19- 22, 2018) - 19.02.2018 – Monday
20.02.2018 –Tuesday
21.02.2018 – Wednesday
22.02.2018 – Thursday

COGNIZANCE (March 23-25, 2018) - 23.03.2018 – Friday
24.03.2018 – Saturday
25.03.2018 – Sunday

COGNIZANCE (March 23, Friday) - This will be a **Non-Teaching working day**

Tuesday time-table will be applicable on February 10, 2018 (Saturday).
Friday time-table will be applicable on March 20, 2018 (Saturday).
Wednesday time-table will be applicable on April 10, 2018 (Saturday).

45 Approved PDC List:

S.No.	Name	Deptt.	Topic	Supervisor	Examiner (For./Ind.)	PDC Date
1	Mr. V. S.K.V. Harish	AHEC	MODELLING AND SIMULATION OF BUILDING ENERGY SYSTEMS USING INTELLIGENT TECHNIQUES	Dr. Arun Kumar	Prof. William P. Bahnfleth / PSU USA Prof. S. Bandyopadhyay / IIT Bombay Prof. Prabodh Bajpai / IIT Kanpur	21.02.17
2	Mr. Irshad Ahmad Ansari	ASE	DEVELOPMENT AND OPTIMIZATION OF IMAGE WATERMARKING TECHNIQUES	Dr. Millie Pant	Prof. Patrick Siarry /Univ. dec Paris, France Dr. P. C. Jha / Uni. of Delhi, Delhi Prof. D. Ghose / IISc Bangalore	03.01.17
3	Ms. Prerna Chaturvedi	ASE	NANOSTRUCTURED Li_2MnSiO_4: A NOVEL ELECTRODE MATERIAL FOR SUPERCAPACITOR	Dr. Y. K. Sharma Dr. Anjan Sil	Prof. V. Thangadurai / UC, Canada Prof. Amreesh Chandra / IIT Kharagpur Prof. A. Manuel Stephan / CSIR Karaikudi	31.01.17
4	Mr. Mohd Nadeem	ASE	THE EXISTENCE RESULTS FOR SOME FRACTIONAL STOCHASTIC DIFFERENTIAL EQUATIONS	Dr. J. Dedas	Prof. G. Wang / SNU, China Prof. D. Bahuguna / IIT Kanpur Prof. Rajni Kant Pandey / IIT Kharagpur	19.01.17
5	Ms. Tina Pujara	AR	OUTDOOR SHARED SPACES: EXPLORING THE ASSOCIATION OF NEIGHBORHOOD DESIGN WITH HAPPINESS	Dr. V. Devadas	Prof. Sidney N. Brower / UM, USA Prof. Santosh Auluck / SPA, New Delhi Prof. M.N.A. Ganju / New Delhi	12.01.17
6	Mr. Thaligari Sandeep Kumar	CH	ADSORPTIVE DESULFURIZATION AND DENITROGENATION BY METAL IMPREGNATED ACTIVATED CARBON	Dr. V. C. Srivastava Dr. B. Prasad	Prof. T. J. Bandosz / CCNY, USA Dr. Jitendra Sangwai / IIT Madras	11.11.16
7	Ms. Mousumi Saha Podder	CH	STUDIES ON REMOVAL OF ARSENIC FROM WASTEWATER	Dr. C. B. Majumder	Prof. J. Bundschuh / USQ Australia Dr. Suparna Mukherji / IIT Bombay Prof. Debabrata Das / IIT Kharagpur	27.10.16
8	Mr. Abrham Bayeh Wassie	CH	THERMO-CHEMICAL MODIFICATIONS OF TEFF STRAW FOR CHROMIUM REMOVAL FROM AQUEOUS SOLUTION	Dr. V. C. Srivastava	Prof. R. Farnood / UT, Canada Prof. K. Mohanty / IIT Guwahati Prof. S. V. Mohan / CSIR Hyderabad	22.01.17
9	Mr. Sumit Kumar	CY	DESIGN, SYNTHESIS AND BIOLOGICAL EVALUATION OF NOVEL FLAVONOID DERIVATIVES	Dr. Naseem Ahmed	Prof. Johan E. Van Lier / US, Canada Dr. Manas K. Ghorai / IIT Kanpur Dr. M. A. Quraishi / IIT (BHU)	19.12.16
10	Ms. Mridula	CY	SPECIATION, CYTOTOXIC AND DNA BINDING STUDIES OF ORGANOTIN(IV) CARBOXYLATES	Dr. Mala Nath	Prof. Irena Kostova / MU, Bulgaria Dr. Jai Deo Singh / IIT Delhi Prof. G. N. Mukherjee / UCS, Kolkata	16.12.16
11	Mr. Arun Sharma	CY	ORGANOCATALYTIC AND CHIRAL METAL COMPLEXES MEDIATED ORGANIC REACTIONS	Dr. R. K. Peddinti	Prof. Vy M Dong / UC, USA Prof. N. G. Ramesh / IIT Delhi Prof. V. R. Pedireddi / IIT Bhubaneswar	06.01.17
12	Mr. Rupam Borah	CY	FEW PROBLEMS IN POLYMER DYNAMICS	Dr. Pallavi Debnath	Prof. T. A. Vilgis / MPIPR, Germany Prof. S.M. Bhattacharjee / IP,Bhubaneswar	10.01.17
13	Mr. Varun	CY	THEORETICAL INVESTIGATIONS ON NON-LINEAR OPTICAL PROPERTIES OF SELECTED ORGANIC MOLECULES	Dr. P. P. Thankachan	Prof. Kinneth Ruud / AUN Norway Prof. S. R. Gadre / SPPU Pune Prof. Sourav Pal / IIT Bombay	08.02.17

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Appendix 'M'
Item No. Senate/68.26

14	Ms. Rosy	CY	VOLTAMMETRIC SENSORS FOR DETERMINATION OF NEUROTRANSMITTERS AND DRUGS IN BIOLOGICAL FLUIDS	Dr. R. N. Goyal	Prof. Mauro Panunzio / AMS Italy Prof. M. M. Singh / BHU Varanasi Prof. S. K. Agarwal / HBNI Mumbai	13.02.17
15	Ms. Bithika Sarkar	CY	COMPLEXES OF VANADIUM, THEIR REACTIVITY AND CATALYTIC APPLICATION	Dr. M. R. Maurya	Prof. D. Gambino / UR Uruguay Prof. Chebrolu Pulla Rao / IIT Bombay	21.02.17
16	Mr. Arun Chauhan	CSE	PREDICTION FOR RECOMMENDATION OF PLACES OF VISIT USING MICROBLOGS	Dr. Durga Toshniwal	Prof. Andrew Ware / USW,United Kingdom Dr. S. K. Gupta / IIT Delhi Prof. A. K. Tripathi / IIT (BHU) Varanasi	23.12.16
17	Mr. Chandresh Kumar Maurya	CSE	ANOMALY DETECTION IN BIG DATA	Dr. Durga Toshniwal	Dr. N.C. Debnath / WSU, USA Dr. S. K. Gupta / IIT Delhi Prof. Sonajharia Minz / JNU, New Delhi	23.12.16
18	Mr. Amit Narwal	EE	ORDER REDUCTION FOR LINEAR SYSTEMS AND CONTROL SYSTEM DESIGN	Dr. Rajendra Prasad	Prof. A. Ferrante / UP, Italy Prof. B. Bandyopadhyay / IIT Bombay Prof. Somnath Pan / IIT Dhanbad	07.02.17
19	Mr. Jagannath Malik	E&CE	COMPACT UWB AND MIMO ANTENNAS FOR HIGH-SPEED COMMUNICATIONS	Dr. M. V. Kartikeyan	Prof. F. Falcone / ELT, Spain Dr. Animesh Biswas / IIT Kanpur Prof. J. Mukherjee / IIT Bombay	25.10.16
20	Mr. Shivam Verma	E&CE	DESIGN OF SPIN TRANSFER TORQUE BASED MEMORY AND LOGIC	Dr. B. K. Kaushik	Prof. Eby G. Friedman / UR, USA Prof. Ashwin Kumar / IIT Bombay Prof. Hafizur Rahaman / IIEST Sahibpur	04.01.17
21	Mr. Arup Sen	EQ	SEISMOTECTONICS OF MAIN FRONTAL THRUST AND INDO-GANGETIC PLAINS AROUND ROORKEE	Prof. Ashwani Kumar Dr. S. C. Gupta	Prof. Conrad Lindholm / Norsar, Norway Dr. G. Suresh / NCS Delhi Dr. S. Baruah / CSIR Assam	04.01.17
22	Mr. Riyaz Ahmad Mir	ES	GEOINFORMATICS FOR CRYOSPHERIC STUDIES UNDER CHANGING CLIMATE IN WESTERN HIMALAYA	Dr. Arun K. Saraf Dr. Sanjay K. Jain	Prof. A.J. Adeloye / HWU United Kingdom Dr. Praveen K. Thakur / ISRO, Dehradun Prof. A. P. Krishna / BIT, Ranchi	13.10.16
23	Ms. Kanika Sharma	ES	REMOTE SENSING STUDIES OF EARTHQUAKE INDUCED GROUND DEFORMATIONS AND LANDSLIDES	Dr. S. K. Saraf Dr. Josodhir Das	Prof. A. Tronin / IRAS Russia Prof. A. P. Krishna / BIT Ranchi Prof. T. N. Singh / IIT Bombay	09.02.17
24	Mr. Varun Mahajan	HSS	TRADE PERFORMANCE, EFFICIENCY AND PRODUCTIVITY OF INDIAN DRUG AND PHARMACEUTICAL INDUSTRY	Dr. D. K. Nauriyal Dr. S. P. Singh	Prof. Subhash Ray / UC USA Prof. V. Upadhyay / IIT Delhi Prof. Pushpa L. Trivedi / IIT Bombay	27.01.17
25	Ms. Shreya Garg	DOMS	IMPACT OF LMX ON EMPLOYEES' SERVICE INNOVATIVE BEHAVIOR AND TURNOVER INTENTIONS	Dr. R. L. Dhar	Prof. Israr Qureshi / IEBS Spain Dr. Kavita Singh / Univ. of Delhi, Delhi Prof. S. Bhaskaran / LU Haryana	20.12.16
26	Mr. Imran Khan	DOMS	A MODEL FOR MEASURING THE INFLUENCE OF BRAND EXPERIENCE ON CONSUMER BEHAVIOR	Dr. Z. Rahman	Prof. C. T. Sun / HKPU Hong Kong Dr. D. Das Gupta / IIM, Lucknow Prof. M. Akbar / IIML Noida	23.12.16
27	Mr. Chandra Prakash	DOMS	A STUDY AND OPTIMIZATION OF REVERSE LOGISTICS ISSUES IN AN ELECTRONICS INDUSTRY	Dr. M. K. Barua	Dr. A. Sukumar / CU London Dr. P. N. Ramkumar / IIMK Kozhikode Prof. H. Karnatak / IIRS Dehradun	27.01.17

28	Mr. Yatish Joshi	DoMS	MODELLING THE PREDICTORS OF CONSUMERS' GREEN PURCHASE INTENTION	Dr. Z. Rahman	Prof. K.V. Pandya / SBS UK Prof. Sanjeev Prashar / IIM Raipur Prof. R. K. Amit / IIT Madras	13.02.17
29	Ms. Deepakshi Jaiswal	DoMS	EFFECT OF HUMAN RESOURCE MANAGEMENT PRACTICES ON EMPLOYEE CREATIVITY	Dr. R. L. Dhar	Prof. Vipin Gupta / CSUSB USA Prof. D. N. Pathak / SAU New Delhi	13.02.17
30	Ms. Anu Bala	MA	OBJECT RECONSTRUCTION AND REGISTRATION WITH IMAGE GRADIENTS USING NUMERICAL SIMULATION	Dr. Rama Bhargava Dr. Sanjeev Kumar	Prof. Haytham Elghazel / UFRI France Prof. Prem K. Kalra / IIT Delhi Prof. Krishna M. Buddhraju / IIT Bombay	09.11.16
31	Mr. Ramu Dubey	MA	OPTIMALITY CONDITIONS AND DUALITY RELATIONS FOR SOME NONLINEAR PROGRAMMING PROBLEMS"	Dr. S. K. Gupta	Prof. M. A-Jimenez / UdC Spain Prof. B. K. Mohanty / IIM Lucknow	28.12.16
32	Mr. Pushpendra Kumar	MA	SOME EFFICIENT ALGORITHMS FOR OPTICAL FLOW ESTIMATION	Dr. Sanjeev Kumar Dr. R. Balasubramanian	Prof. Vijayan K. Ansari / UDKL USA Dr. P. Khanna / CLC Jabalpur Dr. D. Mishra / IIST Trivandrum	31.01.17
33	Mr. Mudimallana Goud	MIE	PERFORMANCE ANALYSIS OF ECDM PROCESS WHILE MACHINING GLASS AND ALUMINA	Dr. A. K. Sharma	Dr. M. Sundaram / UC USA Dr. A. Velayudham / DRDO Chennai	14.12.16
34	Mr. Vijay Kumar Dalla	MIE	STRATEGIES FOR CONTROL OF MULTIPLE AND HYPER REDUNDANT SPACE ROBOTS	Dr. P. M. Pathak	Prof. Shai Arogeti / BGUN Israel Dr. Somnath Sarangi / IIT Patna Prof. Vikas Rastogi / DTU, Delhi	08.11.16
35	Mr. Manish Kumar Chauhan	MIE	CONTROL OF FLOW FIELD OVER A SQUARE CYLINDER USING ACTIVE AND PASSIVE METHODS	Dr. Sushanta Dutta Dr. B. K. Gandhi	Prof. Gary W. Rankin / UW Canada Dr. K. Muralidhar / IIT Kanpur Prof. Atul Sharma / IIT Bombay	03.10.16
36	Mr. Yogesh Kumar Singla	MIE	DEVELOPMENT OF RE MODIFIED FLUXES TO ENHANCE WEAR RESISTANCE	Dr. Navneet Arora Dr. D. K. Dwivedi	Prof. S.H.Rodriguez / UAZ Mexico Dr. Amitava De / IIT Bombay Dr. A. K. Nath / IIT Kharagpur	20.10.16
37	Mr. Sanjeev Kumar	MME	EFFECT OF WELD THERMAL CYCLE ON MICROSTRUCTURE AND MECHANICAL PROPERTIES IN HAZ OF A HY 85 STEEL	Dr. S. K. Nath	Prof. O. G. Comineli / FUES Brazil Dr. D. Samantaray / IGCAR Kalpakkam Prof. D. Chakrabarti / IIT Kharagpur	17.01.17
38	Mr. Presh K. Mandal	MME	STRUCTURE-PROPERTY CORRELATION IN FSPed SCANDIUM INOCULATED CAST Al-Zn-Mg ALLOY	Dr. P. K. Ghosh Dr. Vivek Pancholi	Prof. Zong-yi Ma , IMR China Prof. K. Narayan Prabhu / NIT Karanataka	17.01.17
39	Mr. S. Uday Kumar	NT	DEVELOPMENT OF BIOFUNCTIONAL POLYMERIC NANOFIBERS AND THEIR THERAPEUTIC IMPLICATIONS	Dr. P. Gopinath	Prof. David H. Gracias / JHU USA Dr. Aditya Mittal / IIT Delhi Prof. Pranab Goswami / IIT Guwahati	13.12.16
40	Ms. Raghuveer Kaur	PPE	A STUDY ON EARNINGS MANAGEMENT AND CORPORATE GOVERNANCE IN INDIA	Dr. A. Khanna	Prof. S. K. Mallick / QMUL UK Dr. P. K. Jain / IIT Delhi	23.11.16
41	Mr. Dereje Adeba Gerbi	WRDM	PLANNING OF INTERBASIN TRANSFER FOR SUSTAINABLE WATER MANAGEMENT IN ETHIOPIA	Dr. M. L. Kansal Dr. Sumit Sen	Prof. A. Allen Bradley Jr. / UL USA Dr. V. R. Desai / IIT Kharagpur Dr. Rakesh Khosa / IIT Delhi	13.12.16

42	Mr. Arun Dominic D	WRDM	PERFORMANCE INVESTIGATION OF INDUCTION MOTOR DRIVES UNDER SENSOR FAULTS	Dr. T. R. Chelliah	Prof. H. A. Toliyat / TA&MU USA Dr. K. N. Dinesh Babu / PSEM Chennai	22.11.16
43	Mr. Patil Pravin Rangrao	WRDM	SIMPLIFIED DERIVATION OF UH AND SUH FOR RUNOFF ESTIMATION	Dr. S. K. Mishra Dr. Nayan Sharma	Prof. Ronny Berndtsson / LU Sweden Dr. A. K. Rastogi / IIT Mombay Prof. N. S. Raghuwanshi / IIT Kharagpur	18.10.16
44	Mr. Prabhash K. Mishra	WRDM	OPTIMAL WATER RESOURCES MANAGEMENT IN A CANAL COMMAND CONSIDERING CLIMATE CHANGE	Dr. Deepak Khare	Prof. Nor A. Bin Zakaria / USM Malaysia Prof. Ramakar Jha / NIT Patna	25.01.17
45	Mr. Pramod K. Meena	WRDM	ASSESSMENT OF HYDRO-CLIMATOLOGICAL PARAMETERS IN KSHIPRA RIVER BASIN, INDIA	Dr. Deepak Khare	Prof. E.A. McBean / UG Canada Prof. A. K. Nema / IIT Delhi Prof. R. Nagarajan / IIT Bombay	09.02.17

			Existing	Approved
Unfair means and Plagiarism	27	(1)	In case a student is found adopting or suspected of adopting unfair means before, during or after the examination, or lifting or copying of work(s) of someone else and inserting it in his Class Work Submissions, project. Dissertation, or Report, etc. without proper acknowledgement, credit and reference, or plagiarizing the Dissertation/Project/Class Work Submissions/ Reports, etc. such penal action shall be taken by the Institute against the student as may be necessary and adequate to uphold the sanctity and integrity of the examination system and the credibility of the Institute. The guidelines as shown in Appendix-C shall be applicable for checking plagiarism.	In case a student is found adopting or suspected of adopting unfair means before, during or after the examination, or lifting or copying of work(s) of someone else and inserting it in his Class Work Submissions, project. Dissertation, or Report, etc. without proper acknowledgement, credit and reference, or plagiarizing the Dissertation/Project/Class Work Submissions/ Reports, etc. such penal action shall be taken by the Institute against the student as may be necessary and adequate to uphold the sanctity and integrity of the examination system and the credibility of the Institute. The guidelines as shown in Appendix-C shall be applicable for checking plagiarism.
		(2)	All such cases of unfair means and plagiarism shall be suo-moto taken cognizance of by the Institute Standing Committee appointed by the Senate for this purpose. Such cases may also be reported by any person, including invigilator(s) examiner(s) to the Dean, Academics and/or the Institute Standing Committee for its consideration.	All such cases of unfair means and plagiarism shall be suo-moto taken cognizance of by the Institute Standing Committee appointed by the Senate for this purpose. Such cases may also be reported by any person, including invigilator(s) examiner(s) to the Dean, Academics and/or the Institute Standing Committee for its consideration. General instructions

			General instructions for penal action for use of unfair means and plagiarism are given in Appendix-G. The constitution of the Standing Committee to look into the cases of unfair means and plagiarism is given below: a) Dean, Academics - Chairman b) Dean of Students' Welfare - Member c) Head of the concerned Dept. - Member d) Three Senate Nominees - Members	for penal action for use of unfair means and plagiarism are given in Appendix-G. The constitution of the Standing Committee to look into the cases of unfair means and plagiarism is given below: a) Dean, Academics - Chairman b) Dean of Students' Welfare - Member c) Head of the concerned Dept. - Member d) Three Senate Nominees - Members
		(3)	For Project, Class Work Submissions, ~~**mid-term examination etc.**~~, the Course Coordination Committee may report the matter to the concerned DAPC (or CAPC) as the case may be. The DAPC (or CAPC) may, after considering the matter reported to it and after giving an opportunity to the concerned student(s) to explain his/her conduct, impose appropriate penalty, ~~**including the award of Grade in the concerned course(s)**~~ on the concerned student(s).	For Project, Class Work Submissions, the Course Coordination Committee may report the matter to the concerned DAPC (or CAPC) as the case may be. The DAPC (or CAPC) may, after considering the matter reported to it and after giving an opportunity to the concerned student(s) to explain his/her conduct, impose appropriate penalty, on the concerned student(s).
		04	Any case pertaining to purported to resorting to unfair means/ plagiarism before and after the examination/ ~~**class work submission/ quizzes/ submission of seminar reports/**~~ Dissertation/ ~~**Practicals/ Laboratory classes/**~~	Any case pertaining to purported to resorting to unfair means/plagiarism before and after the examination/ Dissertation etc. shall be dealt by the Institute Standing Committee for dealing with the offence/ case.

			~~**Projects**~~ etc. shall be dealt with by ~~**the appropriate committees/ persons of the concerned Department. In cases of serious nature/ grave offence in the opinion of the appropriate departmental committee, viz course coordination committees, DAPC or CAPC, the matter shall be referred to**~~ the Institute Standing Committee for dealing with the offence/ case. The penalty in such cases of unfair means / plagiarism which have been found to be true and I. which have occurred before or after the examination or partly before and during or during and after the examination; II. which have been detected after the examination/declaration of the result award of the degree; III. which has been reported or detected after a research paper report/ note/ communication has been published in a Research Journal widely circulated magazine/ proceedings of conferences/ seminar or a monograph or a book, and or any electronic device shall be recommended by the appropriate committees of the department/	The penalty in such cases of unfair means / plagiarism which have been found to be true and I. which have occurred before or after the examination or partly before and during or during and after the examination; II. which have been detected after the examination/declaration of the result award of the degree; III. which has been reported or detected after a research paper report/ note/ communication has been published in a Research Journal widely circulated magazine/ proceedings of conferences/ seminar or a monograph or a book, and or any electronic device shall be recommended by the appropriate committees of the department/

			Institute Standing Committee, as the case may be. The imposition of any such penalty shall be at the discretion of the Director, who, after considering the full facts and the report on the matter (i) may impose the same penalty, (ii) may reduce the penalty, or (iii) may enhance the penalty as recommended by the committee.	Institute Standing Committee, as the case may be. The imposition of any such penalty shall be at the discretion of the Director, who, after considering the full facts and the report on the matter (i) may impose the same penalty, (ii) may reduce the penalty, or (iii) may enhance the penalty as recommended by the committee.

REVISION OF B.TECH /B.ARCH/IDD/INT M.TECH/INT.MSc SEATS FOR THE YEAR 2017

Year	2014			2015			2016			2017
Department	Intake	Admitted	Vacant Seats	Intake	Admitted	Vacant Seats	Intake	Admitted	Vacant Seats	Intake
BIOTECH	45	39	6	45	39	6	35	35	0	**35**
CHEMICAL	110	105	5	110	107	3	110	107	3	**90**
CIVIL	135	136	-1	135	132	3	120	119	1	**135**
CSE	75	75	0	75	74	1	75	74	1	**75**
ELECTRICAL	140	138	2	140	138	2	120	120	0	**120**
E&CE	75	75	0	75	75	0	80	79	1	**80**
ENG. PHYSICS	0	0	0	30	30	0	30	29	1	**30**
MECHANICAL	80	80	0	80	79	1	100	100	0	**100**
MMED	110	105	5	110	104	6	100	98	2	**80**
PS	40	24	16	40	30	10	35	33	2	**30**
P & I	60	58	2	60	58	2	40	40	0	**40**
ARCH.	40	34	6	40	35	5	35	27	8	**30**
IMT-GT	30	24	6	30	28	2	30	27	3	**30**
IMT-GPT	30	24	6	30	28	2	30	30	0	**30**
IDD-PMBA	35	19	16	0	0	0	0	0	0	**0**
IMS-APM	30	28	2	30	27	3	30	29	1	**30**
IMS-PHY	30	15	15	0	0	0	0	0	0	**20**
IMS-CHY	-	-	-	-	-	-	-	-	-	**20**
TOTAL	1065	979	86	1030	984	46	970	947	23	**975**

REVISION OF SEATS WITH MHRD ASSISTANT SHIP

Deptt/ centre	Vacancy						
	Vacancy under MHRD	Extra Seats under PMRF *	Total vacancy	Gen	OBC	SC	ST
AHEC	4	2	6	3	2	1	0
Arch & Plng	15	3	18	9	5	3	1
Biotechnology	27	2	29	15	8	4	2
C-Trans	0	1	1	1	0	0	0
Dis. Mit. &Magnt	2	1	3	1	1	1	0
Nanotechnology	0	1	1	1	0	0	0
Chemical Engg	15	5	20	10	5	3	2
Chemistry **	6	0	6	3	1	1	1
Civil Engg	15	5	20	10	5	3	2
Computer Sc. & Engg	21	3	24	12	6	4	2
Earth Sciences **	24	0	24	12	6	4	2
Earthquake Engg	4	3	7	4	2	1	0
Electrical Engg	27	5	32	16	9	5	2
E&CE	24	3	27	14	7	4	2
Hum &Soc. Sciences	18	0	18	9	5	3	1
Hydrology	6	2	8	4	2	1	1
Inst. Instr. Centre	0	0	0	0	0	0	0
Management Studies **	17	0	17	7	5	3	2
Mathematics **	18	0	18	9	5	3	1
Mech&Indl Engg	33	5	38	19	10	6	3
Met & Mat Engg	18	5	23	12	6	3	2
Physics **	45	0	45	23	12	7	3
WRD & M	0	2	2	1	1	0	0
Total	**339**	**48***	**387**	**195**	**103**	**60**	**29**
Applied Sc. & Engg	10	0	10	4	3	2	1
Paper Technology	14	0	14	7	4	2	1
Polymer & Process Engg	24	0	24	12	6	4	2

* 48 seats are available under PM Research Fellow Scheme. The candidates having bachelors degree from IITs with CGPA $\geq$ 8.5 are eligible for this fellowship. They would be paid fellowship of Rs. 60000/- per month for a maximum of 60 months provided they satisfy the other conditions. **Other terms and conditions will be as per the policy/regulations of the institute/guidelines issued/to be issued by MHRD, GOI from time to time.**

** **In case, if any candidate having bachelors degree from IIT with CGPA $\geq$ 8.50 joins these departments, he/she will be shifted to PMRF scheme.**

Appendix 'Q'
Item No. Senate/68.35

Proposed Intake for Admission to PG programmes 2017-18

Sl. No.	Department	Code	Name	2015-16 Total	2015-16 MHRD Intake	2016-17 MHRD Intake	2016-17 SF Intake	2017-18 Proposed MHRD Intake	Extra Seats * M. Tech. (T.A)	Total
1	Architecture & Planning (AR)	10	M.Arch.	36	18	9	9	18	3	12
		11	M.U.R.P.		18	9	9		2	11
2	Alternate Hydro Energy Centre (AH)	12	M.Tech. Alternate Hydro Energy Systems	40	25	12	13	20	3	15
		13	M.Tech. Environmental Management of Rivers and		15	8	7		2	10
3	Chemical Engineering (CH)	14	M.Tech. Computer Aided Process Plant Design	56	28	14	14	28	2	16
		15	M.Tech. Industrial Pollution Abatement		28	14	14		2	16
4	Civil Engineering (CE)	16	M.Tech. Environmental Engg.	144	18	9	9	72	2	11
		17	M.Tech. Geomatics Engg.		24	12	12		2	14
		18	M.Tech. Geotechnical Engg.		24	12	12		3	15
		19	M.Tech. Hydraulic Engg.		18	9	9		2	11
		20	M.Tech. Structural Engg.		36	18	18		3	21
		21	M.Tech. Transportation Engg.		24	12	12		2	14
5	Earthquake Engineering (EQ)	22	M.Tech. Soil Dynamics	64	18	9	9	32	2	11
		23	M.Tech. Structural Dynamics		31	15	16		3	18
		24	M.Tech. Seismic Vulnerability and Risk Assessment		15	8	7		2	10
6	Electrical Engineering (EE)	25	M.Tech. Electric Drives & Power Electronics	92	23	12	11	46	3	15
		26	M.Tech. Instrumentation and Signal Processing		23	11	12		2	13
		27	M.Tech. Power System Engg.		23	12	11		3	15
		28	M.Tech. Systems and Control		23	12	11		2	14
7	Electronics & Communication Engineering (EC)	29	M.Tech. Communication Systems	48	18	9	9	24	3	12
		30	M.Tech. R.F. & Microwave Engg.		15	7	8		2	9
		31	M.Tech. Microelectronics and VLSI		15	8	7		2	10
8	Computer Science & Engineeirng (CS)	32	M.Tech. Computer Science & Engg.	54	54	27	27	27	3	30
9	Hydrology (HY)	33	M.Tech Hydrology	15	15	8	7	8	3	11
10	Mechanical & Industrial Engineering (MI)	34	M.Tech. CAD, CAM & Robotics	87	15	8	7	44	2	10
		35	M.Tech. Machine Design Engg.		18	9	9		3	12
		36	M.Tech. Production & Industrial Systems Engg.		18	9	9		3	12
		37	M.Tech. Thermal Systems Engg.		18	9	9		2	11
		38	M.Tech. Welding Engg.		18	9	9		2	11
11	Metallurgical & Materials Engineering (MT)	39	M.Tech. Industrial Metallurgy	36	18	9	9	18	2	11
		40	M.Tech. Materials Engg.		18	9	9		2	11
12	Paper Technology Saharanpur Campus (PP)	41	M.Tech. Pulp & Paper	38	18	9	9	19	3	12
		42	M.Tech. Packaging Technology		20	10	10		2	12
13	Water Resources Development & Management (WR)	43	M.Tech. Irrigation Water Management	15	3	2	1	8	3	5
		44	M.Tech. Water Resources Development		12	6	6		2	8
14	Chemistry (CY)	45	M.Tech. Advanced Methods of Chemical Analysis	15	15	8	7	8	2	10
15	Physics (PH)	46	M.Tech. Solid State Electronic Materials	18	18	9	9	9	2	11
16	Centre of Excellence-Nanotechnology (NT)	47	M.Tech. Nanotechnology	15	15	8	7	8	2	10
17	Centre of Excellence-Disaster Mitigation & Management	48	M.Tech. Disaster Mitigation and Management	15	15	8	7	8	2	10
18	Transportation Systems (TSC)	49	M.Tech. Infrastructure Systems	15	15	8	7	8	2	10
19	Biotechnology (BTD)	50	M.Tech. Bioprocess Engineering	-	-	8	7	8	2	10
Total				803	803	414	404	413	98	510

*Since the selection process for these additional seats has not been notified till date, it is proposed that admission to these additional seats be done as per present rule applicable to MHRD fellows. The candidates satisfying the criteria after its notification will be shifted to this category. Rest of the candidates will continue under MHRD.