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कुलसचिव
Prashant Garg,
Registrar

भारतीय प्रौद्योगिकी संस्थान रुड़की

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Dated: 19 October 2015

ALL MEMBERS OF THE SENATE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Subject: Minutes of the 62nd Meeting of the Senate held on 29.09.2015

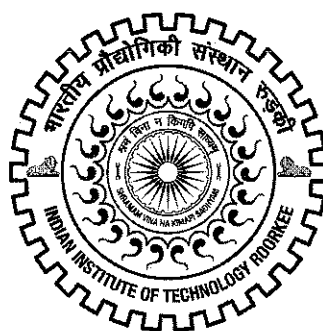
Please find attached a soft copy of the Minutes of the 62nd Meeting of the Senate held on 29.09.2015 in the Senate Hall of the Institute, for your perusal. Your comments, if any, on the minutes may please be sent within 15 days.

Encl: As above

प्रशान्त गर्ग
Prashant Garg
कुलसचिव एवं सचिव, सीनेट
Registrar & Secretary, Senate

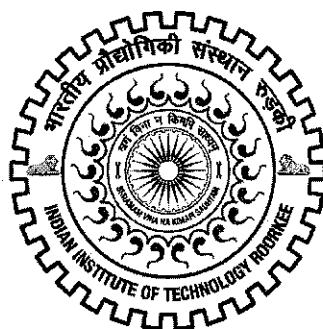
सीनेट की 62वी बैठक का कार्यवृत्त
MINUTES OF THE 62ND MEETING OF THE SENATE

29 सितम्बर 2015
29TH SEPTEMBER 2015



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

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



सूची / I N D E X

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MEETING SECTION
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE



Minutes of the 62nd Meeting of the Senate held on 29.09.2015 in the Senate Hall of the Institute.

Following were present:

- | | | |
|-----|-------------------------|---------------------------|
| 1. | Prof. Pradipta Banerji | Director & Chairman |
| 2. | Prof. Vinod Kumar | Dy. Director |
| 3. | Prof. V. Devdas | (Architecture & Planning) |
| 4. | Prof. (Mrs.) Ila Gupta | (Architecture & Planning) |
| 5. | Prof. R.P. Singh | (Biotechnology) |
| 6. | Prof. Partha Roy | (Biotechnology) |
| 7. | Prof. R.N. Goyal | (Chemistry) |
| 8. | Prof. Ravi Bhushan | (Chemistry) |
| 9. | Prof. Anil Kumar | (Chemistry) |
| 10. | Prof. (Mrs.) Mala Nath | (Chemistry) |
| 11. | Prof. A.K. Singh | (Chemistry) |
| 12. | Prof. U.P. Singh | (Chemistry) |
| 13. | Prof. M.R. Maurya | (Chemistry) |
| 14. | Prof. K.C. Gupta | (Chemistry) |
| 15. | Prof. S.S. Jain | (Civil Engineering) |
| 16. | Prof. Deepak Kashyap | (Civil Engineering) |
| 17. | Prof. C.S.P. Ojha | (Civil Engineering) |
| 18. | Prof. S.K. Ghosh | (Civil Engineering) |
| 19. | Prof. Mahendra Singh | (Civil Engineering) |
| 20. | Prof. M. Parida | (Civil Engineering) |
| 21. | Prof. N.K. Samadhiya | (Civil Engineering) |
| 22. | Prof. K.S. Hari Prasad | (Civil Engineering) |
| 23. | Prof. Akhil Upadhyay | (Civil Engineering) |
| 24. | Prof. Bhola Ram Gurjar | (Civil Engineering) |
| 25. | Prof. M.L. Sharma | (Earthquake Engineering) |
| 26. | Prof. B.K. Maheshwari | (Earthquake Engineering) |
| 27. | Prof. Manish Shrikhande | (Earthquake Engineering) |
| 28. | Prof. D.C. Srivastava | (Earth Sciences) |
| 29. | Prof. G. J. Chakrapani | (Earth Sciences) |
| 30. | Prof. A.K. Sen | (Earth Sciences) |
| 31. | Prof. Pramod Agarwal | (Electrical Engineering) |
| 32. | Prof. S.P. Srivastava | (Electrical Engineering) |
| 33. | Prof. Rajendra Prasad | (Electrical Engineering) |

- | | | |
|-----|---|---|
| 34. | Prof. R.S. Anand | (Electrical Engineering) |
| 35. | Prof. M.J. Nigam | (Electronics & Communication Engg.) |
| 36. | Prof. M.V. Kartikeyan | (Electronics & Communication Engg.) |
| 37. | Prof. Dharmendra Singh | (Electronics & Communication Engg.) |
| 38. | Prof. N.K. Goel | (Hydrology) |
| 39. | Prof. Himanshu Joshi | (Hydrology) |
| 40. | Prof. Nagendra Kumar | (Humanities & Social Sciences) |
| 41. | Prof. Y.S. Negi | (Paper Technology) |
| 42. | Prof. S.C. Sharma | (Paper Technology) |
| 43. | Prof. (Mrs.) Rama Bhargava | (Mathematics) |
| 44. | Prof. R.C. Mittal | (Mathematics) |
| 45. | Prof. V.K. Katiyar | (Mathematics) |
| 46. | Prof. Sunita Gakkhar | (Mathematics) |
| 47. | Prof. Kusum Deep | (Mathematics) |
| 48. | Prof. Tanuja Srivastava | (Mathematics) |
| 49. | Prof. Pradeep Kumar | (Mechanical & Industrial Engg.) |
| 50. | Prof. P.K. Jain | (Mechanical & Industrial Engg.) |
| 51. | Prof. Navneet Arora | (Mechanical & Industrial Engg.) |
| 52. | Prof. P.K. Ghosh | (Metallurgical & Materials Engg.) |
| 53. | Prof. S.K. Nath | (Metallurgical & Materials Engg.) |
| 54. | Prof. Rajesh Srivastava | (Physics) |
| 55. | Prof. Tashi Nautiyal | (Physics) |
| 56. | Prof. K.L. Yadav | (Physics) |
| 57. | Prof. D. K. Walia | (Physics) |
| 58. | Prof. G.D. Varma | (Physics) |
| 59. | Prof. M.L. Kansal | (WRD&M) |
| 60. | Prof. Deepak Khare | (WRD&M) |
| 61. | Prof. S.K. Mishra | (WRD&M) |
| 62. | Prof. Ramesh Chandra | (Institute Instrumentation Centre) |
| 63. | Dr. M.P. Sharma, Head | (A.H.E.C.) |
| 64. | Dr. S.N., Rangnekar, Head | (Management Studies) |
| 65. | Dr. D.S. Arya, Head | (Hydrology) |
| 66. | Dr. R. Balasubramanian, Head | Institute Computer Centre |
| 67. | Dr. P. Jeevanandam | Associate Dean of Students' Welfare
(International Students) |
| 68. | Dr. R.K. Peddinti | Associate Dean, Academic Research |
| 69. | Dr. Yogendra Singh, Librarian | |
| 70. | Dr. R.D. Garg, Associate Professor, Department of Civil Engineering | |
| 71. | Dr. Pravindra Kumar, Associate Professor, Biotechnology | |
| 72. | Dr. Anil K. Gourishetty, Asstt. Professor, Department of Physics | |
| 73. | Dr. Rajat Rastogi, Associate Professor, Department of Civil Engineering | |
| 74. | Dr. Inderdeep Singh, Associate Professor, Department of Mechanical & Industrial Engineering | |
| 75. | Dr. A. Swaminathan, Associate Professor, Department of Mathematics | |
| 76. | Mr. Prashant Garg, Registrar & Secretary, Senate | |

The Chairman (Director) welcomed the members to the 62nd Meeting of the Senate.



Before taking up the agenda, the Chairman thanked Prof. Kirat Pal, the outgoing Senate member and recorded its appreciation for his valuable contributions in the meetings of the Senate:

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

1. Prof. Girishwar Misra, Wardha
2. Prof. Bhim Singh, IIT Delhi
3. Prof. D.K. Nauriyal, Department of Humanities & Social Sciences
4. Prof. Bikash Mohanty, Department of Chemical Engineering
5. Prof. Satish Chandra, Department of Civil Engineering
6. Prof. Kamal Jain, Department of Civil Engineering (In protest of not providing a written notice together with agenda (alleged violation of provision of hard copy)
7. Prof. Ramasare Prasad, Department of Biotechnology
8. Prof. Ravi Kumar, Department of Mechanical & Industrial Engineering
9. Dr. A.K. Sharma, Associate Dean Academics

The Agenda was then taken up:

Item No. 62.1: To confirm the minutes of the 60th meeting held on 8th July 2015 and emergent meeting, which is identified as 61st meeting held on 3rd August 2015, respectively.

The minutes of the 60th meeting of the Senate held on 8th July 2015 and emergent meeting, which is identified as 61st meeting held on 3rd August 2015, respectively were confirmed.

Item No.62.2: To receive a report on the actions taken to implement the decisions taken by the Senate in its 60th meeting held on 8th July 2015 and emergent meeting, which is identified as 61st meeting held on 3rd August 2015, respectively.

The Senate noted the actions taken on the resolutions of the 60th meeting held on 8th July 2015 and emergent meeting, which is identified as 61st meeting held on 3rd August 2015, respectively with the following observation on item No. 60.24 at Point No. 2 and 61.1:



60.24:

"The Senate decided that xxxxxxxxxxxx:

"xxxxxxxxxxxx :

1. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2. The student falls sick being out-station with the permission of DOSW and timely informs the office of the Dean, Academics."

xxxxxxxxxxxxxxxxxxxxxxxxxxxx

This will be applicable from July 2015 onwards".

61.1:

The expulsion of 71 students of B.Tech./IMT/IMS I year due to less than 5.00 CGPA or earned credits less than 22 (minimum requirement) at the end of I year , as specified in Appendix 'J', was considered. The Senate also reviewed the procedure followed throughout the year in implementation of this rule. The Senate has been informed:-

(i) xxxxxxxxxxxxxxx

(ii) xxxxxxxxxxxxxxx

(iii) xxxxxxxxxxxxxxx

During discussion the following were observed:

(a) xxxxxxxxxxxxxxx

(b) xxxxxxxxxxxxxxx

(c) xxxxxxxxxxxxxxx

(d) xxxxxxxxxxxxxxx

(e) xxxxxxxxxxxxxxx

(f) xxxxxxxxxxxxxxx

The Senate also observed that xxxxxxxxxxxxxxx

"All students who have less than 5.00 CGPA & satisfying the minimum 22 credits criterion at the end of I Year of U.G. Programme will be re-admitted as one time measure on the following conditions:



- a) XXXXXXXXXXXX
- b) XXXXXXXXXXXX
- c) XXXXXXXXXXXX
- d) XXXXXXXXXXXX
- e) XXXXXXXXXXXX
- f) XXXXXXXXXXXX
- g) XXXXXXXXXXXX
- h) XXXXXXXXXXXX

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Item No. 62.3: To consider the award of Degrees/Diploma to the students who have qualified for the award of Degrees/Diploma in various disciplines/courses.

The Senate considered and approved the award of Degrees/Diploma to 2162 students, as per **Table-1** below, who have duly qualified for the award of degrees/diploma in various disciplines. The names of the students are listed in **Appendices 'A', 'B' & 'C'**, respectively.

Table-1

Sl. No.	Name of the Degrees	Number of Degrees
1.	B.Tech./B.Arch./IDD/ Integrated Degrees (Appendix 'A')	980
2.	M.Tech./M.Arch./MURP/M.Sc./MCA/ MBA/ M.Tech. (Earth Sciences)/ M.Tech. (SSEM) / M.Tech. (Advance Chemical Analysis)/ Diploma in IWM (Appendix 'B')	945
3.	Ph.D. Degrees (Appendix 'C')	237
Total		2162

The Senate further resolved that, henceforth, the Ph.D. degrees completed till the date of next Senate meeting will be considered in every Senate for approval, instead of approving all Ph.D. degrees to be awarded in the Senate before the Convocation. However, rest of the UG/PG degrees will be considered in the Senate meeting



as per present practice. It was also decided that, in future, the gap between the last date for the consideration of Ph.D. degrees to be awarded in the forthcoming Convocation and the gap of Convocation be reduced to 15 days.

Further resolved that, henceforth, the viva-voce examination reports for the award of Ph.D. degrees will be considered. The format for the report will be modified so that external examiner can give the brief report on the thesis.

Item No. 62.4: To consider the syllabus of revised course entitled **BTN-467: High Throughput Sequencing as a new elective course for B.Tech. (Biotechnology), 3rd and 4th year students.**

As considered and recommended by the IAPC, the Senate decided that the syllabus of **BTN- 467: High Throughput Sequencing**, proposed by the Department of Biotechnology as Departmental Elective for B.Tech. (Biotechnology), 3rd and 4th Year students, as given at **Appendix 'D'** be approved.

Item No. 62.5: To consider the change in name of course **EC-333: Microwave Engineering to **EC-333: Microwave Techniques** in B.Tech. (Electronics and Communication Engineering), III Year.**

As considered and recommended by the IAPC, the Senate decided that the proposal of Department of Electronics and Communication Engineering to rename **EC-333: Microwave Engineering** to **Microwave Techniques** be approved.

Item No. 62.6: To consider the suggestions received from the departments regarding New Grading System.

The recommendations of the IAPC on the New Grading System was presented before the Senate. After deliberations, the Senate decided the new grading system as given in the following table with details as at **Appendix 'E'** be approved.

In addition, the following were also approved:

1. The following note in the Table of Appendix-J of the Ordinances & Regulations 2015 shall be applicable only for the result of I year.



“NOTE: In addition to requirement of earned credits each student has to secure at least 5.00 CGPA for continuation of study”.

2. If a student of I year is unable to get a SGPA of 5.00 at the end of Autumn Semester, he /she shall be put in low pace mode automatically.

This new grading system will be applicable to all UG/PG/Ph.D. students admitted from July 2015. However, its applicability for current enrolled UG and PG students from II Year onwards will be made effective. It was also decided that if any subject under new curriculum (both for UG and PG) is opted by the student(s) beyond their I Semester, the grading will be done as per new system and the grades of students of higher classes will be mapped to old grading system on the basis of grade point as per the following table:

Grades New Grading System	Grade Points	Grades Old Grading System
O	10	-
A	10	A+
B+	9	A
B	8	B+
C+	7	B
C	6	C+
D+	5	C
D	4	D
F	0	F
FS	0	FS
AP	-	AP
AF	-	AF
I	-	I
X	-	X
S	-	S
U	-	U



Item No. 62.7: To consider the syllabi of following Pre-Ph.D. courses proposed by the Department of Physics:

1. PHN-785: Advanced Classical Mechanics and Classical Electrodynamics
2. PHN-786: Advanced Quantum and Statistical Mechanics
3. PHN-788: Experimental Techniques
4. PHN-789: Mathematical and Computational Techniques

As considered and recommended by the IAPC, the Senate decided that the syllabi of the following Pre-Ph.D. courses as proposed by the Department of Physics be approved.:

1. PHN-785: Classical Mechanics and Electrodynamics
2. PHN-786: Advanced Quantum and Statistical Mechanics
3. PHN-788: Advanced Characterization Techniques
4. PHN-789: Mathematical and Computational Techniques

The syllabi of the above-mentioned courses are given at **Appendix 'F'**.

Item No. 62.8: To consider the syllabi of following Programme Elective courses proposed by the Department of Electronics & Communication Engineering:

1. ECN-xxx: RF System Design and Analysis
2. ECN-xxx: RF Power Amplifier and Transmitter Design

As considered and recommended by the IAPC, the Senate decided that the syllabi of the following new Programme Elective courses, as proposed by the Department of Electronics & Communication Engineering for the students of M.Tech. (RF & Microwave Engg.), be approved:

1. ECN-556: RF System Design and Analysis
2. ECN-557: RF Power Amplifier and Transmitter Design



The syllabi of the above cited courses are given at **Appendix 'G'**.

Item No. 62.9: To consider the syllabi of following Programme Elective proposed by the Department of Mechanical & Industrial Engineering:

1. MIN-xxx: Nanomechanics to Multiscale Modeling

As considered and recommended by the IAPC, the Senate decided that the syllabi of **Programme Elective (MIN-611: Nanomechanics to Multiscale Modeling)** course, as proposed by the Department of Mechanical & Industrial Engineering for the students of M.Tech. (CAD-CAM & Robotics) as given at **Appendix 'H'** be approved.

Item No. 62.10: Reported the signing the agreement deed for award of scholarship of the value of Rs. 10,000/0 (Rs. Ten Thousand only) in the name of "Architect Yash Pal Gupta Award of Excellence" for passing out student of B. Arch. Programme of overall topper of the Batch received from Mr. Shobhit Gupta.

The Senate accepted the signing of the agreement deed for award of scholarship of the value of Rs. 10,000/= (Rs. Ten Thousand only) in the name of "Architect Yash Pal Gupta Award of Excellence" for passing out student of B. Arch. Programme of overall topper of the Batch received from Mr. Shobhit Gupta residing at A 601, Eligible Apartments, Plot No. 38, Sector 10, Dwarka, New Delhi.

Item No. 62.11: Reported letter No. IITR/Reporting Item/JAM 2016 dated 18th September 2015 received from Chairman, GATE-JAM 2016 in respect of JAM 2016.

The Senate noted and accepted the introduction of new programmes as informed through the letter No. IITR/Reporting Item/JAM 2016 dated 18th September 2015 received from Chairman, GATE-JAM 2016 in respect of JAM 2016. **(Appendix 'I')**



Item No.62.12: To consider the minor changes in the structure and syllabi/ courses from 1st year Spring Semester to last semester in 4th year (both core and electives) of the B.Tech. (Polymer Science & Engineering) programme.

As considered and recommended by the IAPC, the Senate decided that the structure and syllabi of Programme Core Courses and Programme Elective Courses starting from I Year, second semester onwards, as proposed by the participating departments, as given at **Appendix 'J'** be approved.

Item No. 62.13: Reported the nominees of Research Award/ Cash Prizes/ Medals for the year 2015.

The Senate accepted the nominees of Research Award/ Cash Prizes/ Medals for the year 2015 (**Appendix 'K'**).

Item No. 62.14: Reported the dissertation credits for the students of IDD be made 30 and evaluated in two stages - Stage-I and Stage-II.

The Senate accepted that the credits of dissertation for the students of IDD be made 30 in tune of M.Tech. dissertation and be evaluated in two stages as given below:

- | | |
|--------------------------|------------------|
| 1. Dissertation Stage-I | 12 Credits (40%) |
| 2. Dissertation Stage-II | 18 Credits (60%) |

Item No. 62.15: Reported the rewarding of definition of Departmental Honours Courses (DHC).

The Senate accepted that the students with good academic standing (having CGPA>7.5) desirous of honours degree be allowed to take 4-5 additional courses equivalent to 18-20 credits from the basket of complete list of departmental electives offered by the parent departments. These students will be given degrees in main engineering area with Honours. For example, the degree certificate will indicate B. Tech. in Civil Engineering with Honours.

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



List of Undergraduates/IDD/Integrated Degree Recipients 2015

Sl. No.	Name	Roll No.	Division	Degree
1	ABHINANDITA MOHAPATRA	7.397	First Division	Bachelor of Architecture
2	AGRESH KUMAR	6.317		Bachelor of Architecture
3	AMIT SINGH	7	First Division	Bachelor of Architecture
4	AMMAR NAWAB	6.728	First Division	Bachelor of Architecture
5	ANIRUDDH JAIN	7.251	First Division	Bachelor of Architecture
6	ARAVIND BACHU	6.491		Bachelor of Architecture
7	AYUSH SONI	6.701	First Division	Bachelor of Architecture
8	CHAIKA DAS	7.433	First Division	Bachelor of Architecture
9	CHANCHAL SINGH	7.746	First Division	Bachelor of Architecture
10	CHANDANA R	8.312	First Division	Bachelor of Architecture
11	DAKSH SHARMA	7.201	First Division	Bachelor of Architecture
12	DHRUV BANSAL	6.723	First Division	Bachelor of Architecture
13	DINESH KUMAR	5.821		Bachelor of Architecture
14	DIVYAA SAXENA	8.129	First Division	Bachelor of Architecture
15	GINNI JAIN	7.683	First Division	Bachelor of Architecture
16	GOURAV GOYAL	6.326		Bachelor of Architecture
17	HANAN TARIQ QURESHI	7.183	First Division	Bachelor of Architecture
18	HARMANPREET KAUR	5.607		Bachelor of Architecture
19	HARSHIL MEHTA	8.152	First Division	Bachelor of Architecture
20	JHA ASHUTOSH SONELAL	8.08	First Division	Bachelor of Architecture
21	KARTIK SOOD	6.906	First Division	Bachelor of Architecture
22	KISHLAY KISHORE	6.701	First Division	Bachelor of Architecture
23	KOPAL GUPTA	7.924	First Division	Bachelor of Architecture
24	KUMAR SNEHAN SU	7.062	First Division	Bachelor of Architecture
25	MADHAV SINGH	6.397		Bachelor of Architecture
26	MAYANK AGARWAL	7.004	First Division	Bachelor of Architecture
27	MAYANK SINGHAL	6.929	First Division	Bachelor of Architecture
28	MAYUR KARODIA	6.464		Bachelor of Architecture
29	MEGHANA SINGH	6.871	First Division	Bachelor of Architecture
30	MIRGANK MISHRA	7.33	First Division	Bachelor of Architecture
31	NAMISHA GUPTA	7.509	First Division	Bachelor of Architecture
32	NISHCHAY SHARMA	6.241		Bachelor of Architecture
33	PARTHVI	7.893	First Division	Bachelor of Architecture
34	PRIYANKA RAI	7.098	First Division	Bachelor of Architecture
35	PRIYANKA SINGH	7.147	First Division	Bachelor of Architecture
36	RAGHAV MUNDRA	6.696	First Division	Bachelor of Architecture
37	RINI AGRAWAL	7.237	First Division	Bachelor of Architecture

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Sl. No.	Name	Grade	Division	Department
77	1111102 PRAKHAR UPADHYAY	8.356	First Division	B.Tech. Biotechnology
78	1111103 PRASHASTI GODARA	7.555	First Division	B.Tech. Biotechnology
79	1111103 PRITAM SINGH	8.309	First Division	B.Tech. Biotechnology
80	1011103 PULUGU CHAITANYA	5.052		B.Tech. Biotechnology
81	1111103 RAGHAV NUWAL	7.346	First Division	B.Tech. Biotechnology
82	1111103 RAJA CHAUDHARY	8.571	First Division with	B.Tech. Biotechnology
83	1111103 RAVI YADAV	8.01	First Division	B.Tech. Biotechnology
84	1111103 ROHAN AGGARWAL	7.576	First Division	B.Tech. Biotechnology
85	1111103 ROHIT GUPTA	6.927	First Division	B.Tech. Biotechnology
86	1111103 SAURABH KUSHWAHA	7.644	First Division	B.Tech. Biotechnology
87	1111100 SEVAKULA CHARAN	6.021		B.Tech. Biotechnology
88	1111104 SHUBHAM RATHORE	8.089	First Division	B.Tech. Biotechnology
89	1111104 SONIA RANI	5.859		B.Tech. Biotechnology
90	1111104 SOUMYA GUPTA	8.696	First Division with	B.Tech. Biotechnology
91	1111104 SUKRITI BANSAL	8.173	First Division	B.Tech. Biotechnology
92	1111104 SWAPNIL	6.639	First Division	B.Tech. Biotechnology
93	1111104 TANAY SINGH DINDOR	6.853	First Division	B.Tech. Biotechnology
94	1111104 TANVEEN KAUR RANDHAWA	7.555	First Division	B.Tech. Biotechnology
95	0911104 TUSHAR KANT SAHAY	5.565		B.Tech. Biotechnology
96	1111102 YASH BRIJRATAN MUNDRA	8.026	First Division	B.Tech. Biotechnology
97	1111300 ABHISHEK GUPTA	6.895	First Division	B.Tech. Civil Engineering
98	1111300 ABHISHEK PATEL	6.785	First Division	B.Tech. Civil Engineering
99	1111300 ABHISHEK SINGLA	7.34	First Division	B.Tech. Civil Engineering
100	1111300 ABHISHEK YADAV	6.241		B.Tech. Civil Engineering
101	1141100 AKASH AGARWAL	9.565	First Division with	B.Tech. Civil Engineering
102	1111300 AKHIL DHIMAN	6.534	First Division	B.Tech. Civil Engineering
103	1111300 AKSHAY GOYAL	7.084	First Division	B.Tech. Civil Engineering
104	1111300 AKSHAY SINGH	7.298	First Division	B.Tech. Civil Engineering
105	1111301 AMAN KUMAR JAIN	7.754	First Division	B.Tech. Civil Engineering
106	1111301 ANIRUDH YADAV	8.77	First Division with	B.Tech. Civil Engineering
107	1112001 ANKIT JAIN	8.487	First Division	B.Tech. Civil Engineering
108	1111301 ANKIT KR YADAV	7.691	First Division	B.Tech. Civil Engineering
109	1111301 ANKIT KUMAWAT	7.147	First Division	B.Tech. Civil Engineering
110	1111301 ANKURJEET SINGH	6.199		B.Tech. Civil Engineering
111	1111301 ANUBHAV SINGH	7.236	First Division	B.Tech. Civil Engineering
112	1111301 ANUJ YADAV	7.539	First Division	B.Tech. Civil Engineering
113	1111301 APURVA A KOCHAR	7.361	First Division	B.Tech. Civil Engineering
114	1111301 ARJUN MALIK	6.974	First Division	B.Tech. Civil Engineering
115	1111301 ARSHDEEP SINGH	8.639	First Division with	B.Tech. Civil Engineering

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Sl. No.	NAME	POST	GRADE	Division	Qualification
116	ASHISH GAUTAM		5.377		B.Tech. Civil Engineering
117	BABOO LAL KUMAWAT		6.749	First Division	B.Tech. Civil Engineering
118	CH VISHWANATH		5.283		B.Tech. Civil Engineering
119	CHANDRAMAULI		8.12	First Division	B.Tech. Civil Engineering
120	CHIRAG ASHOK KAVDIA		8.094	First Division	B.Tech. Civil Engineering
121	DEVKISHAN KUMHAR		7.283	First Division	B.Tech. Civil Engineering
122	DHEERAJ GOYAL		7.136	First Division	B.Tech. Civil Engineering
123	DHRUV GARG		8.45	First Division	B.Tech. Civil Engineering
124	DINESH KUMAR SONI		6.293		B.Tech. Civil Engineering
125	DIPANSHU CHITTARA		7.827	First Division	B.Tech. Civil Engineering
126	GAURAV KUMAR GUPTA		9.147	First Division with	B.Tech. Civil Engineering
127	GAURAV VERMA		8.649	First Division with	B.Tech. Civil Engineering
128	GITIN ARORA		7.895	First Division	B.Tech. Civil Engineering
129	HARSH GOEL		8.843	First Division with	B.Tech. Civil Engineering
130	HARSHVARDHAN		7.932	First Division	B.Tech. Civil Engineering
131	HEMANT KUMAR		6.937	First Division	B.Tech. Civil Engineering
132	HEMANT RAJ SHARMA		8.047	First Division	B.Tech. Civil Engineering
133	HIMANSHU CHAWLA		8.288	First Division	B.Tech. Civil Engineering
134	HULSURKAR ANIRUDHA		8.398	First Division	B.Tech. Civil Engineering
135	ISHITA		8.822	First Division with	B.Tech. Civil Engineering
136	JERRIPOTHULA V NAVEEN		6.88	First Division	B.Tech. Civil Engineering
137	JYOTIKA KHATRI		7.508	First Division	B.Tech. Civil Engineering
138	KANISHK DABAKRA		7.047	First Division	B.Tech. Civil Engineering
139	KARAN TYAGI		7.592	First Division	B.Tech. Civil Engineering
140	KASU NAVEEN RAJU		8.293	First Division	B.Tech. Civil Engineering
141	KISHAN KUMAR		6.864	First Division	B.Tech. Civil Engineering
142	KSHITIJ SONI		7.236	First Division	B.Tech. Civil Engineering
143	KULKARNI KAUSTUBH		7.969	First Division	B.Tech. Civil Engineering
144	LAKSHAY CHOUDHARY		6.749	First Division	B.Tech. Civil Engineering
145	MADAN LAL CHOUDHARY		5.01		B.Tech. Civil Engineering
146	MAITRESH AGARWAL		8.482	First Division	B.Tech. Civil Engineering
147	MANISH KUMAR JANGID		8.047	First Division	B.Tech. Civil Engineering
148	MANNAT GUPTA		9.047	First Division with	B.Tech. Civil Engineering

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Sl. No.	Roll No.	Name	Qualification	Grade	Division	Post
149	1111305	MAYANK JAUHARI	B.Tech. Civil Engineering	6.796	First Division	
150	1111305	MEHUL MEENA	B.Tech. Civil Engineering	5.623		
151	1111305	MUKUL KAUSHIK	B.Tech. Civil Engineering	7.126	First Division	
152	1111306	NEERAJ CHAUHAN	B.Tech. Civil Engineering	6.335		
153	1111306	NIDHISH JAIN	B.Tech. Civil Engineering	8.047	First Division	
154	1111306	NIKHIL GUPTA	B.Tech. Civil Engineering	8.178	First Division	
155	1111306	NIKHIL GUPTA	B.Tech. Civil Engineering	7.916	First Division	
156	1111306	NIKHIL SHARMA	B.Tech. Civil Engineering	7.66	First Division	
157	1111306	NITIN VERMA	B.Tech. Civil Engineering	6.948	First Division	
158	1111306	PALLAV RANJAN	B.Tech. Civil Engineering	7.921	First Division	
159	1111306	PARMESHVAR SUTHAR	B.Tech. Civil Engineering	7.738	First Division	
160	1111307	PAWAN KUMAR NAGAR	B.Tech. Civil Engineering	5.686		
161	1111307	PRADEEP SINGH GAUTAM	B.Tech. Civil Engineering	5.398		
162	1111307	PRAKARSH DUHOON	B.Tech. Civil Engineering	8.12	First Division	
163	1111307	PRAMESH KUMAR	B.Tech. Civil Engineering	8.062	First Division	
164	1111307	PRASHANT CHATURVEDI	B.Tech. Civil Engineering	7.581	First Division	
165	1111307	PRATEEK RAJ MEENA	B.Tech. Civil Engineering	5.597		
166	1111307	PRATIK GARG	B.Tech. Civil Engineering	8.55	First Division with	
167	1111307	PRATYUSH KUMAR	B.Tech. Civil Engineering	7.628	First Division	
168	1111307	PUNIT MITTAL	B.Tech. Civil Engineering	7.565	First Division	
169	1111308	RAHUL ADHIKARI	B.Tech. Civil Engineering	9.073	First Division with	
170	1011308	RAHUL KUMAR MEENA	B.Tech. Civil Engineering	4.935		
171	1111308	RAJANA RAVICHANDRA	B.Tech. Civil Engineering	5.691		
172	1111308	RAJAT GARG	B.Tech. Civil Engineering	8.246	First Division	
173	1111308	RAJAT SINGLA	B.Tech. Civil Engineering	6.99	First Division	
174	1111308	RAVI RANJAN KUMAR SINGH	B.Tech. Civil Engineering	6.654	First Division	
175	1111308	RAVI VERMA	B.Tech. Civil Engineering	8.597	First Division with	
176	1111309	RAVINDER	B.Tech. Civil Engineering	7.921	First Division	
177	1011308	RAVINDER SOHAN	B.Tech. Civil Engineering	5.099		
178	1111309	RISHAB GARG	B.Tech. Civil Engineering	7.738	First Division	
179	1111309	RISHI KUMAR	B.Tech. Civil Engineering	7.764	First Division	
180	1111309	ROHIT SHARMA	B.Tech. Civil Engineering	5.136		
181	1111309	SACHIN	B.Tech. Civil Engineering	7.366	First Division	
182	1111309	SAHIL SINGHAL	B.Tech. Civil Engineering	7.696	First Division	
183	1111309	SAMEER GIRISH SHENOY	B.Tech. Civil Engineering	7.639	First Division	
184	1111309	SAURABH KUMAR	B.Tech. Civil Engineering	5.524		

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Sl. No.						
264	1111506	PALASH KUMAR MEENA	7.295	First Division	B.Tech. Electrical Engineering	
265	1111506	PANKAJ YADAV	5.089		B.Tech. Electrical Engineering	
266	1111506	PARUL	8.389	First Division	B.Tech. Electrical Engineering	
267	1111506	PIYUSH AGRAWAL	8.016	First Division	B.Tech. Electrical Engineering	
268	1111506	PIYUSH KUMAR	7.137	First Division	B.Tech. Electrical Engineering	
269	1111506	PIYUSH MAHARIYA	7.516	First Division	B.Tech. Electrical Engineering	
270	1111506	PRAFUL GUPTA	9.121	First Division with	B.Tech. Electrical Engineering	
271	1111506	PRANAV SHARMA	7.921	First Division	B.Tech. Electrical Engineering	
272	1111506	PRASHANT	6.353		B.Tech. Electrical Engineering	
273	1011507	PREM PRAKASH MEENA	5.01		B.Tech. Electrical Engineering	
274	1111507	PULKIT AGGARWAL	9.058	First Division with	B.Tech. Electrical Engineering	
275	1111507	PUNEET KUMAR	7.379	First Division	B.Tech. Electrical Engineering	
276	1111507	PUNJABI KUNAL SRICHAND	8.058	First Division	B.Tech. Electrical Engineering	
277	1111507	RAHUL KUMAR MEENA	6.889	First Division	B.Tech. Electrical Engineering	
278	1011508	RAHUL MEENA	4.801		B.Tech. Electrical Engineering	
279	1111507	RAHUL RANJAN	7.468	First Division	B.Tech. Electrical Engineering	
280	1111308	RAJAN MANTRI	9.495	First Division with	B.Tech. Electrical Engineering	
281	1111507	RAJHANS SINGH	8.542	First Division with	B.Tech. Electrical Engineering	
282	1111507	RATAN SINGH AHIRWAR	7.179	First Division	B.Tech. Electrical Engineering	
283	1011508	RAVI VERMA	5.716		B.Tech. Electrical Engineering	
284	1111507	RICHA JAIN	7.895	First Division	B.Tech. Electrical Engineering	
285	1111507	RITESH KUMAR	7.342	First Division	B.Tech. Electrical Engineering	
286	1111507	ROHIT GUPTA	6.432		B.Tech. Electrical Engineering	
287	1111508	ROHIT JANGID	7.316	First Division	B.Tech. Electrical Engineering	
288	1111508	ROHIT YADAV	7.032	First Division	B.Tech. Electrical Engineering	
289	1111508	RUPAL SARASWAT	9.311	First Division with	B.Tech. Electrical Engineering	
290	1111508	SAGAR	5.426		B.Tech. Electrical Engineering	
291	1111508	SAHITHI SARJANA	8.8	First Division with	B.Tech. Electrical Engineering	
292	1111508	SAMDEESH SINGH	7.158	First Division	B.Tech. Electrical Engineering	
293	1111508	SANAPUREDDY REVANTH	7.416	First Division	B.Tech. Electrical Engineering	
294	1011509	SANDEEP KUMAR	5.068		B.Tech. Electrical Engineering	
295	1111508	SANJEEV KUMAR	7.211	First Division	B.Tech. Electrical Engineering	
296	1111508	SANTOSH KUMAR BAIS	7.211	First Division	B.Tech. Electrical Engineering	

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Sl. No.	Employee Name	Grade	Division	Pay Band	Post
297	1111509 SAURABH GUPTA	8.626	First Division with	B. Tech. Electrical Engineering	
298	1111904 SAURABH JAISWAL	8.6	First Division with	B. Tech. Electrical Engineering	
299	1111509 SAURAV KUMAR GANGULY	6.794	First Division	B. Tech. Electrical Engineering	
300	1111509 SHAILESH SHARMA	6.216		B. Tech. Electrical Engineering	
301	1111509 SHARAD KUMAR	6.284		B. Tech. Electrical Engineering	
302	1111509 SHEBIN SCARIA	7.032	First Division	B. Tech. Electrical Engineering	
303	1111509 SHIVAM GUPTA	7.442	First Division	B. Tech. Electrical Engineering	
304	1111509 SHUBHAM GAURAV	7.426	First Division	B. Tech. Electrical Engineering	
305	1111509 SHUBHAM GUPTA	7.595	First Division	B. Tech. Electrical Engineering	
306	1111509 SHUBHAM MAHESHWARI	8.089	First Division	B. Tech. Electrical Engineering	
307	1111510 SHUBHO DAS	7.032	First Division	B. Tech. Electrical Engineering	
308	1111510 SHYAM JI DUBEY	8.468	First Division	B. Tech. Electrical Engineering	
309	1111510 SOMURI SAI SANTOSH	7.853	First Division	B. Tech. Electrical Engineering	
310	1111510 SONALI SINGH	8.542	First Division with	B. Tech. Electrical Engineering	
311	1111510 SONU MEENA	6.158		B. Tech. Electrical Engineering	
312	1111510 SOURABH KUMAR MAMODIA	6.295		B. Tech. Electrical Engineering	
313	1111510 SPANDAN CHANDRA	6.579	First Division	B. Tech. Electrical Engineering	
314	1111510 SUMIT SINGLA	8.137	First Division	B. Tech. Electrical Engineering	
315	1111510 SURENDER SAHARAN	7.279	First Division	B. Tech. Electrical Engineering	
316	1111510 SUYOG TRIVEDI	8.174	First Division	B. Tech. Electrical Engineering	
317	1111511 SWATI SINGH	7.974	First Division	B. Tech. Electrical Engineering	
318	1111511 SYED TAUSEEF TANWEER	7.437	First Division	B. Tech. Electrical Engineering	
319	1111511 TAPOJYOTI MANDAL	8.232	First Division	B. Tech. Electrical Engineering	
320	0911509 THOTA JAYA SREE SATYA	5.419		B. Tech. Electrical Engineering	
321	1111511 VIKALP GUPTA	7.489	First Division	B. Tech. Electrical Engineering	
322	1111511 VINAYAK SHEKHAR SAHAI	8.042	First Division	B. Tech. Electrical Engineering	
323	1111511 VISHAL KUMAR RAHUL	5.747		B. Tech. Electrical Engineering	
324	1111104 VISHAL RATHI	8.942	First Division with	B. Tech. Electrical Engineering	
325	1111511 YARAMALA CHANDAN	5.689		B. Tech. Electrical Engineering	
326	1011511 YOGESH CHOUDHARY	5.242		B. Tech. Electrical Engineering	
327	1111700 ABHINAV GHOSH	6.894	First Division	B. Tech. Mechanical Engineering	
328	1111700 ABHINAV RAJIVANSHI	9.608	First Division with	B. Tech. Mechanical Engineering	
329	1111700 ABHISHEK CHAURASIA	7.614	First Division	B. Tech. Mechanical Engineering	
330	1111700 ABHISHEK KUMAR SWAMI	6.005		B. Tech. Mechanical Engineering	
331	1111700 ADITYA AGARWAL	7.09	First Division	B. Tech. Mechanical Engineering	
332	1111700 ADITYA POKRA	8.037	First Division	B. Tech. Mechanical Engineering	

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Sl. No.						
333	1111700	AKSHAY KUMAR	6.354			B.Tech. Mechanical Engineering
334	1011700	AMAN KUMAR	6.392			B.Tech. Mechanical Engineering
335	1111700	AMAN MITTAL	8.101	First Division		B.Tech. Mechanical Engineering
336	1111700	AMIR RAZA	7.54	First Division		B.Tech. Mechanical Engineering
337	1111701	AMIT KUMAR GUPTA	8.288	First Division		B.Tech. Mechanical Engineering
338	1111701	AMIT KUMAR MEENA	5.767			B.Tech. Mechanical Engineering
339	1111701	ANIRUDH AGARWAL	8.778	First Division with		B.Tech. Mechanical Engineering
340	1111701	ANKIT SHRIVASTAVA	8.46	First Division		B.Tech. Mechanical Engineering
341	1111701	ARJUN KHOLIA	7.101	First Division		B.Tech. Mechanical Engineering
342	1111701	ASHISH RAMAN	7.344	First Division		B.Tech. Mechanical Engineering
343	1111701	ASHOK KUMAR MEENA	5.646			B.Tech. Mechanical Engineering
344	1111701	ATUL KUMAR	6.836	First Division		B.Tech. Mechanical Engineering
345	1111701	ATUL MIGLANI	6.407			B.Tech. Mechanical Engineering
346	1111802	BELEKAR VIRAJ VILAS	7.741	First Division		B.Tech. Mechanical Engineering
347	1111702	BIPIN KUMAR	7.852	First Division		B.Tech. Mechanical Engineering
348	1111702	BRJESH KUMAR	6.603	First Division		B.Tech. Mechanical Engineering
349	1111702	CHIRAG DHULL	6.566	First Division		B.Tech. Mechanical Engineering
350	1111702	DARJI VATSAL	5.783			B.Tech. Mechanical Engineering
351	1111702	DEEPANSHU GUPTA	7.106	First Division		B.Tech. Mechanical Engineering
352	1111702	DEEPANSHU SAINI	7.423	First Division		B.Tech. Mechanical Engineering
353	1111302	DHRUV MITTAL	9.164	First Division with		B.Tech. Mechanical Engineering
354	1111702	DIVYAM AGGARWAL	7.82	First Division		B.Tech. Mechanical Engineering
355	1011702	GUNADALA RAJ KUMAR	5.487			B.Tech. Mechanical Engineering
356	1011702	GURLEEN SINGH	5.831			B.Tech. Mechanical Engineering
357	1111702	GYAN PRAKASH VERMA	6.429			B.Tech. Mechanical Engineering
358	1111702	HARRIT DIWAN	7.825	First Division		B.Tech. Mechanical Engineering
359	1111702	HARSH DESWAL	7.804	First Division		B.Tech. Mechanical Engineering
360	1111703	HARSHIT GUPTA	7.608	First Division		B.Tech. Mechanical Engineering
361	1111703	JAYANT JAIN	6.836	First Division		B.Tech. Mechanical Engineering
362	1111703	JEEVAN SHANKAR BALAGAM	8.534	First Division with		B.Tech. Mechanical Engineering
363	1111703	K AVINASH REDDY	7.101	First Division		B.Tech. Mechanical Engineering
364	0911703	KARTHEEK KUMAR K	5.55			B.Tech. Mechanical Engineering
365	1111703	KHALID IBRAHIM ASHRAF	7.354	First Division		B.Tech. Mechanical Engineering
366	1111703	KHUMUKCHAM BIJENKUMAR	6.81	First Division		B.Tech. Mechanical Engineering
367	1111703	KULDEEP KANAUIJA	8.095	First Division		B.Tech. Mechanical Engineering
368	1111703	KUNAL ANAND	7.714	First Division		B.Tech. Mechanical Engineering
369	1111704	LEO JOHNS	7.995	First Division		B.Tech. Mechanical Engineering

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Sl. No.						
370	1111704	MANISH RATHORE		5.73		B.Tech. Mechanical Engineering
371	1111704	METTU AMITH AARON	7.354	First Division		B.Tech. Mechanical Engineering
372	1111704	MUKUL AGARWAL	8.36	First Division		B.Tech. Mechanical Engineering
373	1111704	MUKUL GUPTA	6			B.Tech. Mechanical Engineering
374	1111704	NAMAN JAIN	7.894	First Division		B.Tech. Mechanical Engineering
375	1111705	NAMONARAYAN MEENA	5.862			B.Tech. Mechanical Engineering
376	1011703	NAVREET SINGH	5.376			B.Tech. Mechanical Engineering
377	1111705	NIHAR AGARWAL	7.45	First Division		B.Tech. Mechanical Engineering
378	1111705	NIKHIL JAIN	7.683	First Division		B.Tech. Mechanical Engineering
379	1111705	P S SAI SHARAN	6.09			B.Tech. Mechanical Engineering
380	0911703	PARRI HARISH	5.015			B.Tech. Mechanical Engineering
381	1111705	PATEL ARCHIT MAHESH	6.106			B.Tech. Mechanical Engineering
382	1111705	PHASE JAIRAJ RAJENDRA	7.571	First Division		B.Tech. Mechanical Engineering
383	1111705	PIYUSH BHARTI	7.106	First Division		B.Tech. Mechanical Engineering
384	1111705	PRAFUL KUMAR SINGH	5.974			B.Tech. Mechanical Engineering
385	1011705	RAHUL KUMAR MEENA	5.63			B.Tech. Mechanical Engineering
386	1111706	RAHUL KUMAR RAGHAVA	7.026	First Division		B.Tech. Mechanical Engineering
387	1111706	RAHUL KUMAR TRIPATHI	5.228			B.Tech. Mechanical Engineering
388	1111706	RAJAT GOYAL	7.042	First Division		B.Tech. Mechanical Engineering
389	1111706	RAJAT GUPTA	8.296	First Division		B.Tech. Mechanical Engineering
390	1111706	RATNESH MADHAN	7.714	First Division		B.Tech. Mechanical Engineering
391	1111706	ROHIT MITTAL	7.582	First Division		B.Tech. Mechanical Engineering
392	1111706	SACHIN KUMAR	6.492			B.Tech. Mechanical Engineering
393	1111808	SANDIPP KRISHNAN R	8.259	First Division		B.Tech. Mechanical Engineering
394	1111706	SAURABH DUDANI	6.466			B.Tech. Mechanical Engineering
395	1111706	SHARAD GANGWAR	7.138	First Division		B.Tech. Mechanical Engineering
396	1111706	SHINDE DIPAK PRAKASH	7.942	First Division		B.Tech. Mechanical Engineering
397	1111707	SHRISH KUMBHAR	5.868			B.Tech. Mechanical Engineering
398	1111707	SHIVRAJ NAGAR	6.767	First Division		B.Tech. Mechanical Engineering
399	1111707	SHUBHAM GUPTA	8.54	First Division with		B.Tech. Mechanical Engineering
400	1111707	SHUBHRANSHU ATRAY	7.979	First Division		B.Tech. Mechanical Engineering
401	1111707	SUHANJ INJETI	6.566	First Division		B.Tech. Mechanical Engineering
402	1111311	SUKHDARSHAN SINGH SAINI	9.508	First Division with		B.Tech. Mechanical Engineering
403	1111707	SUSHANT YADAV	5.635			B.Tech. Mechanical Engineering
404	1011707	UMESH CHANDRA KISKU	5.635			B.Tech. Mechanical Engineering
405	1111707	VAIBHAV MULCHANDANEY	7.619	First Division		B.Tech. Mechanical Engineering
406	0911706	VAMSHI RAJ K	5.005			B.Tech. Mechanical Engineering

Sl. No.						
407	1111703	VIPUL VASUDEO KUMBHAR	6.079		B.Tech. Mechanical Engineering	
408	1111707	YASH PANCHOLI	7.608	First Division	B.Tech. Mechanical Engineering	
409	1111707	YESWANTH SAI GUPTHA	9.302	First Division with	B.Tech. Mechanical Engineering	
410	0911800	ABHAY BIR SINGH RANA	5.812		B.Tech. Production & Industrial Engineering	
411	1111900	ABHISHEK KUMAR	7.33	First Division	B.Tech. Production & Industrial Engineering	
412	1111900	AJEET MERAVI	6.639	First Division	B.Tech. Production & Industrial Engineering	
413	1111900	AKASH CHAUDHARY	5.628		B.Tech. Production & Industrial Engineering	
414	1111900	AKSHAY GOYAL	7.817	First Division	B.Tech. Production & Industrial Engineering	
415	1111900	AMAL PAL	7.45	First Division	B.Tech. Production & Industrial Engineering	
416	1111900	ANAND KUMAR LEEL	8.152	First Division	B.Tech. Production & Industrial Engineering	
417	1111900	ANKIT AGARWAL	8.131	First Division	B.Tech. Production & Industrial Engineering	
418	1111900	ANKIT PALAWAT	5.848		B.Tech. Production & Industrial Engineering	
419	1111900	ANMOL CHOUKSEY	7.314	First Division	B.Tech. Production & Industrial Engineering	
420	1111901	ARCHIT JAIN	8.969	First Division with	B.Tech. Production & Industrial Engineering	
421	1111901	AROHAN KUMAR	8.445	First Division	B.Tech. Production & Industrial Engineering	
422	1111901	ASHISH TANEJA	8.592	First Division with	B.Tech. Production & Industrial Engineering	
423	1111901	BHAVESH SINGHAL	7.157	First Division	B.Tech. Production & Industrial Engineering	
424	1011901	DHAVAL KUMAR VINUBHAI	5.063		B.Tech. Production & Industrial Engineering	
425	1111901	DHRUV NARAYAN	9.094	First Division with	B.Tech. Production & Industrial Engineering	
426	1111901	DIVYE ANAND GUPTA	7.639	First Division	B.Tech. Production & Industrial Engineering	
427	1011901	GAURAV MEENA	5.058		B.Tech. Production & Industrial Engineering	
428	1111901	HIRENDRA DOODHIYA	6.115		B.Tech. Production & Industrial Engineering	
429	1111901	HITESH GARG	6.194		B.Tech. Production & Industrial Engineering	
430	1111902	JYOTI PRAKASH	7.052	First Division	B.Tech. Production & Industrial Engineering	
431	1111902	KANWAR PAL SINGH	6.571	First Division	B.Tech. Production & Industrial Engineering	
432	1111902	KORAVI GNANA	6.859	First Division	B.Tech. Production & Industrial Engineering	
433	1111902	KUSHAL BHAGAT	6.733	First Division	B.Tech. Production & Industrial Engineering	
434	1111902	MAKWANA BINOY	5.916		B.Tech. Production & Industrial Engineering	
435	1111902	MAYANK GUPTA	8.058	First Division	B.Tech. Production & Industrial Engineering	
436	1111902	MEGHA VIJAYVARGIA	8.592	First Division with	B.Tech. Production & Industrial Engineering	
437	1111902	MITRA VERMA	6.817	First Division	B.Tech. Production & Industrial Engineering	
438	1111902	MOHIT HEMRAJANI	8.005	First Division	B.Tech. Production & Industrial Engineering	
439	1111902	MOHIT SONI	7.984	First Division	B.Tech. Production & Industrial Engineering	
440	1111903	MUKESH SINGH	7.251	First Division	B.Tech. Production & Industrial Engineering	
441	1111903	NAKSHATRA SINGH	6.529	First Division	B.Tech. Production & Industrial Engineering	
442	1111903	NITESH KUMAR	8.084	First Division	B.Tech. Production & Industrial Engineering	
443	1111903	PALNATI VIVEK REDDY	7.262	First Division	B.Tech. Production & Industrial Engineering	
444	1111903	PRADEEP KUMAR	5.576		B.Tech. Production & Industrial Engineering	
445	1111903	PULKIT JINDAL	8.277	First Division	B.Tech. Production & Industrial Engineering	
446	1111903	PUNEET PANDEY	7.377	First Division	B.Tech. Production & Industrial Engineering	
447	1111903	RAHUL JAIN	6.796	First Division	B.Tech. Production & Industrial Engineering	
448	1111903	RISHABH PAWAR	6.325		B.Tech. Production & Industrial Engineering	

Sl. No.					
449	1111903	ROHIT PATHAK	7.702	First Division	B.Tech. Production & Industrial Engineering
450	1111904	SAURABH RANJAN	8.455	First Division	B.Tech. Production & Industrial Engineering
451	1111904	SURAJ KUMAR	8.414	First Division	B.Tech. Production & Industrial Engineering
452	1111904	VAIBHAV GOEL	8.623	First Division with	B.Tech. Production & Industrial Engineering
453	1111904	VARUN GUPTA	8.257	First Division	B.Tech. Production & Industrial Engineering
454	1111904	VIKALP AGGARWAL	7.901	First Division	B.Tech. Production & Industrial Engineering
455	1111904	YUGAL KISHORE	7.366	First Division	B.Tech. Production & Industrial Engineering
456	1111600	ABHISHEK KUMAR SINGH	8.091	First Division	B.Tech. Electronics & Communication Engineering
457	1111600	ABHISHEK MAJUMDAR	7.128	First Division	B.Tech. Electronics & Communication Engineering
458	1111600	ADITYA KUMAR	7.149	First Division	B.Tech. Electronics & Communication Engineering
459	1111600	ADITYA SHUKLA	8.144	First Division	B.Tech. Electronics & Communication Engineering
460	1111600	ADURY SURYA KIRAN	7.925	First Division	B.Tech. Electronics & Communication Engineering
461	1111600	AKSHAY KUMAR SANGHAI	7.545	First Division	B.Tech. Electronics & Communication Engineering
462	1111600	ALANKRITA GAUTAM	8.053	First Division	B.Tech. Electronics & Communication Engineering
463	1111600	AMIT JANGRA	7.378	First Division	B.Tech. Electronics & Communication Engineering
464	1111601	ANISHA GROVER	7.807	First Division	B.Tech. Electronics & Communication Engineering
465	1111601	ANJALI VERMA	6.524	First Division	B.Tech. Electronics & Communication Engineering
466	1111601	ANURAG MEENA	6.513	First Division	B.Tech. Electronics & Communication Engineering
467	1111601	ARJUN SINGH	6.701	First Division	B.Tech. Electronics & Communication Engineering
468	1111302	AVIJIT SINGH YADAV	8.213	First Division	B.Tech. Electronics & Communication Engineering
469	1111601	AVINASH KUMAR	6.649	First Division	B.Tech. Electronics & Communication Engineering
470	1011600	BEANT SINGH	5.326		B.Tech. Electronics & Communication Engineering
471	1111601	BOYINA LALLU PRASAD	5.209		B.Tech. Electronics & Communication Engineering
472	1111601	CHINTAPENTA	7.487	First Division	B.Tech. Electronics & Communication Engineering
473	1011601	DADANAMPALLY SANKETH	5.428		B.Tech. Electronics & Communication Engineering
474	1112002	DEEP JAIN	9.31	First Division with	B.Tech. Electronics & Communication Engineering
475	1111601	G PRANEETH REDDY	6.749	First Division	B.Tech. Electronics & Communication Engineering
476	1111601	GAURAV KAPATIA	7.005	First Division	B.Tech. Electronics & Communication Engineering
477	1111602	GOSULA RAJ KIRAN	7.755	First Division	B.Tech. Electronics & Communication Engineering
478	1111602	GOURESH SINGHAL	8.086	First Division	B.Tech. Electronics & Communication Engineering
479	1111602	GUTALA SRIRAMACHANDRA	8.564	First Division with	B.Tech. Electronics & Communication Engineering
480	1111602	HARSH KUMAR	8.947	First Division with	B.Tech. Electronics & Communication Engineering
481	1111602	HARSHIT SIHARE	8.5	First Division with	B.Tech. Electronics & Communication Engineering
482	1111602	HIMANSHU TANDON	7.433	First Division	B.Tech. Electronics & Communication Engineering
483	1111602	ISHAAN BAINS	7.144	First Division	B.Tech. Electronics & Communication Engineering
484	1111602	JAIVEER YADAV	6.802	First Division	B.Tech. Electronics & Communication Engineering
485	1111602	KAMRAN ALAM	7.245	First Division	B.Tech. Electronics & Communication Engineering
486	1111602	KORADA RAVIKUMAR	5.369		B.Tech. Electronics & Communication Engineering

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487	1111603	KURELLA AKHILA REDDY	7.428	First Division	B.Tech. Electronics & Communication Engineering
488	1111603	MANUSH GUPTA	7.134	First Division	B.Tech. Electronics & Communication Engineering
489	1111603	PABBISETTI YASWANTH	8.261	First Division	B.Tech. Electronics & Communication Engineering
490	1111603	PARTH GAGGAR	8.535	First Division with	B.Tech. Electronics & Communication Engineering
491	1111603	PEGADARAJU ROHITH	7.481	First Division	B.Tech. Electronics & Communication Engineering
492	1111603	PINKA YADAV	7.134	First Division	B.Tech. Electronics & Communication Engineering
493	1111603	PRAKASH CHAND YADAV	7.203	First Division	B.Tech. Electronics & Communication Engineering
494	1111603	PRATIBHA KISHORE	5		B.Tech. Electronics & Communication Engineering
495	1111603	PUNEET KUMAR	6.642	First Division	B.Tech. Electronics & Communication Engineering
496	1111604	PUNIT KUMAR GUJRATHI	6.225		B.Tech. Electronics & Communication Engineering
497	1111604	RACHAMADUGU SHIVA	9.214	First Division with	B.Tech. Electronics & Communication Engineering
498	1111604	RACHIT	6.578	First Division	B.Tech. Electronics & Communication Engineering
499	1111604	RAJAT SRIVASTAVA	7.898	First Division	B.Tech. Electronics & Communication Engineering
500	1111604	RISHABH BHATNAGAR	9.021	First Division with	B.Tech. Electronics & Communication Engineering
501	1111604	RISHAV SONI	7.583	First Division	B.Tech. Electronics & Communication Engineering
502	1111604	SAJAL ANAND	7.048	First Division	B.Tech. Electronics & Communication Engineering
503	1011604	SANJEET	5.246		B.Tech. Electronics & Communication Engineering
504	1111604	SANTOSH KUMAR SINGH	7.16	First Division	B.Tech. Electronics & Communication Engineering
505	1011604	SATISH CHANDRA VERMA	5.749		B.Tech. Electronics & Communication Engineering
506	1111604	SATYENDRA SINGH	7.214	First Division	B.Tech. Electronics & Communication Engineering
507	1111604	SAURABH SUMAN	7.77	First Division	B.Tech. Electronics & Communication Engineering
508	1111605	SHASHANK MEHTA	7.267	First Division	B.Tech. Electronics & Communication Engineering
509	0811603	SHIVAM YADAV	4.984		B.Tech. Electronics & Communication Engineering
510	1111605	SURAJ KUMAR SAU	8.342	First Division	B.Tech. Electronics & Communication Engineering
511	1011605	THUMMALA REENATH	5.214		B.Tech. Electronics & Communication Engineering
512	1111605	VIJAY JAIN	7.941	First Division	B.Tech. Electronics & Communication Engineering
513	1111605	VINEET SINGLA	8.337	First Division	B.Tech. Electronics & Communication Engineering
514	1111605	VISHAL SINGH	6.262		B.Tech. Electronics & Communication Engineering
515	1111400	AKSHAY AGARWAL	7.55	First Division	B.Tech. Computer Science & Engineering
516	1011400	AMIT JAIN	5.484		B.Tech. Computer Science & Engineering
517	1111400	ANKIT PATEL	8.277	First Division	B.Tech. Computer Science & Engineering
518	1111400	ANSHUL SINGHAL	8.325	First Division	B.Tech. Computer Science & Engineering
519	1111400	ANU YADAV	7.56	First Division	B.Tech. Computer Science & Engineering
520	1111601	ARCHIT AGRAWAL	9.539	First Division with	B.Tech. Computer Science & Engineering
521	1111400	ARPIT JAIN	7.948	First Division	B.Tech. Computer Science & Engineering
522	1111400	ARUN KUMAR RAM	5.084		B.Tech. Computer Science & Engineering
523	1111400	ASHISH KUMAR SINGH	6.398		B.Tech. Computer Science & Engineering
524	1111401	AVINASH MODI	7.099	First Division	B.Tech. Computer Science & Engineering
525	1111401	AVINASH WILSON TIRKEY	6.016		B.Tech. Computer Science & Engineering
526	1011401	BANGAL SAGAR BABULAL	5.324		B.Tech. Computer Science & Engineering
527	1111401	DEVARASHETTY DILEEP	7.136	First Division	B.Tech. Computer Science & Engineering
528	1111401	DEVENDRA PRATAP SINGH	6.675	First Division	B.Tech. Computer Science & Engineering

Sl. No.					
650	1111802	CHAMANDEEP SINGH	7.079	First Division	B.Tech. Metallurgical and Materials Engineering
651	0811801	DASARI MOUNIKA	4.974		B.Tech. Metallurgical and Materials Engineering
652	1111803	DEEPAK SWARNKAR	7.9	First Division	B.Tech. Metallurgical and Materials Engineering
653	1111803	DEEPENDRA KUMAR SINGH	7.089	First Division	B.Tech. Metallurgical and Materials Engineering
654	1111803	DEVENDRA SINGH MEENA	6.1		B.Tech. Metallurgical and Materials Engineering
655	1111803	DHEERAJ P B	6.684	First Division	B.Tech. Metallurgical and Materials Engineering
656	1111803	DIGANT RAY	7.747	First Division	B.Tech. Metallurgical and Materials Engineering
657	1111803	GAURAV MODI	9.358	First Division with	B.Tech. Metallurgical and Materials Engineering
658	1111803	GAURAV RATHORE	6.658	First Division	B.Tech. Metallurgical and Materials Engineering
659	1111803	GONA MOUNIKA	7.568	First Division	B.Tech. Metallurgical and Materials Engineering
660	1111803	GOVIND DAN CHARAN	6.937	First Division	B.Tech. Metallurgical and Materials Engineering
661	1111804	GUJJA AKHIL	7.858	First Division	B.Tech. Metallurgical and Materials Engineering
662	1111804	HEMANT CHARAYA	8.205	First Division	B.Tech. Metallurgical and Materials Engineering
663	1111804	HIMANSHU SINGH	6.437		B.Tech. Metallurgical and Materials Engineering
664	1111804	IESH DIXIT	7.232	First Division	B.Tech. Metallurgical and Materials Engineering
665	1111804	KARAN BIR KANSAL	7.8	First Division	B.Tech. Metallurgical and Materials Engineering
666	1111804	KASHINATH PARSHETTY	7.168	First Division	B.Tech. Metallurgical and Materials Engineering
667	1111804	KOLLI RAMAN	6.621	First Division	B.Tech. Metallurgical and Materials Engineering
668	1111805	KORLAM SUDHEER	8.968	First Division with	B.Tech. Metallurgical and Materials Engineering
669	1111805	KUMARI SHIKHA	7.942	First Division	B.Tech. Metallurgical and Materials Engineering
670	1111805	KUSHAL SANJAY SHARMA	7.899	First Division	B.Tech. Metallurgical and Materials Engineering
671	1111805	LALIT MEENA	6.058		B.Tech. Metallurgical and Materials Engineering
672	1111805	MANGALDEEP PRASAD	6.537	First Division	B.Tech. Metallurgical and Materials Engineering
673	1111805	MANOJ KUMAR MEENA	5.121		B.Tech. Metallurgical and Materials Engineering
674	1111805	MAYANK AGRAWAL	6.805	First Division	B.Tech. Metallurgical and Materials Engineering
675	1111805	MAYANK PATWA	8.416	First Division	B.Tech. Metallurgical and Materials Engineering
676	1111805	MOHINI AGARWAL	7.911	First Division	B.Tech. Metallurgical and Materials Engineering
677	1111805	MOHIT TANWAR	6.326		B.Tech. Metallurgical and Materials Engineering
678	1111806	MUSKAN RAJORIA	7.284	First Division	B.Tech. Metallurgical and Materials Engineering
679	1111806	NATU DIVAKAR ANANT	8.163	First Division	B.Tech. Metallurgical and Materials Engineering
680	1111806	NISHIT MISRA	7.047	First Division	B.Tech. Metallurgical and Materials Engineering
681	1111806	NITIN VARSHNEY	6.621	First Division	B.Tech. Metallurgical and Materials Engineering
682	1111806	PALISETTI YESWANTH	7.2	First Division	B.Tech. Metallurgical and Materials Engineering

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Sl. No.				
717	1112000	ABHISHEK TYAGI	6.392	B.Tech. Pulp and Paper Engineering
718	1112000	ADITYA SHARMA	7.746	B.Tech. Pulp and Paper Engineering
719	1112001	ADITYA THAKUR	5.571	B.Tech. Pulp and Paper Engineering
720	1112001	AKASH KUMAR PATRO	7.471	B.Tech. Pulp and Paper Engineering
721	1112001	AKASH TYAGI	7.46	B.Tech. Pulp and Paper Engineering
722	1112001	AKSHAY KADAM	6.64	B.Tech. Pulp and Paper Engineering
723	1112001	AMAN KUMAR	6.005	B.Tech. Pulp and Paper Engineering
724	1112001	AMAR VAISH	9.159	B.Tech. Pulp and Paper Engineering
725	1112001	ANAND KUMAR NAYAK	7.741	B.Tech. Pulp and Paper Engineering
726	1112001	ANKIT KUMAR JHA	7.386	B.Tech. Pulp and Paper Engineering
727	1112002	ARUN KUMAR AGARWAL	8.725	B.Tech. Pulp and Paper Engineering
728	1112002	BHEEM PRAKASH	7.577	B.Tech. Pulp and Paper Engineering
729	1112002	CHIRAG	5.344	B.Tech. Pulp and Paper Engineering
730	1112002	DALJEET KUMAR	8.788	B.Tech. Pulp and Paper Engineering
731	1112002	DEVPRAKASH JATAV	5.243	B.Tech. Pulp and Paper Engineering
732	1012002	DHIRAJ CHIRUVELLA	5.063	B.Tech. Pulp and Paper Engineering
733	1112003	DOWRLA SACHIN	5.952	B.Tech. Pulp and Paper Engineering
734	1112003	GANESH RAM KS	8.481	B.Tech. Pulp and Paper Engineering
735	1112003	HANSHIKA GUPTA	8.81	B.Tech. Pulp and Paper Engineering
736	1112003	HARI GOVIND M	8.63	B.Tech. Pulp and Paper Engineering
737	1112003	HEMANT KUMAR SINGH	5.455	B.Tech. Pulp and Paper Engineering
738	1112003	HEMANT KUMAR SONI	5.831	B.Tech. Pulp and Paper Engineering
739	1112003	HIMANSHU BANSAL	5.386	B.Tech. Pulp and Paper Engineering
740	1112003	JONNALAGADDA	7.434	B.Tech. Pulp and Paper Engineering
741	1112004	K SAI TEJA	5.921	B.Tech. Pulp and Paper Engineering
742	1112004	KAPIL AGGARWAL	6.815	B.Tech. Pulp and Paper Engineering
743	1112004	KUMAR CHITRESH	6.847	B.Tech. Pulp and Paper Engineering
744	1112004	MAJETY DINESH SRIHARSHA	5.466	B.Tech. Pulp and Paper Engineering
745	1112004	MANDEEP	7.101	B.Tech. Pulp and Paper Engineering
746	1112004	MAULIK CHITRANSH	6.667	B.Tech. Pulp and Paper Engineering
747	1112004	MAYANK GUPTA	8.836	B.Tech. Pulp and Paper Engineering
748	1112005	MIR NOAMAN ALI	6.672	B.Tech. Pulp and Paper Engineering
749	1112005	MOODAVATH ANIL	5.169	B.Tech. Pulp and Paper Engineering
750	1112005	MUDIT PARASRAMPURIA	8.307	B.Tech. Pulp and Paper Engineering
751	1012004	NAVEEN DHILLON	5.376	B.Tech. Pulp and Paper Engineering
752	1112005	NAVEEN KUMAR GOYAL	7.73	B.Tech. Pulp and Paper Engineering
753	1112005	NEHA BANSAL	8.413	B.Tech. Pulp and Paper Engineering
754	1112005	NISHANT SHARMA	7.116	B.Tech. Pulp and Paper Engineering
755	1112005	NITISH KUMAR	7.212	B.Tech. Pulp and Paper Engineering



Sl. No.	NAME	Roll No.	First Division	Programme
794	1021401	PALAVARAPU SHRAVANYA	6.081	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
795	1021401	PRASHANT KUMAR	6.157	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
796	1021401	RAJESH RANJAN	9.166	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
797	1021401	SAHIL	8.099	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
798	1021402	SAURAV KUMAR	8.309	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
799	1021402	SHAH CHINTANKUMAR	7.126	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
800	1021402	SHAIENDRA	6.726	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
801	1021402	SHWETA YASHASVI	6.188	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
802	1021402	SIDDHARTH JINDAL	6.323	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
803	1021402	TILAK AGARWAL	6.879	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
804	1021403	VAMSHEDHAR REDDY C	7.247	Integrated Dual Degree (B.Tech. Process Engg. + M.B.A.)
805	1021000	ABHIMANYU	6.183	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
806	1021000	ABHINOV RAMAN	6.868	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
807	1021000	ALOK KATIYAR	7.329	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
808	1021000	ANCHAL TYAGI	8.457	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
809	1021000	ANKIT SHAKYA	8.493	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
810	1021000	ANUJ MINZ	5.685	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
811	1021000	ANURAG MEENA	5.753	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
812	1021000	ARCHIT TRICHAL	8.758	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
813	1021001	ARVIND SUTHAR	6.443	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
814	1021001	BHARDWAJ UDAY UMAKANT	7.79	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
815	1021001	BUKHYA VIJAY KUMAR	6.557	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
816	1021001	E VANI BHARANI ROJA	7.959	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
817	1021001	G PRASHANTH KUMAR	5.352	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
818	1011101	ISHANI GUPTA	9.091	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
819	1021001	ISHITA SINGH	6.064	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
820	1021001	KAPIL CHANDRA SUYAL	7.119	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
821	1021001	KEVAL PARETA	8.776	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
822	1021001	KUNAL ARORA	8.119	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
823	1021002	NAVEEN KUMAR MISHRA	8.201	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
824	1021002	NEHA MADAN	6.991	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
825	1021002	RISHABH GUPTA	8.808	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
826	1021002	SACHIN MEENA	6.251	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
827	1021002	SANDEEP DIVYAJYOTI	6.164	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)
828	1021002	SAURABH SAINI	7.836	Integrated Dual Degree (B.Tech. Chemical Engg. + M.Tech.)

Sl. No.						
872	1021200	RAJEEV RANJAN	7.904	First Division	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
873	1021200	RAVI BHUSHAN	8.648	First Division with	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
874	1021200	SUBHAM KUMAR SINGH	9.041	First Division with	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
875	1021201	SUSHANK KUMAR	6.977	First Division	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
876	1011809	TANYA SINHA	8.598	First Division with	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
877	1021201	TARACHANDANI SUKUN	7.315	First Division	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
878	1021201	TITIYA CHIRAG DILIPKUMAR	7.073	First Division	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
879	1021201	VIPIN KUMAR SINGH	6.612	First Division	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
880	1021201	VIPUL KUMAR	8.84	First Division with	Integrated Dual Degree (B.Tech. Electrical Engg. + M.Tech. Power	
881	1041000	ABHINAV SHARMA	5.022		Integrated M.Tech. (Geological Technology)	
882	1041000	ADITYA CHAKRAVARTY	7.29	First Division	Integrated M.Tech. (Geological Technology)	
883	1041000	AMIT KUMAR AGRAWAL	7.129	First Division	Integrated M.Tech. (Geological Technology)	
884	1041000	ANCHIT GUPTA	8.156	First Division	Integrated M.Tech. (Geological Technology)	
885	1041000	APURV	7.71	First Division	Integrated M.Tech. (Geological Technology)	
886	1041000	BADAL DUTT MATHUR	7.612	First Division	Integrated M.Tech. (Geological Technology)	
887	0941101	BONTHU YURI KASPOROV	5.067		Integrated M.Tech. (Geological Technology)	
888	1041000	DEEPAK RAWAT	6.576	First Division	Integrated M.Tech. (Geological Technology)	
889	1041001	DHRUV GAUR	8.737	First Division with	Integrated M.Tech. (Geological Technology)	
890	1041001	DINESH KUMAR	5.844		Integrated M.Tech. (Geological Technology)	
891	1041001	GAURAV KIRTI	6.094		Integrated M.Tech. (Geological Technology)	
892	1041001	HARSHUL KHANDELWAL	8.54	First Division with	Integrated M.Tech. (Geological Technology)	
893	1041001	HITENDRA SINGH PARIHAR	7.366	First Division	Integrated M.Tech. (Geological Technology)	
894	1041002	NAYINI PRIYANKA	5.996		Integrated M.Tech. (Geological Technology)	
895	0941001	PATTAPU CHAITANYA	5.031		Integrated M.Tech. (Geological Technology)	
896	1041002	PIYUSH KUMAR JAIN	7.598	First Division	Integrated M.Tech. (Geological Technology)	
897	1041002	ROHAN ARORA	7.183	First Division	Integrated M.Tech. (Geological Technology)	
898	1041002	ROHAN DHAR	7.397	First Division	Integrated M.Tech. (Geological Technology)	
899	1041002	SAHELI SARKAR	7.714	First Division	Integrated M.Tech. (Geological Technology)	
900	1041002	SARITA NANDWANI	9.018	First Division with	Integrated M.Tech. (Geological Technology)	
901	1041002	SHAUMIK DAITYARI	7.585	First Division	Integrated M.Tech. (Geological Technology)	
902	1041002	SHIVAM SHUKLA	5.107		Integrated M.Tech. (Geological Technology)	
903	1041002	SRISTHY DIXIT	8.469	First Division	Integrated M.Tech. (Geological Technology)	
904	1041003	STEPHY THOMAS	8.871	First Division with	Integrated M.Tech. (Geological Technology)	
905	0941002	SUKELA SYAM KRISHNA	5.857		Integrated M.Tech. (Geological Technology)	
906	1041003	VEER SINGH MEENA	6.732	First Division	Integrated M.Tech. (Geological Technology)	
907	1041100	AAYUSH GARG	9.067	First Division with	Integrated M.Tech. (Geophysical Technology)	
908	1041100	AKSHIT GOEL	8.707	First Division with	Integrated M.Tech. (Geophysical Technology)	
909	1041100	ALKESH GOYAL	7.862	First Division	Integrated M.Tech. (Geophysical Technology)	
910	1041100	AMIT PATRA	8.133	First Division	Integrated M.Tech. (Geophysical Technology)	
911	1041100	ANKIT KUMAR	5.169		Integrated M.Tech. (Geophysical Technology)	
912	1041100	ARUN KUMAR	5.262		Integrated M.Tech. (Geophysical Technology)	
913	1041100	CHETAN AGRAWAL	7.333	First Division	Integrated M.Tech. (Geophysical Technology)	
914	1041100	CHINMAY SAXENA	6.569	First Division	Integrated M.Tech. (Geophysical Technology)	

Sl. No.	Name	Programme	8.28	First Division	Integrated M. Tech. (Geophysical Technology)
915	1041101 DEEPANKAR SATYAVRAT	Integrated M. Tech. (Geophysical Technology)	8.28	First Division	Integrated M. Tech. (Geophysical Technology)
916	1041101 DISHANT SINGLA	Integrated M. Tech. (Geophysical Technology)	7.476	First Division	Integrated M. Tech. (Geophysical Technology)
917	1041101 JASBIR	Integrated M. Tech. (Geophysical Technology)	8.484	First Division	Integrated M. Tech. (Geophysical Technology)
918	1041101 KOMAL CHAUHAN	Integrated M. Tech. (Geophysical Technology)	7.28	First Division	Integrated M. Tech. (Geophysical Technology)
919	1041101 KUNDURU SANJANA	Integrated M. Tech. (Geophysical Technology)	7.827	First Division	Integrated M. Tech. (Geophysical Technology)
920	1041101 KUSHAGRA GOYAL	Integrated M. Tech. (Geophysical Technology)	6.324	First Division	Integrated M. Tech. (Geophysical Technology)
921	1041101 LAVIKA AGGARWAL	Integrated M. Tech. (Geophysical Technology)	7.618	First Division	Integrated M. Tech. (Geophysical Technology)
922	1041101 MUKESH BISWAS	Integrated M. Tech. (Geophysical Technology)	5.071		Integrated M. Tech. (Geophysical Technology)
923	1041101 PRASHANT NEGI	Integrated M. Tech. (Geophysical Technology)	5.587		Integrated M. Tech. (Geophysical Technology)
924	1041101 PRATIK VERMUN	Integrated M. Tech. (Geophysical Technology)	5.218		Integrated M. Tech. (Geophysical Technology)
925	1041102 PRAVESH JAIN	Integrated M. Tech. (Geophysical Technology)	7.84	First Division	Integrated M. Tech. (Geophysical Technology)
926	1041102 PRINCE GROVER	Integrated M. Tech. (Geophysical Technology)	7.413	First Division	Integrated M. Tech. (Geophysical Technology)
927	1041102 SHANBHAG AALOK GANESH	Integrated M. Tech. (Geophysical Technology)	8.36	First Division	Integrated M. Tech. (Geophysical Technology)
928	1041102 SHASHI KUMAR SUMAN	Integrated M. Tech. (Geophysical Technology)	6.24		Integrated M. Tech. (Geophysical Technology)
929	1041102 SIDDHARTH KEJRIWAL	Integrated M. Tech. (Geophysical Technology)	8.213	First Division	Integrated M. Tech. (Geophysical Technology)
930	1041102 SONAL TOPNO	Integrated M. Tech. (Geophysical Technology)	5.578		Integrated M. Tech. (Geophysical Technology)
931	1041102 SUNKESULA	Integrated M. Tech. (Geophysical Technology)	7.4	First Division	Integrated M. Tech. (Geophysical Technology)
932	1041102 SUREPALLI DEEPTHI	Integrated M. Tech. (Geophysical Technology)	6.751	First Division	Integrated M. Tech. (Geophysical Technology)
933	1041103 TANYA KOTHARI	Integrated M. Tech. (Geophysical Technology)	7.387	First Division	Integrated M. Tech. (Geophysical Technology)
934	1041103 TUPKAR SAGAR	Integrated M. Tech. (Geophysical Technology)	7.8	First Division	Integrated M. Tech. (Geophysical Technology)
935	1041103 VAIBHAV SONI	Integrated M. Tech. (Geophysical Technology)	7.947	First Division	Integrated M. Tech. (Geophysical Technology)
936	1041103 WAGH SAURABH DILIP	Integrated M. Tech. (Geophysical Technology)	8.351	First Division	Integrated M. Tech. (Geophysical Technology)
937	1031100 AMAN ABHISHEK	Integrated M. Sc. (Physics)	8.149	First Division	Integrated M. Sc. (Physics)
938	1031100 ANKIT AGARWAL	Integrated M. Sc. (Physics)	7.324	First Division	Integrated M. Sc. (Physics)
939	1031101 ASHMEET SINGH	Integrated M. Sc. (Physics)	9.405	First Division with	Integrated M. Sc. (Physics)
940	1031101 BHAWNA MOTWANI	Integrated M. Sc. (Physics)	8.5	First Division with	Integrated M. Sc. (Physics)
941	1031101 DHANUSH A HANGAL	Integrated M. Sc. (Physics)	7.488	First Division	Integrated M. Sc. (Physics)
942	1031101 NAVEEN	Integrated M. Sc. (Physics)	7.923	First Division	Integrated M. Sc. (Physics)
943	1031101 PUNEET JAIN	Integrated M. Sc. (Physics)	8.198	First Division	Integrated M. Sc. (Physics)
944	1031101 RAVAN ANIKET SHRIKANT	Integrated M. Sc. (Physics)	8.023	First Division	Integrated M. Sc. (Physics)
945	1031102 SATWIK	Integrated M. Sc. (Physics)	7.802	First Division	Integrated M. Sc. (Physics)
946	1031102 SHUBHAM JAIN	Integrated M. Sc. (Physics)	7.73	First Division	Integrated M. Sc. (Physics)
947	1031102 TUMMALA MEENAN REDDY	Integrated M. Sc. (Physics)	6.775	First Division	Integrated M. Sc. (Physics)
948	1031101 KANCHAN AGGARWAL	Integrated M. Sc. (Chemistry)	8.316	First Division	Integrated M. Sc. (Chemistry)
949	1031001 MOHINA GIDWANI	Integrated M. Sc. (Chemistry)	8.169	First Division	Integrated M. Sc. (Chemistry)
950	1031001 NAVJOT KAUR	Integrated M. Sc. (Chemistry)	6.225		Integrated M. Sc. (Chemistry)
951	1031002 VIMAL KUMAR SWARNKAR	Integrated M. Sc. (Chemistry)	6.013		Integrated M. Sc. (Chemistry)
952	1031200 ANIMESH MISHRA	Integrated M. Sc. (Applied Mathematics)	7.466	First Division	Integrated M. Sc. (Applied Mathematics)

Sl. No.	Roll No.	Name	7.43	First Division	Integrated M.Sc. (Applied Mathematics)
953	1031200	DIVYANSHU UPRETI	6.638	First Division	Integrated M.Sc. (Applied Mathematics)
954	1031200	HIMANSHU CHATURVEDI	6.787	First Division	Integrated M.Sc. (Applied Mathematics)
955	1031200	JANIKA GAHALOT	7.213	First Division	Integrated M.Sc. (Applied Mathematics)
956	1031201	KRISHNA CHAITANYA BANDI	6.67	First Division	Integrated M.Sc. (Applied Mathematics)
957	1031201	MOHINI MANGLA	6.063		Integrated M.Sc. (Applied Mathematics)
958	1031201	MUKUL JINDAL	6.122		Integrated M.Sc. (Applied Mathematics)
959	1031201	NITESH KUMAR	7.299	First Division	Integrated M.Sc. (Applied Mathematics)
960	1031201	PANKAJ RAHEJA	6.783	First Division	Integrated M.Sc. (Applied Mathematics)
961	1031201	PERURI ABHISHEK	8.629	First Division with	Integrated M.Sc. (Applied Mathematics)
962	1031201	PRATEEK MEHTA	8.552	First Division with	Integrated M.Sc. (Applied Mathematics)
963	1031201	PRIYA S	8.271	First Division	Integrated M.Sc. (Applied Mathematics)
964	1031202	SARASANI VISHAL REDDY	6.267		Integrated M.Sc. (Applied Mathematics)
965	1031202	SHUBHAM MEHTA	5.392		Integrated M.Tech. (Polymer Science and Technology)
966	1041200	ANIMESH CHANDRA	8.407	First Division	Integrated M.Tech. (Polymer Science and Technology)
967	1041200	ANUBHA MALAV	6.195		Integrated M.Tech. (Polymer Science and Technology)
968	1041200	CHUSHUL SURI	7.624	First Division	Integrated M.Tech. (Polymer Science and Technology)
969	1041200	DIVELA RAVI KIRAN	7.326	First Division	Integrated M.Tech. (Polymer Science and Technology)
970	1041201	KAPIL SHARMA	5.977		Integrated M.Tech. (Polymer Science and Technology)
971	1041201	MADDIRALA AVINASH	7.552	First Division	Integrated M.Tech. (Polymer Science and Technology)
972	1041201	N KRISHNAN	6.063		Integrated M.Tech. (Polymer Science and Technology)
973	1041201	NAVEEN KUMAR CHANDRA	7.344	First Division	Integrated M.Tech. (Polymer Science and Technology)
974	1041201	NIRAV GUPTA	7.67	First Division	Integrated M.Tech. (Polymer Science and Technology)
975	1041201	PANKAJ KUMAR	6.326		Integrated M.Tech. (Polymer Science and Technology)
976	1041202	PASUMARTHI	8.516	First Division with	Integrated M.Tech. (Polymer Science and Technology)
977	1041202	REHAN ALI PRADHAN	6.778	First Division	Integrated M.Tech. (Polymer Science and Technology)
978	1041202	SAILESH PASUMARTHI	6.86	First Division	Integrated M.Tech. (Polymer Science and Technology)
979	1041202	SANJAY KRISHNA	8.439	First Division	Integrated M.Tech. (Polymer Science and Technology)
980	1041202	SHARMA NIVEDITA ANUJ			Integrated M.Tech. (Polymer Science and Technology)

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List of Postgraduate Degree Recipients 2015

Sl. No.	NAME	MARKS	DIVISION	DEGREE
1	AINA MITTAL	7.588	First Division	Master of Architecture
2	ANIL KUMAR K.	7.5	First Division	Master of Architecture
3	ANKIT GUSAIN	7.471	First Division	Master of Architecture
4	DHIRUBAJYOTI SARDAR	8.559	First Division with Distinction	Master of Architecture
5	DILIP KUMAR G R	6.853	First Division	Master of Architecture
6	GULLAPALLI AMULYA	7.765	First Division	Master of Architecture
7	HARSIMRAN KAUR	8.529	First Division with Distinction	Master of Architecture
8	HUDHA ABDUL SALAM	7.441	First Division	Master of Architecture
9	KAMAL PASSI	7	First Division	Master of Architecture
10	LAKSHMI M.M.	7.5	First Division	Master of Architecture
11	NAMAN MIRAJIKAR	8.059	First Division	Master of Architecture
12	NEETU KAPOOR	8.059	First Division	Master of Architecture
13	RABI NARAYAN MOHANTY	7.676	First Division	Master of Architecture
14	SATHYAVIGNESH J	7.618	First Division	Master of Architecture
15	VENUS KASHYAP	7.912	First Division	Master of Architecture
16	VIJAY KUMAR VERMA	7.647	First Division	Master of Architecture
17	ADITI SHARMA	8.765	First Division with Distinction	Master of Urban and Rural Planning
18	AKHIL P	7.765	First Division	Master of Urban and Rural Planning
19	ANAND SINGH	7.324	First Division	Master of Urban and Rural Planning
20	ANSHUL PURIYA	6.765	First Division	Master of Urban and Rural Planning
21	ARJUN SATHEESH	7.225	First Division	Master of Urban and Rural Planning
22	ARVIND KUMAR	8.412	First Division	Master of Urban and Rural Planning
23	GARUD AMRUTA	8.471	First Division	Master of Urban and Rural Planning
24	HARDE SUMIT VILAS	6.794	First Division	Master of Urban and Rural Planning
25	INDERJEET SINGH SEERA	7.765	First Division	Master of Urban and Rural Planning
26	KUMAR ABHISHEK	7.735	First Division	Master of Urban and Rural Planning
27	MAHFUZAR RAHMAN	7.647	First Division	Master of Urban and Rural Planning
28	MANISH SHARMA	8	First Division	Master of Urban and Rural Planning

Item No.

Senate/62.3

29	13511012	RADHA KRISHAN	7.529	First Division	Master of Urban and Rural Planning
30	13511013	SANIL KUMAR	8.941	First Division with Distinction	Master of Urban and Rural Planning
31	13511014	SARIKA JAIN	7.412	First Division	Master of Urban and Rural Planning
32	13511015	SHAHNA SHAMIM	8.324	First Division	Master of Urban and Rural Planning
33	13511016	SHASHIKANT NISHANT	6.588	First Division	Master of Urban and Rural Planning
34	13511017	SONA PINGUA	7.206	First Division	Master of Urban and Rural Planning
35	13511018	TALABATHULA MADHAV	7.588	First Division	Master of Urban and Rural Planning
36	13511019	UDYAMA. C.R.	7.882	First Division	Master of Urban and Rural Planning
37	13511020	VAIBHAV KULSHRESTHA	7.706	First Division	Master of Urban and Rural Planning
38	13512001	AJAY KUMAR VERMA	7.576	First Division	M.Tech. Alternate Hydro Energy Systems
39	13512002	AKSHITA GUPTA	9.121	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
40	13512003	ANAND KUMAR JAISWAL	7.939	First Division	M.Tech. Alternate Hydro Energy Systems
41	13512004	ANU BHALLA	8.636	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
42	13512005	ANURAG YADAV	8.727	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
43	13512006	APPURVA APPAN	9.182	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
44	13512007	ASHIMA KRISHNA	8.818	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
45	13512008	BUDIGAPAKA NAGARAJU	6.697	First Division	M.Tech. Alternate Hydro Energy Systems
46	13512009	CHARU MITTAL	9.121	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
47	12512011	DEEPAK KUMAR SHARMA	7.515	First Division	M.Tech. Alternate Hydro Energy Systems
48	13512010	DISHA SAXENA	7.788	First Division	M.Tech. Alternate Hydro Energy Systems
49	13512011	HARSH	8.576	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
50	13512012	JAYNENDRA KUMAR	7.091	First Division	M.Tech. Alternate Hydro Energy Systems
51	13512013	KESHAV PANDEY	7.97	First Division	M.Tech. Alternate Hydro Energy Systems
52	13512014	KUNWAR SANGRAM SINGH	6.848	First Division	M.Tech. Alternate Hydro Energy Systems
53	13512015	MANISH KUMAR	8.242	First Division	M.Tech. Alternate Hydro Energy Systems
54	13512016	MANTOSH KUMAR PANDEY	8.424	First Division	M.Tech. Alternate Hydro Energy Systems
55	13512017	MD ZAFAR ALAM	7.333	First Division	M.Tech. Alternate Hydro Energy Systems
56	13512018	MUKESH GUPTA	8.939	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
57	12512019	NEHA PUROHIT	8.636	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
58	13512019	NIKUNJ TOMAR	9.667	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
59	13512020	P.V.V. PAWAN KUMAR	6.545	First Division	M.Tech. Alternate Hydro Energy Systems
60	13512021	PALLAVI BEHERA	8.939	First Division with Distinction	M.Tech. Alternate Hydro Energy Systems
61	13512022	PRAGATI SHINDE	7.788	First Division	M.Tech. Alternate Hydro Energy Systems
62	13512024	PRASHANT KUMAR SINGH	6.364		M.Tech. Alternate Hydro Energy Systems

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63	13512025	PRASHNAJIT BEHERA	8	First Division	M. Tech. Alternate Hydro Energy Systems
64	13512026	RAJ KUMAR BAIRWA	7.394	First Division	M. Tech. Alternate Hydro Energy Systems
65	13512027	RAJESH KUMAR	7.394	First Division	M. Tech. Alternate Hydro Energy Systems
66	13512029	SACHIN KUMAR	7.03	First Division	M. Tech. Alternate Hydro Energy Systems
67	13512034	SANTOSH CHAUDHARY	7.333	First Division	M. Tech. Alternate Hydro Energy Systems
68	13512030	SHIVANSH TYAGI	7.061	First Division	M. Tech. Alternate Hydro Energy Systems
69	13512031	SUMER CHAND PRASAD	8.515	First Division with Distinction	M. Tech. Alternate Hydro Energy Systems
70	13512035	VIDYA PRASAD KAFLE	8.273	First Division	M. Tech. Alternate Hydro Energy Systems
71	13512032	VINEET KAUR	8.879	First Division with Distinction	M. Tech. Alternate Hydro Energy Systems
72	13512033	VINEET KUMAR RANA	7.182	First Division	M. Tech. Alternate Hydro Energy Systems
73	12512030	YOGESH KUMAR	8.697	First Division with Distinction	M. Tech. Alternate Hydro Energy Systems
74	13513001	AKANKSHA KAUSHAL	7.928	First Division	M. Tech. Environmental Management of Rivers and Lakes
75	13513002	ASEEM PAL SINGH	7.58	First Division	M. Tech. Environmental Management of Rivers and Lakes
76	13513003	GHONE ABHIJEET SURESH	8.304	First Division	M. Tech. Environmental Management of Rivers and Lakes
77	13513004	KARTHIK KUMAR C	8.232	First Division	M. Tech. Environmental Management of Rivers and Lakes
78	13513005	KRITIKA KAUSHIK	8.116	First Division	M. Tech. Environmental Management of Rivers and Lakes
79	13513006	PARUL BARANWAL	8.029	First Division	M. Tech. Environmental Management of Rivers and Lakes
80	13513007	POORAN SINGH PATWAL	7.493	First Division	M. Tech. Environmental Management of Rivers and Lakes
81	13513008	RUBY RAJU	7.507	First Division	M. Tech. Environmental Management of Rivers and Lakes
82	13513009	SAURABH MISHRA	7.638	First Division	M. Tech. Environmental Management of Rivers and Lakes
83	13513010	SRAVANTHI ANIMIREDDY	8.812	First Division with Distinction	M. Tech. Environmental Management of Rivers and Lakes
84	13513011	SURBHI TAK	8.768	First Division with Distinction	M. Tech. Environmental Management of Rivers and Lakes
85	13513012	VIRENDER SINGH	7.986	First Division	M. Tech. Environmental Management of Rivers and Lakes
86	13514001	AKSHAY KUMAR	7.515	First Division	M. Tech. Computer Aided Process Plant Design
87	13514002	AMIT KUMAR	7.515	First Division	M. Tech. Computer Aided Process Plant Design
88	13514004	ARUN P	8.697	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
89	13514006	ATIYA BANERJEE	9.227	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
90	13514007	BHAN PRAKASH	6.515	First Division	M. Tech. Computer Aided Process Plant Design
91	13514008	DEVYANI VARSHNEY	9.864	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
92	13514009	GARIMA VISHAL	7.545	First Division	M. Tech. Computer Aided Process Plant Design
93	13514010	JYOTI TOMAR	8.53	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
94	13514011	KRISHNA MOHAN TRIPATHI	7.409	First Division	M. Tech. Computer Aided Process Plant Design
95	13514012	KULDEEP SINGH	6.106		M. Tech. Computer Aided Process Plant Design
96	13514013	MANI RATTAN SINGH	7.409	First Division	M. Tech. Computer Aided Process Plant Design

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97	13514014	MANNE SAI TEJA	8.333	First Division	M. Tech. Computer Aided Process Plant Design
98	13514015	MANOHAR PRASAD	6.697	First Division	M. Tech. Computer Aided Process Plant Design
99	13514016	NEELAM	8.97	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
100	13514017	RACHITHA D SOUZA	9.242	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
101	13514018	ROHIT KUMAR	6.848	First Division	M. Tech. Computer Aided Process Plant Design
102	13514019	SALMAN ZAFAR	9.318	First Division with Distinction	M. Tech. Computer Aided Process Plant Design
103	13514021	SHASHANK TANDON	7.652	First Division	M. Tech. Computer Aided Process Plant Design
104	13514025	UPENDER KUMAR	7.015	First Division	M. Tech. Computer Aided Process Plant Design
105	13514026	VIKAS KUMAR	6.606	First Division	M. Tech. Computer Aided Process Plant Design
106	13514027	VINEET KUMAR	8.015	First Division	M. Tech. Computer Aided Process Plant Design
107	13514028	VISHAL BARANWAL	6.439		M. Tech. Computer Aided Process Plant Design
108	13515001	ABHISHEK RATNA	6.894	First Division	M. Tech. Industrial Pollution Abatement
109	13515002	AL AMEEN A	8.03	First Division	M. Tech. Industrial Pollution Abatement
110	13515004	AMIT KUMAR	7.606	First Division	M. Tech. Industrial Pollution Abatement
111	13515005	AMIT SINGH	7.742	First Division	M. Tech. Industrial Pollution Abatement
112	13515006	ANIRUDH	7.091	First Division	M. Tech. Industrial Pollution Abatement
113	13515008	ANUPAMA KUMARI	7.985	First Division	M. Tech. Industrial Pollution Abatement
114	13515009	ANURAG KUMAR SINGH	7.515	First Division	M. Tech. Industrial Pollution Abatement
115	13515010	ASHISH KUMAR	7.955	First Division	M. Tech. Industrial Pollution Abatement
116	13515011	BHAVANA SAHU	9.667	First Division with Distinction	M. Tech. Industrial Pollution Abatement
117	13515012	BHUWAN BHASKAR	7.273	First Division	M. Tech. Industrial Pollution Abatement
118	13515013	DILEEP KUMAR DOHARE	7.576	First Division	M. Tech. Industrial Pollution Abatement
119	13515014	DIPAYAN LODH	7.242	First Division	M. Tech. Industrial Pollution Abatement
120	12515009	GAURAV	6.258		M. Tech. Industrial Pollution Abatement
121	13515015	LAXMI SETHI	7.455	First Division	M. Tech. Industrial Pollution Abatement
122	13515016	MYLAPILLI S V PRASAD	7.712	First Division	M. Tech. Industrial Pollution Abatement
123	13515017	NEERAJ P	8.848	First Division with Distinction	M. Tech. Industrial Pollution Abatement
124	13515018	NIKITA SINGH	8.091	First Division	M. Tech. Industrial Pollution Abatement
125	13515020	PUSHPENDER SINGH	7.652	First Division	M. Tech. Industrial Pollution Abatement
126	13515021	RAM SINGH	8.773	First Division with Distinction	M. Tech. Industrial Pollution Abatement
127	13515022	SANJAY GAUTAM	8.061	First Division	M. Tech. Industrial Pollution Abatement
128	13515023	SHWETA GARG	8.682	First Division with Distinction	M. Tech. Industrial Pollution Abatement
129	13515024	VENKATARAMAN N V	8.742	First Division with Distinction	M. Tech. Industrial Pollution Abatement
130	13515025	VIKASH SINGH	7.591	First Division	M. Tech. Industrial Pollution Abatement

131	13515026	VIKKY ANAND	9.106	First Division with Distinction	M. Tech. Industrial Pollution Abatement
132	13516001	ABHISHEK MALIK	7.485	First Division	M. Tech. Industrial Safety & Hazards Management
133	13516002	AMAN KUMAR MISHRA	7.515	First Division	M. Tech. Industrial Safety & Hazards Management
134	13516003	AMITA GAHANOLIA	7.515	First Division	M. Tech. Industrial Safety & Hazards Management
135	12516003	ASHISH KUMAR	6.712	First Division	M. Tech. Industrial Safety & Hazards Management
136	13516005	BABLOO KUMAR	7.636	First Division	M. Tech. Industrial Safety & Hazards Management
137	13516007	KUWAR SINGH	7.47	First Division	M. Tech. Industrial Safety & Hazards Management
138	13516008	MD. SHADAB ALAM	7.833	First Division	M. Tech. Industrial Safety & Hazards Management
139	13516009	NAVEEN SAMAD A.M.	7	First Division	M. Tech. Industrial Safety & Hazards Management
140	13516010	PRADEEP KUMAR GUPTA	7.121	First Division	M. Tech. Industrial Safety & Hazards Management
141	13516011	PRAGATI GUPTA	8.848	First Division with Distinction	M. Tech. Industrial Safety & Hazards Management
142	13516012	PUSHPENDRA KUMAR	7.439	First Division	M. Tech. Industrial Safety & Hazards Management
143	13516014	YASH VARDHAN PORWAL	6.712	First Division	M. Tech. Industrial Safety & Hazards Management
144	13517002	ANKIT AGARWAL	6.242		M. Tech. Building Technology
145	13517004	APARNA. K.P.	8.333	First Division	M. Tech. Building Technology
146	13517007	ILYAS HUSSAIN P K	7.515	First Division	M. Tech. Building Technology
147	13517010	NANDU S PRASAD	7.97	First Division	M. Tech. Building Technology
148	13517012	PARGHI HITESHKUMAR	7.485	First Division	M. Tech. Building Technology
149	12517013	R ROHIT	6.576	First Division	M. Tech. Building Technology
150	13517013	RANJEET DEVIDAS RAMTEKE	7.061	First Division	M. Tech. Building Technology
151	13517017	SWATHY MANOHAR	8.515	First Division with Distinction	M. Tech. Building Technology
152	13517018	VIPUL PARKASH	6.576	First Division	M. Tech. Building Technology
153	13519004	AYUSH WALIA	8.791	First Division with Distinction	M. Tech. Environmental Engineering
154	13519005	DEEPAK KUMAR JAIN	7.612	First Division	M. Tech. Environmental Engineering
155	13519006	DEEPAK SUYAL	8.806	First Division with Distinction	M. Tech. Environmental Engineering
156	12519005	DEVENDRA KUMAR	7.358	First Division	M. Tech. Environmental Engineering
157	13519007	HEMANT CHANDOLA	7.478	First Division	M. Tech. Environmental Engineering
158	13519008	LOKESH KUMAR VERMA	8.418	First Division	M. Tech. Environmental Engineering
159	13519010	MARSHAL KUMAR	8.104	First Division	M. Tech. Environmental Engineering
160	13519011	MOHIT GUPTA	7.612	First Division	M. Tech. Environmental Engineering
161	13519013	NEELAM GUNJAL	7.955	First Division	M. Tech. Environmental Engineering
162	13519014	PANKAJ BANYAL	8.284	First Division	M. Tech. Environmental Engineering
163	13519015	RAJA SONAL ANAND	8.179	First Division	M. Tech. Environmental Engineering
164	13519016	RATHOD HARSHADKUMAR	8.269	First Division	M. Tech. Environmental Engineering

165	13519017	RENUKA	8.015	First Division	M. Tech. Environmental Engineering
166	13519018	SANDEEP SAXENA	8.612	First Division with Distinction	M. Tech. Environmental Engineering
167	13519019	SHUBHAM PATEL	7.373	First Division	M. Tech. Environmental Engineering
168	12519017	SURAJ VERMA	7.641	First Division	M. Tech. Environmental Engineering
169	13519021	VIKAS CHAUHAN	8.045	First Division	M. Tech. Environmental Engineering
170	13519022	VISHAL SINGH	9.239	First Division with Distinction	M. Tech. Environmental Engineering
171	13520001	AJAY KUMAR	6.529	First Division	M. Tech. Geomatics Engineering
172	13520002	ANIMESH SINGH	7.441	First Division	M. Tech. Geomatics Engineering
173	13520003	ANKUR GOYAL	8.235	First Division	M. Tech. Geomatics Engineering
174	13520004	AVINASH KUMAR SINGH	7.382	First Division	M. Tech. Geomatics Engineering
175	13520005	DEEN DAYAL	6.647	First Division	M. Tech. Geomatics Engineering
176	13520006	GAURAV KUMAR MISHRA	7.441	First Division	M. Tech. Geomatics Engineering
177	13520007	LAXMAN SINGH KHANGAROT	8.206	First Division	M. Tech. Geomatics Engineering
178	13520009	NANDINI VARSHNEY	8.941	First Division with Distinction	M. Tech. Geomatics Engineering
179	13520010	NEHA JAGTAP	7.265	First Division	M. Tech. Geomatics Engineering
180	13520012	RAKESH KUMAR VERMA	6.559	First Division	M. Tech. Geomatics Engineering
181	13520014	SUMIT SHARMA	7.265	First Division	M. Tech. Geomatics Engineering
182	13520015	SURESH SINGH	9.206	First Division with Distinction	M. Tech. Geomatics Engineering
183	13520016	TANVIR SINGH MARWAH	8.676	First Division with Distinction	M. Tech. Geomatics Engineering
184	13520017	VISHAL SAINI	8.971	First Division with Distinction	M. Tech. Geomatics Engineering
185	13520018	WRICK HOM CHOUDHURY	7.206	First Division	M. Tech. Geomatics Engineering
186	13521001	AASHIQ HUSSAIN GANAIE	8.909	First Division with Distinction	M. Tech. Geotechnical Engineering
187	13521002	ABHISHEK SAINI	7.333	First Division	M. Tech. Geotechnical Engineering
188	13521004	ALLA KRANTHIKUMARREDDY	8.606	First Division with Distinction	M. Tech. Geotechnical Engineering
189	13521005	ANAMIKA	7.667	First Division	M. Tech. Geotechnical Engineering
190	13521006	ANKIT KACHHAL	7.152	First Division	M. Tech. Geotechnical Engineering
191	13521008	CHINTAMANI GUPTA	8.121	First Division	M. Tech. Geotechnical Engineering
192	13521009	DIANA ALICE SUGUNAN	7.545	First Division	M. Tech. Geotechnical Engineering
193	12521012	FAIZAN NOOR	7.182	First Division	M. Tech. Geotechnical Engineering
194	13521019	PRITI MAURYA	6.515	First Division	M. Tech. Geotechnical Engineering
195	13521020	RICHA MUDLIAR	7.121	First Division	M. Tech. Geotechnical Engineering
196	12521021	SADASHIV CHOUHAN	6.364		M. Tech. Geotechnical Engineering
197	13521022	SOUKAT KUMAR DAS	8.545	First Division with Distinction	M. Tech. Geotechnical Engineering
198	13521023	SUKLESWAR BORO	7.727	First Division	M. Tech. Geotechnical Engineering

199	12521024	SUNIL KUMAR	6.879	First Division	M. Tech. Geotechnical Engineering
200	13522001	ADITYA GUPTA	8	First Division	M. Tech. Hydraulic Engineering
201	13522002	ALOK KUMAR SAMANTARAY	8.333	First Division	M. Tech. Hydraulic Engineering
202	13522003	AMIT KUMAR	7.576	First Division	M. Tech. Hydraulic Engineering
203	13522004	ANGAD KUMAR SHARMA	8.152	First Division	M. Tech. Hydraulic Engineering
204	13522005	ICKKSHAANSHU SONKAR	9.121	First Division with Distinction	M. Tech. Hydraulic Engineering
205	13522006	JAYA BHATT	9	First Division with Distinction	M. Tech. Hydraulic Engineering
206	13522007	K RAJSEKHAR	8.03	First Division	M. Tech. Hydraulic Engineering
207	13522008	MANISH KUMAR MALL	7.848	First Division	M. Tech. Hydraulic Engineering
208	13522009	MANISH SHUKLA	8.97	First Division with Distinction	M. Tech. Hydraulic Engineering
209	13522010	PREETY VERMA	8.697	First Division with Distinction	M. Tech. Hydraulic Engineering
210	13522011	RAVINDRA KUMAR SINGH	7.152	First Division	M. Tech. Hydraulic Engineering
211	13522013	SHUBHAM TRIVEDI	8.606	First Division with Distinction	M. Tech. Hydraulic Engineering
212	13522014	UTTAM KUMAR	8.515	First Division with Distinction	M. Tech. Hydraulic Engineering
213	13522015	VIJIT RATHORE	8.606	First Division with Distinction	M. Tech. Hydraulic Engineering
214	12522019	VIPIN SHARMA	8.788	First Division with Distinction	M. Tech. Hydraulic Engineering
215	13523002	ANUJ SAURABH	8.97	First Division with Distinction	M. Tech. Structural Engineering
216	13523004	CHANDALURI TEJA KUMAR	8.212	First Division	M. Tech. Structural Engineering
217	13523007	HEMAM PRASANTA SINGH	7.424	First Division	M. Tech. Structural Engineering
218	12523012	MOHAMMAD AZAM WARIS	7.818	First Division	M. Tech. Structural Engineering
219	13517009	MUSTESIN ALI KHAN	8.394	First Division	M. Tech. Structural Engineering
220	12523014	PAPPU TEJASWINI	7.97	First Division	M. Tech. Structural Engineering
221	13523011	PRADEEP SINGH	7.97	First Division	M. Tech. Structural Engineering
222	13523012	RAJESH JUYAL	7.455	First Division	M. Tech. Structural Engineering
223	13523013	RAVINDER AHLAWAT	7.727	First Division	M. Tech. Structural Engineering
224	13523016	SAURABH DUTT	6.182		M. Tech. Structural Engineering
225	13523017	SAURABH TARIYAL	7.576	First Division	M. Tech. Structural Engineering
226	13523018	SHREYANS KANSWA	7.364	First Division	M. Tech. Structural Engineering
227	13523019	SONU RAJAK	7.818	First Division	M. Tech. Structural Engineering
228	13523020	SUKHWINDER SINGH	7.606	First Division	M. Tech. Structural Engineering
229	13523021	TAMANARI VARAHALA BABU	7	First Division	M. Tech. Structural Engineering
230	12524001	AJIT KUMAR CHAUDHARY	6.273		M. Tech. Transportation Engineering
231	13524002	AMIT DUBEY	8.727	First Division with Distinction	M. Tech. Transportation Engineering
232	12524003	ANKIT VERMA	8.545	First Division with Distinction	M. Tech. Transportation Engineering

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233	13524003	ANSHU BAMNEY	8.212	First Division	M. Tech. Transportation Engineering
234	13524004	ANSHUMAN CHOWDHARY	8.636	First Division with Distinction	M. Tech. Transportation Engineering
235	13524005	ANSHUMAN SHARMA	9.061	First Division with Distinction	M. Tech. Transportation Engineering
236	13524006	ASHISH WALIA	8.061	First Division	M. Tech. Transportation Engineering
237	13524007	BHASKAR PRATIM DAS	7.97	First Division	M. Tech. Transportation Engineering
238	13524010	GAURAV SINGH	9.788	First Division with Distinction	M. Tech. Transportation Engineering
239	13524012	GYANDEEP BHUMARKAR	8.091	First Division	M. Tech. Transportation Engineering
240	13524013	JAGBIR SINGH KALRA	7.182	First Division	M. Tech. Transportation Engineering
241	13524014	MADHUSOODAN SHARMA	6.939	First Division	M. Tech. Transportation Engineering
242	13524015	MOHAMMED WASIM AKHTAR	6.515	First Division	M. Tech. Transportation Engineering
243	13524016	NAVEEN KUMAR	8.061	First Division	M. Tech. Transportation Engineering
244	12524013	NIKHIL KUMAR SHRIVASTAV	7.515	First Division	M. Tech. Transportation Engineering
245	13524017	PRIYAMOL R	7.606	First Division	M. Tech. Transportation Engineering
246	13524018	RAJEEV DHINGRA	8.758	First Division with Distinction	M. Tech. Transportation Engineering
247	13524019	SHIVRAJ SINGH MEENA	7.848	First Division	M. Tech. Transportation Engineering
248	13524020	SHOBHIT TIWARI	8.485	First Division	M. Tech. Transportation Engineering
249	13524023	SUSHIL KUMAR SINGH	7.545	First Division	M. Tech. Transportation Engineering
250	13524024	SYED RAGIB ALI	8.394	First Division	M. Tech. Transportation Engineering
251	13524025	VED PRAKASH	8.273	First Division	M. Tech. Transportation Engineering
252	12525002	AMBEY SHARMA	6.727	First Division	M. Tech. Soil Dynamic
253	13525001	ANKIT AGARWAL	7.121	First Division	M. Tech. Soil Dynamic
254	13525003	ATISHAY BAJAJ JAIN	7.394	First Division	M. Tech. Soil Dynamic
255	13525004	DEEPIKA SAYANA	6.97	First Division	M. Tech. Soil Dynamic
256	13525005	DESAI ANIKET SANJAY	7.576	First Division	M. Tech. Soil Dynamic
257	13525006	DIVYA VARKEY	9.636	First Division with Distinction	M. Tech. Soil Dynamic
258	13525008	HITENDER KADIAN	8.091	First Division	M. Tech. Soil Dynamic
259	13525010	MARTAND PRAKASH	6.576	First Division	M. Tech. Soil Dynamic
260	13525011	MEGHA MISHRA	7.848	First Division	M. Tech. Soil Dynamic
261	13525012	MOHIT KUMAR SINGH	7.606	First Division	M. Tech. Soil Dynamic
262	13525013	NILAY R. MOHGAONKAR	8.061	First Division	M. Tech. Soil Dynamic
263	13525014	RAHUL SINGH	7.848	First Division	M. Tech. Soil Dynamic
264	13525015	RITESH KUMAR	8.818	First Division with Distinction	M. Tech. Soil Dynamic
265	13525016	RUCHIKA SAINI	7.848	First Division	M. Tech. Soil Dynamic
266	13525018	SHIVADITYA A	6.788	First Division	M. Tech. Soil Dynamic

267	13526001	ABHISHEK SINGH	6.394		M. Tech. Structural Dynamics
268	13526002	ABIR MANDAL	8.212	First Division	M. Tech. Structural Dynamics
269	13526003	ADARSH S	8.121	First Division	M. Tech. Structural Dynamics
270	13526004	AHMED BILAL	7.394	First Division	M. Tech. Structural Dynamics
271	13526006	BANTUPALLI VEERA PAVAN	8.091	First Division	M. Tech. Structural Dynamics
272	13526007	BATTA JAYA NAGA SATISH	8.636	First Division with Distinction	M. Tech. Structural Dynamics
273	13526009	DHANASHREE MAHENDRA	7.606	First Division	M. Tech. Structural Dynamics
274	13526010	DIPANJAN MUKHERJEE	7.788	First Division	M. Tech. Structural Dynamics
275	13526011	DOMADA VEERA VENKATA	7.727	First Division	M. Tech. Structural Dynamics
276	13526012	GAURAV SHARMA	7.455	First Division	M. Tech. Structural Dynamics
277	13526013	GOVIND GAURAV	8.455	First Division	M. Tech. Structural Dynamics
278	13526014	GURURAJAN	7.273	First Division	M. Tech. Structural Dynamics
279	13526015	GYANENDRA PRAKASH	6.758	First Division	M. Tech. Structural Dynamics
280	13526016	HARISH KUMAR S N	8.212	First Division	M. Tech. Structural Dynamics
281	13526019	M J MAHESH	9.545	First Division with Distinction	M. Tech. Structural Dynamics
282	13526020	MOHAMMAD HAROON	8.242	First Division	M. Tech. Structural Dynamics
283	13526021	MOHD. AAMIR KHAN	7.697	First Division	M. Tech. Structural Dynamics
284	13526022	MUHAMMAD ASLAM	7	First Division	M. Tech. Structural Dynamics
285	13526023	NABEEL AHMED KHAN	8.03	First Division	M. Tech. Structural Dynamics
286	13526024	NARINGREKAR AMEY	8.485	First Division	M. Tech. Structural Dynamics
287	13526025	PARLA RAJESH	7.242	First Division	M. Tech. Structural Dynamics
288	13526026	SAJAL	7.364	First Division	M. Tech. Structural Dynamics
289	13526027	SARIDE ANVESH	9.606	First Division with Distinction	M. Tech. Structural Dynamics
290	13526030	SHIVANG SHEKHAR	8.636	First Division with Distinction	M. Tech. Structural Dynamics
291	13526031	VIJAY KUMAR	6.545	First Division	M. Tech. Structural Dynamics
292	13553001	ABHISHEK KUMAR	7.333	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
293	13553002	ASHISH VISHNOI	9	First Division with Distinction	M. Tech. Seismic Vulnerability and Risk Assessment
294	13553003	G NAVYA	8.697	First Division with Distinction	M. Tech. Seismic Vulnerability and Risk Assessment
295	13553004	HRISHIKESH DUBEY	7.636	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
296	13553005	ISHAN ROY	7.424	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
297	13553006	KOTHAPALLI VENKATA	8.303	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
298	13553007	MOHAMMAD AMIR	7.242	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
299	13553008	MIRADUL SACHAN	7.667	First Division	M. Tech. Seismic Vulnerability and Risk Assessment
300	13553009	PHIBE KHALKHO	7.515	First Division	M. Tech. Seismic Vulnerability and Risk Assessment

301	13553010	POOJA SAINI	8.424	First Division	M.Tech. Seismic Vulnerability and Risk Assessment
302	13553011	RAJARSHI DAS	9.394	First Division with Distinction	M.Tech. Seismic Vulnerability and Risk Assessment
303	13553012	RISHI KUMAR	6.636	First Division	M.Tech. Seismic Vulnerability and Risk Assessment
304	13553013	SHOBHIT SRIVASTAVA	7.667	First Division	M.Tech. Seismic Vulnerability and Risk Assessment
305	12553010	SMITA SINGH	8.152	First Division	M.Tech. Seismic Vulnerability and Risk Assessment
306	13553014	SOUMYA	8.879	First Division with Distinction	M.Tech. Seismic Vulnerability and Risk Assessment
307	13553015	TABISH ALI	8	First Division	M.Tech. Seismic Vulnerability and Risk Assessment
308	12527004	ANUPAM CHOUDHARY	6.242		M.Tech. Electric Drives and Power Electronics
309	12527006	DEEPAK KUMAR	6.212		M.Tech. Electric Drives and Power Electronics
310	13527007	GAURAV MODI	8.455	First Division	M.Tech. Electric Drives and Power Electronics
311	13527010	HARSHIT AGARWAL	7.788	First Division	M.Tech. Electric Drives and Power Electronics
312	13527011	K GNANA PRASAD	7.545	First Division	M.Tech. Electric Drives and Power Electronics
313	13527013	KAMODULA LOKESWARA	5.909		M.Tech. Electric Drives and Power Electronics
314	12527010	MANISH KUMAR SAHU	6.576	First Division	M.Tech. Electric Drives and Power Electronics
315	13527015	MOTHE RAVI KIRAN	6.485		M.Tech. Electric Drives and Power Electronics
316	13527016	PRABIN KUMAR SINGH	7.97	First Division	M.Tech. Electric Drives and Power Electronics
317	13527018	SAURABH KUMAR	8.515	First Division with Distinction	M.Tech. Electric Drives and Power Electronics
318	13527020	SUNEEL KUMAR AGRAWAL	7.909	First Division	M.Tech. Electric Drives and Power Electronics
319	13527022	VIJAY SINGH CHAUHAN	8.03	First Division	M.Tech. Electric Drives and Power Electronics
320	12528002	AMBER SINGH	7.212	First Division	M.Tech. Instrumentation and Signal Processing
321	13528001	AMIR IMAM	6.636	First Division	M.Tech. Instrumentation and Signal Processing
322	11528003	ANSHUL SUNERI	7.697	First Division	M.Tech. Instrumentation and Signal Processing
323	13528003	JASPREET KAUR	8.485	First Division	M.Tech. Instrumentation and Signal Processing
324	13528005	JINTI HAZARIKA	8.182	First Division	M.Tech. Instrumentation and Signal Processing
325	13528006	KARAN SAREEN	8.788	First Division with Distinction	M.Tech. Instrumentation and Signal Processing
326	13528007	KULDEEP KUMAR CHAUHAN	7.394	First Division	M.Tech. Instrumentation and Signal Processing
327	13528008	MANJINDER SINGH	6.182		M.Tech. Instrumentation and Signal Processing
328	13528009	MEHTA SANJAY KUMAR	7.939	First Division	M.Tech. Instrumentation and Signal Processing
329	13528010	MOHAMMAD IKRAM	8.121	First Division	M.Tech. Instrumentation and Signal Processing
330	13528012	NAVKIRAN BRAR	8.576	First Division with Distinction	M.Tech. Instrumentation and Signal Processing
331	13528013	NIKHIL JAMNADAS	7.061	First Division	M.Tech. Instrumentation and Signal Processing
332	13528015	PARVEEN KUMAR	8.6	First Division with Distinction	M.Tech. Instrumentation and Signal Processing
333	12528016	RAJEEV RANJAN	8.121	First Division	M.Tech. Instrumentation and Signal Processing
334	13528016	RAVI	6.152		M.Tech. Instrumentation and Signal Processing

335	13528017	REDDIPALLI BHARGAV	7.879	First Division	M. Tech. Instrumentation and Signal Processing
336	13528018	SACHIN PANDEY	7.424	First Division	M. Tech. Instrumentation and Signal Processing
337	13528019	SANTHAPURI PRASAD	6.97	First Division	M. Tech. Instrumentation and Signal Processing
338	13528022	SOM DATT	8.182	First Division	M. Tech. Instrumentation and Signal Processing
339	13528024	UDIT BANGAR	5.788		M. Tech. Instrumentation and Signal Processing
340	13528027	YERGE UMAKANT	8.576	First Division with Distinction	M. Tech. Instrumentation and Signal Processing
341	13529003	ANURAG SRIVASTAVA	7.606	First Division	M. Tech. Power System Engineering
342	13529005	ATUL KUMAR MAURYA	6.394		M. Tech. Power System Engineering
343	12529005	CHANDAN KUMAR	7.242	First Division	M. Tech. Power System Engineering
344	12529006	CHETNA VERMA	6.909	First Division	M. Tech. Power System Engineering
345	12529007	DEVVRAT MISHRA	6.879	First Division	M. Tech. Power System Engineering
346	13529008	FIRDOUS UL NAZIR	9.455	First Division with Distinction	M. Tech. Power System Engineering
347	13529010	GUNJAN	7.697	First Division	M. Tech. Power System Engineering
348	13529011	KOTA SAI SASANK	9.061	First Division with Distinction	M. Tech. Power System Engineering
349	13529012	LALIT KUMAR	5.879		M. Tech. Power System Engineering
350	13529013	LAV KUMAR KHANDLWAL	6.121		M. Tech. Power System Engineering
351	13529014	MADAN MOHAN SAHU	7.424	First Division	M. Tech. Power System Engineering
352	12529010	NAVEEN SINGH	7.212	First Division	M. Tech. Power System Engineering
353	13529015	NIDHI GUPTA	8.333	First Division	M. Tech. Power System Engineering
354	13529016	NITISH VERMA	7.727	First Division	M. Tech. Power System Engineering
355	13529017	PAWAN KUMAR GUPTA	7.848	First Division	M. Tech. Power System Engineering
356	13529018	PAWAR BANDOPANT	9	First Division with Distinction	M. Tech. Power System Engineering
357	13529019	PRIYANJAN PANDEY	7.152	First Division	M. Tech. Power System Engineering
358	13529020	RAHUL SHARMA	7.273	First Division	M. Tech. Power System Engineering
359	13529021	SACHIN KUMAR	6.606	First Division	M. Tech. Power System Engineering
360	13529023	SHEJUL KUNAL	7.667	First Division	M. Tech. Power System Engineering
361	13530001	AADITYA PRAKASH	7.606	First Division	M. Tech. System and Control
362	13530002	ANOOP CHERIAN THOMAS	7.831	First Division	M. Tech. System and Control
363	13530006	ANURAG BHARDWAJ	7	First Division	M. Tech. System and Control
364	13530008	AUSAF AHMAD	7.545	First Division	M. Tech. System and Control
365	12530008	BHARAT SHARMA	8.53	First Division with Distinction	M. Tech. System and Control
366	13530009	DIVIYA DURAIRAJ VASANTHI	7.333	First Division	M. Tech. System and Control
367	13530011	JANGAM SURESH	7.758	First Division	M. Tech. System and Control
368	13530012	KAUSHIK MALLIK	9.692	First Division with Distinction	M. Tech. System and Control

369	13530015	MAYANK VISHVAKARMA	7.242	First Division	M. Tech. System and Control
370	12530018	NISIT KUMAR GUPTA	8.091	First Division	M. Tech. System and Control
371	13530016	PRAFULL SEN SINGH	6.818	First Division	M. Tech. System and Control
372	13530017	PRATYUSHA PRATIK	7.515	First Division	M. Tech. System and Control
373	13530019	SACHIN	8.061	First Division	M. Tech. System and Control
374	12530023	SANDEEP KUMAR	8.879	First Division with Distinction	M. Tech. System and Control
375	13530020	SATISH KUMAR	6.97	First Division	M. Tech. System and Control
376	13530022	SWAGATIKA PANIGRAHI	7.879	First Division	M. Tech. System and Control
377	13530023	VIPIN TIWARI	8.03	First Division	M. Tech. System and Control
378	13531002	AJAY MATHEW	7.361	First Division	M. Tech. Communication Engineering
379	13531003	DEEPIKA GUPTA	8.115	First Division	M. Tech. Communication Engineering
380	13531004	FIROZ AHMED KHAN	7.049	First Division	M. Tech. Communication Engineering
381	13531005	GULSHAN KUMAR	6.852	First Division	M. Tech. Communication Engineering
382	13531006	JITENDRA KUMAR	9	First Division with Distinction	M. Tech. Communication Engineering
383	13531007	KUNAL SONI	8.459	First Division	M. Tech. Communication Engineering
384	13531008	LAVEEN BAKSHI	8.557	First Division with Distinction	M. Tech. Communication Engineering
385	13531010	MARAPAREDDY DAMODAR	8.721	First Division with Distinction	M. Tech. Communication Engineering
386	13531011	PAYAL AGARWAL	8.754	First Division with Distinction	M. Tech. Communication Engineering
387	12531012	PRABHASH KUMAR SINGH	6.164		M. Tech. Communication Engineering
388	13531015	SUNIL BARLA	6.59	First Division	M. Tech. Communication Engineering
389	13531016	TANOJ AGGARWAL	8.377	First Division	M. Tech. Communication Engineering
390	13531017	THOTTEMPUDI NAGESWARA	8.541	First Division with Distinction	M. Tech. Communication Engineering
391	13531018	VIKASH JANGID	6.967	First Division	M. Tech. Communication Engineering
392	13531019	VIVEK SAINI	6.246		M. Tech. Communication Engineering
393	13532001	ABHINN SALUJA	7.21	First Division	M. Tech. System Modeling and Control
394	13532003	BALJINDER SINGH	7.774	First Division	M. Tech. System Modeling and Control
395	13532005	HIMANSHU VERMA	6.371		M. Tech. System Modeling and Control
396	13532006	KARANDE AMIT SHRIRANG	7.226	First Division	M. Tech. System Modeling and Control
397	13532009	RAHUL PATEL	8.468	First Division	M. Tech. System Modeling and Control
398	13532010	RAVI KUMAR SONI	7.935	First Division	M. Tech. System Modeling and Control
399	13532011	SHUBHASREE A V	7.032	First Division	M. Tech. System Modeling and Control
400	13532012	SONU KUMAR	7.984	First Division	M. Tech. System Modeling and Control
401	13532014	SUMIT KUMAR	6.21		M. Tech. System Modeling and Control
402	13533001	ADITI PURWAR	8.556	First Division with Distinction	M. Tech. R.F. & Microwave Engineering

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403	13533002	AJAY KUMAR MAURYA	7.524	First Division	M.Tech. R.F. & Microwave Engineering
404	13533003	AKANKSHA AGRAWAL	8.857	First Division with Distinction	M.Tech. R.F. & Microwave Engineering
405	13533005	AVADHESH KUMAR	7.317	First Division	M.Tech. R.F. & Microwave Engineering
406	13533009	M SRINIVASULU	7.238	First Division	M.Tech. R.F. & Microwave Engineering
407	13533012	RAHUL AHIRWAL	6.524	First Division	M.Tech. R.F. & Microwave Engineering
408	13533013	ROHITASHV KUMAR BANSAL	7.476	First Division	M.Tech. R.F. & Microwave Engineering
409	12533017	VINAY KUMAR	6.532	First Division	M.Tech. R.F. & Microwave Engineering
410	13533011	VISHWAS N G	8.016	First Division	M.Tech. R.F. & Microwave Engineering
411	13534001	ANKIT SINGHAI	8.767	First Division with Distinction	M.Tech. Microelectronics and VLSI
412	13534002	ARSALAN ALAM	8.317	First Division	M.Tech. Microelectronics and VLSI
413	13534003	AYAN DUTTA	7.45	First Division	M.Tech. Microelectronics and VLSI
414	13534005	KOWTHRAPU TRISHANKARA	7.95	First Division	M.Tech. Microelectronics and VLSI
415	13534006	LALIT MOHAN GOSWAMI	7.75	First Division	M.Tech. Microelectronics and VLSI
416	13534007	MADIMATLA	9.3	First Division with Distinction	M.Tech. Microelectronics and VLSI
417	13534008	MOHIT SHARMA	7.383	First Division	M.Tech. Microelectronics and VLSI
418	13534009	NEERAJ MISHRA	7.2	First Division	M.Tech. Microelectronics and VLSI
419	13534010	PRAMESHWAR CHOYAL	7.817	First Division	M.Tech. Microelectronics and VLSI
420	13534011	PRERNA GOYAL	8.933	First Division with Distinction	M.Tech. Microelectronics and VLSI
421	13534012	SANJAY MAHAWAR	8.25	First Division	M.Tech. Microelectronics and VLSI
422	13534013	SATENDRA KUMAR GAUTAM	7.7	First Division	M.Tech. Microelectronics and VLSI
423	13534014	SHILPA BISNOI	8.333	First Division	M.Tech. Microelectronics and VLSI
424	13534016	YOGESH CHAURASIYA	8.117	First Division	M.Tech. Microelectronics and VLSI
425	13535003	ALOK KUMAR	5.565		M.Tech. Computer Science & Engineering
426	13535004	AMARPRIT KAUR	8.419	First Division	M.Tech. Computer Science & Engineering
427	13535006	ANIL PAL	6.645	First Division	M.Tech. Computer Science & Engineering
428	13535007	ANJALI BHARTI	6.098		M.Tech. Computer Science & Engineering
429	13535008	ANKITA SINGLA	8.262	First Division	M.Tech. Computer Science & Engineering
430	13535009	ANKUR KUMAR AGRAWAL	7.742	First Division	M.Tech. Computer Science & Engineering
431	13535010	ANUNAYA SRIVASTAVA	7.065	First Division	M.Tech. Computer Science & Engineering
432	13535013	ANURAAG	7.177	First Division	M.Tech. Computer Science & Engineering
433	13535015	CHINNALA GOUTHAM	6.836	First Division	M.Tech. Computer Science & Engineering
434	13535017	DIKSHA GUPTA	7.672	First Division	M.Tech. Computer Science & Engineering
435	13535018	DIVYA SHARMA	8.426	First Division	M.Tech. Computer Science & Engineering
436	13535019	DUDEKULA RIZWAN	7.656	First Division	M.Tech. Computer Science & Engineering

437	13535020	GANESH NIMBOLKAR	7.097	First Division	M.Tech. Computer Science & Engineering
438	13535021	GAURAV SINGH	7.806	First Division	M.Tech. Computer Science & Engineering
439	13535023	HAMENDER SINGH	7.59	First Division	M.Tech. Computer Science & Engineering
440	13535024	HARSHITA PANDA	8.083	First Division	M.Tech. Computer Science & Engineering
441	13535026	HIMANSHU KUMAR TIWARI	7.274	First Division	M.Tech. Computer Science & Engineering
442	13535027	JOYDEEP MONDAL	7.967	First Division	M.Tech. Computer Science & Engineering
443	13535028	KARBHAL ANIKET VITTHAL	7.393	First Division	M.Tech. Computer Science & Engineering
444	13535029	KATTAMURI MANI KANTA	7.393	First Division	M.Tech. Computer Science & Engineering
445	13535030	MADHU SINGH	7.295	First Division	M.Tech. Computer Science & Engineering
446	13535031	MADHUMANTI DEY	8.613	First Division with Distinction	M.Tech. Computer Science & Engineering
447	13535032	MANISH KALRA	7.548	First Division	M.Tech. Computer Science & Engineering
448	13535033	NALLURI SRI MAHATHI	8.787	First Division with Distinction	M.Tech. Computer Science & Engineering
449	13535034	PATEL RONAK VINODBHAI	7.115	First Division	M.Tech. Computer Science & Engineering
450	13535035	PRATEEK KHARE	7.387	First Division	M.Tech. Computer Science & Engineering
451	13535036	PRAVEEN JHARBADE	6.823	First Division	M.Tech. Computer Science & Engineering
452	13535037	PUNJABI NIRAJKUMAR	7.607	First Division	M.Tech. Computer Science & Engineering
453	13535038	RAJAT AGARWAL	7.919	First Division	M.Tech. Computer Science & Engineering
454	13535039	RAJENDRA KUMAR DWIVEDI	7.836	First Division	M.Tech. Computer Science & Engineering
455	13535041	RAM GOPAL	8.066	First Division	M.Tech. Computer Science & Engineering
456	13535042	RAVI KUMAR GURU	7.468	First Division	M.Tech. Computer Science & Engineering
457	13535045	SHASHANK SHESHAR SINGH	8.033	First Division	M.Tech. Computer Science & Engineering
458	13535046	SHIVANI	7.59	First Division	M.Tech. Computer Science & Engineering
459	13535047	SINGH RISHI ARUN	8.355	First Division	M.Tech. Computer Science & Engineering
460	13535048	SOUMYAJYOTI BANERJEE	8.475	First Division	M.Tech. Computer Science & Engineering
461	13535049	SURABHI GOYAL	7.8	First Division	M.Tech. Computer Science & Engineering
462	13535052	THIRPATHAIAH KATTULA	6.836	First Division	M.Tech. Computer Science & Engineering
463	13535053	UTPAL CHOWDHURY	7.246	First Division	M.Tech. Computer Science & Engineering
464	13535054	VINAY SARDA	8.645	First Division with Distinction	M.Tech. Computer Science & Engineering
465	13538001	AMIT VISHWAKARMA	6.879	First Division	M.Tech. CAD, CAM & Robotics
466	13538002	DEEPAK CHANDRA PARGAIN	7.091	First Division	M.Tech. CAD, CAM & Robotics
467	12538003	HIMANSHU	5.758		M.Tech. CAD, CAM & Robotics
468	13538003	INDERJEET SINGH	8.97	First Division with Distinction	M.Tech. CAD, CAM & Robotics
469	13538004	JEEWAN CHANDRA ATWAL	8.03	First Division	M.Tech. CAD, CAM & Robotics
470	13538005	JITENDRA ADHIKARI	7.788	First Division	M.Tech. CAD, CAM & Robotics

471	13538011	SATISH KUMAR	8.242	First Division	M. Tech. CAD, CAM & Robotics
472	13538013	TARUN SACHDEVA	8.939	First Division with Distinction	M. Tech. CAD, CAM & Robotics
473	13538014	VIKAS VERMA	6.939	First Division	M. Tech. CAD, CAM & Robotics
474	13538015	YENGKHOM MILANNAR	6.97	First Division	M. Tech. CAD, CAM & Robotics
475	13539001	ABHISHEK RAWAT	8.364	First Division	M. Tech. Machine Design Engineering
476	13539002	AKASH SINGH BHUWAL	8.636	First Division with Distinction	M. Tech. Machine Design Engineering
477	13539003	AMIT KUMAR SHARMA	9.848	First Division with Distinction	M. Tech. Machine Design Engineering
478	13539004	ANKIT PANDEY	8.758	First Division with Distinction	M. Tech. Machine Design Engineering
479	13539006	APUL NAUTIYAL	7.212	First Division	M. Tech. Machine Design Engineering
480	13539007	ATUL KUMAR TOMAR	7.697	First Division	M. Tech. Machine Design Engineering
481	13539008	BHAGWAT SURBHI	8.273	First Division	M. Tech. Machine Design Engineering
482	13539009	BORSE DEEPAK RAVINDRA	8.636	First Division with Distinction	M. Tech. Machine Design Engineering
483	13539010	DEEPAK KUMAR	7.121	First Division	M. Tech. Machine Design Engineering
484	13539011	GHANASHYAM SAHU	7	First Division	M. Tech. Machine Design Engineering
485	13539013	JAGANNATH MOHAPATRA	7.333	First Division	M. Tech. Machine Design Engineering
486	13539014	KIRTI SHARMA	7.727	First Division	M. Tech. Machine Design Engineering
487	13539015	MAHESH	7.424	First Division	M. Tech. Machine Design Engineering
488	12539009	PRADEEP KUMAR YADAV	7.303	First Division	M. Tech. Machine Design Engineering
489	13539016	PRIYABRATA BEHERA	7.273	First Division	M. Tech. Machine Design Engineering
490	13539017	RAJAT PRATAP	8.515	First Division with Distinction	M. Tech. Machine Design Engineering
491	13539019	SHASHANK BHANUDAS	8.545	First Division with Distinction	M. Tech. Machine Design Engineering
492	13539020	SHEETABHA BAJPAYEE	8.545	First Division with Distinction	M. Tech. Machine Design Engineering
493	13539021	SURESH CHANDRA SINGH	7.455	First Division	M. Tech. Machine Design Engineering
494	13539022	WANKHADE NARENDRA	7.121	First Division	M. Tech. Machine Design Engineering
495	13540001	AMIT GAUR	9.152	First Division with Distinction	M. Tech. Production & Industrial Systems Engineering
496	13540002	ANANYA CHATTREE	8.788	First Division with Distinction	M. Tech. Production & Industrial Systems Engineering
497	12540004	ARUN PRASAD	6.121		M. Tech. Production & Industrial Systems Engineering
498	13540004	BALVINDER CHAUHAN	9.091	First Division with Distinction	M. Tech. Production & Industrial Systems Engineering
499	13540005	CHANDRESH CHHIPA	7.576	First Division	M. Tech. Production & Industrial Systems Engineering
500	13540007	KAMALESH SINGH	8.394	First Division	M. Tech. Production & Industrial Systems Engineering
501	13540008	KAMALJIT SINGH	7.303	First Division	M. Tech. Production & Industrial Systems Engineering
502	13540009	KHANDELWAL GAURAV	8.182	First Division	M. Tech. Production & Industrial Systems Engineering
503	13540010	NIKKI RATHORE	9.485	First Division with Distinction	M. Tech. Production & Industrial Systems Engineering
504	13540012	PANKAJ SINGH PANGATY	6.636	First Division	M. Tech. Production & Industrial Systems Engineering

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505	13540013	PRAG SHARMA	8.576	First Division with Distinction	M. Tech. Production & Industrail Systems Engineering
506	13540014	PRATIP ROY	7.364	First Division	M. Tech. Production & Industrail Systems Engineering
507	13540015	RAMANDEEP SINGH	6.364		M. Tech. Production & Industrail Systems Engineering
508	13540017	SATYA PRAKASH BHARATI	5.727		M. Tech. Production & Industrail Systems Engineering
509	13540018	SHRUTI MAHESHWARI	9.364	First Division with Distinction	M. Tech. Production & Industrail Systems Engineering
510	13540019	SUMITRA SAHOO	9.697	First Division with Distinction	M. Tech. Production & Industrail Systems Engineering
511	13540020	VICHARE JAYCHANDRA	7.879	First Division	M. Tech. Production & Industrail Systems Engineering
512	13540021	WANKHEDE UMESH	7.394	First Division	M. Tech. Production & Industrail Systems Engineering
513	13541001	ADITYA KUMAR	8.03	First Division	M. Tech. Thermal Engineering
514	13541002	ANKIT DEV	6.909	First Division	M. Tech. Thermal Engineering
515	13541003	ARUN JAIN	7.636	First Division	M. Tech. Thermal Engineering
516	13541004	CHANDRA KANT GANGWAR	7.697	First Division	M. Tech. Thermal Engineering
517	13541008	KULDEEP PATHAK	8.818	First Division with Distinction	M. Tech. Thermal Engineering
518	13541014	RUCHIN KUMAR	7.061	First Division	M. Tech. Thermal Engineering
519	13541016	SUBODH KHULLAR	9	First Division with Distinction	M. Tech. Thermal Engineering
520	13541018	VAIBHAV SHARMA	8.03	First Division	M. Tech. Thermal Engineering
521	13542001	ABHILASH KUMAR BALLA	7.727	First Division	M. Tech. Welding Engineering
522	13542002	AKASH BARSAIYAN	8.061	First Division	M. Tech. Welding Engineering
523	12542002	AKASH KUSHWAH	6.636	First Division	M. Tech. Welding Engineering
524	13542003	ARCHISMAN VISHVESHA	7.788	First Division	M. Tech. Welding Engineering
525	13542004	DEEPAN M	7.848	First Division	M. Tech. Welding Engineering
526	13542005	DHRUV SINGH BAGHEL	6.485		M. Tech. Welding Engineering
527	13542006	GUPTA BHAVESH ARYA	7.576	First Division	M. Tech. Welding Engineering
528	13542007	KANISHTHA YADAV	7.394	First Division	M. Tech. Welding Engineering
529	13542008	KRISHNA PRASATH L	8.667	First Division with Distinction	M. Tech. Welding Engineering
530	13542009	MOHIT TEACHER	6.909	First Division	M. Tech. Welding Engineering
531	13542010	NAVEEN KUMAR	8.455	First Division	M. Tech. Welding Engineering
532	13542012	POHOR PATRIC DEBBARMA	6.606	First Division	M. Tech. Welding Engineering
533	13542014	SANDHYA	8.091	First Division	M. Tech. Welding Engineering
534	13542016	UMA KANT	7.212	First Division	M. Tech. Welding Engineering
535	13543002	AMIT KUMAR TRIPATHI	7.636	First Division	M. Tech. Corrosion Engineering
536	13543004	ARIGELA VISWANADH	9.273	First Division with Distinction	M. Tech. Corrosion Engineering
537	13543005	AVANTAK PATEL	8.303	First Division	M. Tech. Corrosion Engineering
538	13543006	GURUPRAKASH. N	7.667	First Division	M. Tech. Corrosion Engineering

539	13543007	HARI RAJ	7.441	First Division	M. Tech. Corrosion Engineering
540	13543008	KOLLI SATISH KUMAR	9.091	First Division with Distinction	M. Tech. Corrosion Engineering
541	13543010	MOHD IRFAN KHAN	8.394	First Division	M. Tech. Corrosion Engineering
542	13543009	MOHD. AZEEM	7.576	First Division	M. Tech. Corrosion Engineering
543	13543011	MONICA SINGHAL	7.727	First Division	M. Tech. Corrosion Engineering
544	13543012	NITIN KUMAR	7.091	First Division	M. Tech. Corrosion Engineering
545	13543013	PIYUSH MISHRA	7.909	First Division	M. Tech. Corrosion Engineering
546	13543014	PRITHA SANBIGHRAHI	7.364	First Division	M. Tech. Corrosion Engineering
547	13543015	SAIM ABBAS	7.03	First Division	M. Tech. Corrosion Engineering
548	13543016	SATYADEV YADAV	6.939	First Division	M. Tech. Corrosion Engineering
549	13543018	VAIBHAV JAIN	7.303	First Division	M. Tech. Corrosion Engineering
550	13543019	YASH PRATAP SINGH	6.121		M. Tech. Corrosion Engineering
551	13544001	AKESHWAR SINGH YADAV	7.818	First Division	M. Tech. Industrial Metallurgy
552	13544002	AMIT KUMAR SINGH	7.545	First Division	M. Tech. Industrial Metallurgy
553	12544004	ANSHUL AGARWAL	7.394	First Division	M. Tech. Industrial Metallurgy
554	13544003	ANURAG KUMAR	7.697	First Division	M. Tech. Industrial Metallurgy
555	13544004	AVISHEK KUMAR GUPTA	8.182	First Division	M. Tech. Industrial Metallurgy
556	13544005	GITARTHA DEV SARMAH	8.242	First Division	M. Tech. Industrial Metallurgy
557	13544006	GURJIT SINGH	9.091	First Division with Distinction	M. Tech. Industrial Metallurgy
558	13544007	MANORANJAN KUMAR RAI	8.333	First Division	M. Tech. Industrial Metallurgy
559	13544009	NIKUL ARYA	6.697	First Division	M. Tech. Industrial Metallurgy
560	13544011	NITISH BHARDWAJ	7.788	First Division	M. Tech. Industrial Metallurgy
561	13544012	PANKAJ SHARMA	6.273		M. Tech. Industrial Metallurgy
562	13544014	RUCHI PATHAK	6.182		M. Tech. Industrial Metallurgy
563	13544015	SAMANVAY SHAH	7.758	First Division	M. Tech. Industrial Metallurgy
564	13544016	SANJAY SINGH	7.182	First Division	M. Tech. Industrial Metallurgy
565	13544017	SOURMYARANJAN NAYAK	8.303	First Division	M. Tech. Industrial Metallurgy
566	13545001	ABHISHEK KUMAR	6.97	First Division	M. Tech. Physical Metallurgy
567	13545002	AJAY KUMAR SINGH	7.788	First Division	M. Tech. Physical Metallurgy
568	12545001	AMAN NARWAL	7.091	First Division	M. Tech. Physical Metallurgy
569	13545003	ANKIT KALRA	7.424	First Division	M. Tech. Physical Metallurgy
570	12545002	ANUBHAV OJHA	6.606	First Division	M. Tech. Physical Metallurgy
571	13545004	BABUL DAS	6.909	First Division	M. Tech. Physical Metallurgy
572	13545005	GAURAV CHANDRA PANDEY	7.333	First Division	M. Tech. Physical Metallurgy

573	13545006	GAURAV MAHENDRU	8	First Division	M. Tech. Physical Metallurgy
574	13545007	HARI BABU L	7.636	First Division	M. Tech. Physical Metallurgy
575	13545008	KAPIL DEV SHARMA	6.576	First Division	M. Tech. Physical Metallurgy
576	13545009	MONIKA GAUTAM	6.485		M. Tech. Physical Metallurgy
577	13545010	OM PRAKASH YADAV	7.364	First Division	M. Tech. Physical Metallurgy
578	13545013	S S LOKESH VENDRA	8.455	First Division	M. Tech. Physical Metallurgy
579	13545015	SUPRIYA GUPTA	7.636	First Division	M. Tech. Physical Metallurgy
580	13545016	YASH DEVRA	7.152	First Division	M. Tech. Physical Metallurgy
581	13545017	YASHPAL	7.636	First Division	M. Tech. Physical Metallurgy
582	13546001	ABHILASH TIWARI	7.719	First Division	M. Tech. Pulp & Paper
583	13546002	ANANT GHANASHAM	6.891	First Division	M. Tech. Pulp & Paper
584	13546003	ANKIT GUPTA	8.453	First Division	M. Tech. Pulp & Paper
585	13546004	CHANDRAVATI	8.562	First Division with Distinction	M. Tech. Pulp & Paper
586	13546005	KALAIYARASAN S	7.688	First Division	M. Tech. Pulp & Paper
587	13546006	KRITHIKA R	9.656	First Division with Distinction	M. Tech. Pulp & Paper
588	13546007	MANORMA	7.938	First Division	M. Tech. Pulp & Paper
589	13546008	POOJA	8.25	First Division	M. Tech. Pulp & Paper
590	13546009	POONAM	7.641	First Division	M. Tech. Pulp & Paper
591	13546010	PRASHANT SONI	8.672	First Division with Distinction	M. Tech. Pulp & Paper
592	13546011	PRITHA BHATTACHARYA	7.891	First Division	M. Tech. Pulp & Paper
593	13546013	RAJESH KUMAR R	6.922	First Division	M. Tech. Pulp & Paper
594	13546014	SANDHYA SINGH	7.859	First Division	M. Tech. Pulp & Paper
595	13546015	SHAILESH PATHAK	8.438	First Division	M. Tech. Pulp & Paper
596	13546016	SUDI KSHA AGRAWAL	8.969	First Division with Distinction	M. Tech. Pulp & Paper
597	13546017	VAISHALI SAROHA	8.125	First Division	M. Tech. Pulp & Paper
598	13546018	YOGENDRA SONI	6.609	First Division	M. Tech. Pulp & Paper
599	13537001	IQBAL SHEIKH	7.636	First Division	M. Tech. Surface Water
600	13537002	RAVI SHAKYA	9.455	First Division with Distinction	M. Tech. Surface Water
601	13537003	SHAILESH KUMAR	7.909	First Division	M. Tech. Surface Water
602	13537004	SRISHTI VISHWAKARMA	8.788	First Division with Distinction	M. Tech. Surface Water
603	13537005	SUMIT KUMAR KAWDE	7.667	First Division	M. Tech. Surface Water
604	13537006	SUNIL POUDEL	8.758	First Division with Distinction	M. Tech. Surface Water
605	13537007	KUNTAL PURKAYASTHA	8.909	First Division with Distinction	M. Tech. Ground Water
606	13537008	MANISH TUNGARIA	7.394	First Division	M. Tech. Ground Water

607	13537009	PARDEEP		8.152	First Division	M. Tech. Ground Water
608	13537014	RONIT SINGH		8.879	First Division with Distinction	M. Tech. Watershed Management
609	13537015	SHUBHAM RAGHUWANSHI		8.697	First Division with Distinction	M. Tech. Watershed Management
610	13537016	VIJAY JIRWAN		8.273	First Division	M. Tech. Watershed Management
611	13537017	WAIKHOM RAHUL SINGH		9	First Division with Distinction	M. Tech. Watershed Management
612	13547001	AJIT KUMAR SHREEVASTAVA		8.706	First Division with Distinction	M. Tech. Irrigation Water Management
613	13547003	BINAYA PAUDEL		8.676	First Division with Distinction	M. Tech. Irrigation Water Management
614	13547004	INNOCENT CHRISTOPHER		8.118	First Division	M. Tech. Irrigation Water Management
615	13547006	MOGAREKAR NIKHIL SUNIL		8.706	First Division with Distinction	M. Tech. Irrigation Water Management
616	13547009	TUMAINI ERASTO ROBERT		7.412	First Division	M. Tech. Irrigation Water Management
617	13548001	ALOK KUMAR		9.353	First Division with Distinction	M. Tech. Water Resources Development
618	13548002	ANKIT KUMAR		7.529	First Division	M. Tech. Water Resources Development
619	13548003	ARUN KUMAR SONI		8.765	First Division with Distinction	M. Tech. Water Resources Development
620	13548004	DEEPA S. KOOMULLIL		9.824	First Division with Distinction	M. Tech. Water Resources Development
621	13548005	GURMEET SINGH		8.088	First Division	M. Tech. Water Resources Development
622	13548006	HEMANT ACHYUT JOSHI		8.941	First Division with Distinction	M. Tech. Water Resources Development
623	13548008	KUMAR GAURAV		8.412	First Division	M. Tech. Water Resources Development
624	13548009	LALAN KUMAR JHA		9.294	First Division with Distinction	M. Tech. Water Resources Development
625	13548010	M. NAVEEN KUMAR		9.059	First Division with Distinction	M. Tech. Water Resources Development
626	13548011	MANISH KOTHARI		8.882	First Division with Distinction	M. Tech. Water Resources Development
627	13548012	MANNAN UMAR		8	First Division	M. Tech. Water Resources Development
628	13548013	NANGTIKI TARIANG		7.5	First Division	M. Tech. Water Resources Development
629	12548018	NITU SINGH		8.206	First Division	M. Tech. Water Resources Development
630	13548014	PATRICK NTOW YEBOAH		8.471	First Division	M. Tech. Water Resources Development
631	12548020	PRATIBHA		7.588	First Division	M. Tech. Water Resources Development
632	13548028	RAMRAJ PANDA		8.706	First Division with Distinction	M. Tech. Water Resources Development
633	13548017	RASMITA KUMARI SAHU		9.706	First Division with Distinction	M. Tech. Water Resources Development
634	13548027	RATI KANTA MOHANTA		6.941	First Division	M. Tech. Water Resources Development
635	13548016	REETU GANGWAR		7.412	First Division	M. Tech. Water Resources Development
636	13548026	RITESH KUMAR JAISWAL		9.059	First Division with Distinction	M. Tech. Water Resources Development
637	13548018	SANDEEP KUMAR SINGH		8.412	First Division	M. Tech. Water Resources Development
638	13548019	SHREE PRASAD SAH		8.559	First Division with Distinction	M. Tech. Water Resources Development
639	13548020	SUHAS SETHI		8.5	First Division with Distinction	M. Tech. Water Resources Development
640	13548021	SURESH A		7.147	First Division	M. Tech. Water Resources Development

641	13548022	TEG BAHADUR SINGH	6.559	First Division	M. Tech. Water Resources Development
642	13548023	THAJUDDIN UBAID B M	8.059	First Division	M. Tech. Water Resources Development
643	13548024	VIJAYA KUMAR P.G.	9.176	First Division with Distinction	M. Tech. Water Resources Development
644	13548025	VISHALA	8.206	First Division	M. Tech. Water Resources Development
645	13552001	ABHISHEK KUMAR	7.636	First Division	M. Tech. Disaster Mitigation & Management
646	13552002	ANKUR SRIVASTAVA	8.879	First Division with Distinction	M. Tech. Disaster Mitigation & Management
647	13552003	ANSHUMAN SHUKLA	8.091	First Division	M. Tech. Disaster Mitigation & Management
648	13552005	DEVILATA PEGU	7.788	First Division	M. Tech. Disaster Mitigation & Management
649	13552006	HARISANKAR K	7.152	First Division	M. Tech. Disaster Mitigation & Management
650	13552007	JAYA SINGH	7.97	First Division	M. Tech. Disaster Mitigation & Management
651	13552008	LAXMI GUPTA	8.424	First Division	M. Tech. Disaster Mitigation & Management
652	13552009	PRIYANKA SAINI	8.277	First Division	M. Tech. Disaster Mitigation & Management
653	13552011	SANGEETA	8	First Division	M. Tech. Disaster Mitigation & Management
654	13552012	SHIVANI CHOUHAN	7.818	First Division	M. Tech. Disaster Mitigation & Management
655	13552013	SIDDHARTH SHANKAR	7.394	First Division	M. Tech. Disaster Mitigation & Management
656	12552015	VIPIN CHANALIA	7.441	First Division	M. Tech. Disaster Mitigation & Management
657	13551001	ABHISHEK SACHAN	7.106	First Division	M. Tech. Nanotechnology
658	13551002	ARUNIMA SINGH	8.318	First Division	M. Tech. Nanotechnology
659	13551003	BIJJAM MADHUSUDHAN	6.765	First Division	M. Tech. Nanotechnology
660	13551004	JAYDEEP SINGH	8.303	First Division	M. Tech. Nanotechnology
661	13551005	KAMESH SHRIVASTAVA	7.803	First Division	M. Tech. Nanotechnology
662	13551006	KHUSHBOO KUMARI	8.485	First Division	M. Tech. Nanotechnology
663	13551007	KISHOR KUMAR KUNTAL	6.955	First Division	M. Tech. Nanotechnology
664	13551008	KRISHNA SAINI	8.788	First Division with Distinction	M. Tech. Nanotechnology
665	13551011	NIDHI PAL	8.088	First Division	M. Tech. Nanotechnology
666	13551013	SURUCHI	7.912	First Division	M. Tech. Nanotechnology
667	13551014	SWAPNIL ASHOK PAKHALE	7.212	First Division	M. Tech. Nanotechnology
668	13551015	VIJAY KUMAR PANDEY	7.507	First Division	M. Tech. Nanotechnology
669	13551016	VRINDA	8.167	First Division	M. Tech. Nanotechnology
670	13554001	ABHA SINGH	8.03	First Division	M. Tech. Infrastructure Systems
671	13554002	ANIL KUMAR	8.394	First Division	M. Tech. Infrastructure Systems
672	13554003	ANURAG KALBHOR	9.303	First Division with Distinction	M. Tech. Infrastructure Systems
673	13554004	ASEEM TIGGA	7.758	First Division	M. Tech. Infrastructure Systems
674	13554005	ASHISH SUMAN	7.061	First Division	M. Tech. Infrastructure Systems

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675	13554006	BHUSHAN ARUNRAO	7.909	First Division	M. Tech. Infrastructure Systems
676	13554007	HASMEET KAUR	8.364	First Division	M. Tech. Infrastructure Systems
677	13554008	K ZAHEER ABBAS	8.636	First Division with Distinction	M. Tech. Infrastructure Systems
678	13554009	KUKUNOOR SAI CHARAN	7.152	First Division	M. Tech. Infrastructure Systems
679	13554010	M FARAZ AHMAD	9.152	First Division with Distinction	M. Tech. Infrastructure Systems
680	13554011	MICHAEL MARIA JOSEPH	8	First Division	M. Tech. Infrastructure Systems
681	13554014	NITHIN RAJ	8.03	First Division	M. Tech. Infrastructure Systems
682	13554015	PRANATI AWASTHI	8.879	First Division with Distinction	M. Tech. Infrastructure Systems
683	13554016	RITESH GOENKA	8.879	First Division with Distinction	M. Tech. Infrastructure Systems
684	13610001	AASHISH JAIN	9.44	First Division with Distinction	M.Sc. Biotechnology
685	13610002	AMIT KUMAR SINGH	8.044	First Division	M.Sc. Biotechnology
686	13610003	ANIKETH BISHNU	8.769	First Division with Distinction	M.Sc. Biotechnology
687	13610004	ANUPAMA	7.912	First Division	M.Sc. Biotechnology
688	13610005	ASHUTOSH KUMAR ARYA	7.396	First Division	M.Sc. Biotechnology
689	13610006	AWADHESH CHAUHAN	8.011	First Division	M.Sc. Biotechnology
690	13610007	BULBUL TIRKEY	8	First Division	M.Sc. Biotechnology
691	13610008	CHRISTY NOCHE K MARAK	7.758	First Division	M.Sc. Biotechnology
692	13610009	DEV KANT SINDHU	6.879	First Division	M.Sc. Biotechnology
693	13610010	GEETIKA CHOCHAN	9.396	First Division with Distinction	M.Sc. Biotechnology
694	13610011	HARIPRIYA PARTHASARATHY	9	First Division with Distinction	M.Sc. Biotechnology
695	13610012	KANIKA GUPTA	8.692	First Division with Distinction	M.Sc. Biotechnology
696	13610013	KRITI JUNEJA	9.044	First Division with Distinction	M.Sc. Biotechnology
697	13610014	NEHA SINGH	8.209	First Division	M.Sc. Biotechnology
698	13610015	OSIN SONI	7.527	First Division	M.Sc. Biotechnology
699	13610016	PALLY DHARMA TEJESHWAR	9.044	First Division with Distinction	M.Sc. Biotechnology
700	13610017	PARVANENDHU P	7.736	First Division	M.Sc. Biotechnology
701	13610018	PAWAN KANT	6.703	First Division	M.Sc. Biotechnology
702	13610019	POUSHALI CHAKRABORTY	8.396	First Division	M.Sc. Biotechnology
703	13610021	RAVI PAL	8.429	First Division	M.Sc. Biotechnology
704	13610022	RAVI SAINI	8.055	First Division	M.Sc. Biotechnology
705	13610023	RAZA AKHTAR	7.648	First Division	M.Sc. Biotechnology
706	13610024	SAWANT AVISHKAR VISHNU	9.011	First Division with Distinction	M.Sc. Biotechnology
707	13610025	SHALINI AGGARWAL	7.692	First Division	M.Sc. Biotechnology
708	13610026	SNEHA SAURABH KHALKHO	6.011		M.Sc. Biotechnology

709	13610027	SUJATA KUMARI	5.879		M.Sc. Biotechnology
710	13610028	UMRALIYA DHRUVIT	7.78	First Division	M.Sc. Biotechnology
711	13610029	ZEENAT RASHIDA	9.176	First Division with Distinction	M.Sc. Biotechnology
712	13611001	ALOK PANWAR	8	First Division	M.Sc. Chemistry
713	13611002	AMIT YADAV	6.25		M.Sc. Chemistry
714	13611003	BHUMIKA CHAUDHARY	8.227	First Division	M.Sc. Chemistry
715	13611004	BIKESH	6.841	First Division	M.Sc. Chemistry
716	13611005	DEEPSHIKHA ARORA	8.284	First Division	M.Sc. Chemistry
717	13611006	KOMAL MALIK	7.602	First Division	M.Sc. Chemistry
718	13611008	KRITI SETH	8.989	First Division with Distinction	M.Sc. Chemistry
719	13611009	NANCY JANGRA	7.33	First Division	M.Sc. Chemistry
720	13611010	NASIT AFROZ	7.125	First Division	M.Sc. Chemistry
721	13611011	NIDHI	9.852	First Division with Distinction	M.Sc. Chemistry
722	13611012	NIDHI GUPTA	8.136	First Division	M.Sc. Chemistry
723	13611013	POOJA SARKAR	7.182	First Division	M.Sc. Chemistry
724	13611014	RAJU BISWAS	6.228		M.Sc. Chemistry
725	13611015	SAKSHI GANOTRA	9.023	First Division with Distinction	M.Sc. Chemistry
726	13611016	SHEELA KUMARI	7.625	First Division	M.Sc. Chemistry
727	13611017	SUBRATA HAZRA	7.511	First Division	M.Sc. Chemistry
728	13611018	SUMIT	6.636	First Division	M.Sc. Chemistry
729	13611019	SUVAJIT BERA	6.171		M.Sc. Chemistry
730	13611020	VARUN KANT	8.205	First Division	M.Sc. Chemistry
731	13549001	AMBIKESHWAR PANDEY	8.031	First Division	M.Tech. Advanced Chemical Analysis
732	13549002	ANSHU SINGH	7.323	First Division	M.Tech. Advanced Chemical Analysis
733	13549003	DIPIKA DAS	8.477	First Division	M.Tech. Advanced Chemical Analysis
734	13549004	GOPINATH MONDAL	6.831	First Division	M.Tech. Advanced Chemical Analysis
735	13549005	HARENDRA TYAGI	7.2	First Division	M.Tech. Advanced Chemical Analysis
736	13549006	HEMKANT SAINI	6.969	First Division	M.Tech. Advanced Chemical Analysis
737	13549007	MERUVA PURUSHOTHAM	7.954	First Division	M.Tech. Advanced Chemical Analysis
738	13549009	NAVEEN SINGH RAWAT	8	First Division	M.Tech. Advanced Chemical Analysis
739	13549010	NIGAM KUMAR SWAIN	6.631	First Division	M.Tech. Advanced Chemical Analysis
740	13549011	PRAVIN KUMAR	7.108	First Division	M.Tech. Advanced Chemical Analysis
741	13549012	PRITAM SURKAR	8.015	First Division	M.Tech. Advanced Chemical Analysis
742	13549013	REVATHI RAMACHANDRAN	7.692	First Division	M.Tech. Advanced Chemical Analysis

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743	13612001	AGNIDIPTO BASU	8.061	First Division	M.Sc. Applied Geology
744	13612002	AMULYA RATNA ROUL	8.515	First Division with Distinction	M.Sc. Applied Geology
745	13612003	ARCHIT KUMAR SAHOO	6.838	First Division	M.Sc. Applied Geology
746	13612004	AUMPRKASH SAHOO	7.424	First Division	M.Sc. Applied Geology
747	13612006	DEBIJA CHAKRABORTY	9.354	First Division with Distinction	M.Sc. Applied Geology
748	13612008	EIRIN KAR	9.182	First Division with Distinction	M.Sc. Applied Geology
749	13612009	GIRIDAS MAITI	8.788	First Division with Distinction	M.Sc. Applied Geology
750	13612010	HIMANSHU	7.192	First Division	M.Sc. Applied Geology
751	13612011	LOHIT KUMAR MOHANTA	6.374		M.Sc. Applied Geology
752	13612012	POOJA TRIPATHI	8.616	First Division with Distinction	M.Sc. Applied Geology
753	13612013	PREM CHANDRA MAURYA	7.263	First Division	M.Sc. Applied Geology
754	13612014	ROHINI DAS	8.576	First Division with Distinction	M.Sc. Applied Geology
755	12711001	BOLIMERA RATNASRI	5.504		M.Tech. Geological Technology
756	12711002	FREDRICK RONALD	7.126	First Division	M.Tech. Geological Technology
757	12711003	ISHA MUKHERJEE	8.672	First Division with Distinction	M.Tech. Geological Technology
758	12711004	SAFEER ALI E	7.521	First Division	M.Tech. Geological Technology
759	12711005	SANGHITA NANDY	9.244	First Division with Distinction	M.Tech. Geological Technology
760	12711006	SAPTARSHI GHOSH	8.218	First Division	M.Tech. Geological Technology
761	12711007	SHREYASI CHOUDHURY	7.849	First Division	M.Tech. Geological Technology
762	12710002	AKSHAY PANWAR	6.87	First Division	M.Tech. Geophysical Technology
763	12710003	ANKIT SHARMA	8.065	First Division	M.Tech. Geophysical Technology
764	12710004	DAVID STEPHEN LALL	8.382	First Division	M.Tech. Geophysical Technology
765	12710005	DEEPAK KUMAR	5.935		M.Tech. Geophysical Technology
766	12710006	DHARMENDRA KUMAR SINGH	6.772	First Division	M.Tech. Geophysical Technology
767	12710009	MANISHA GUPTA	8.049	First Division	M.Tech. Geophysical Technology
768	12710010	MANOJ KUMAR	7.699	First Division	M.Tech. Geophysical Technology
769	12710011	OJASWITA SINGH	8.268	First Division	M.Tech. Geophysical Technology
770	13613001	DEEPAK KUMAR	6.468		M.Sc. Applied Mathematics
771	13613002	DEEPIKA SINGH	7.382	First Division	M.Sc. Applied Mathematics
772	13613003	PAVITRA TRIPATHI	8.118	First Division	M.Sc. Applied Mathematics
773	13613004	PAWAN KUMAR	6.247		M.Sc. Applied Mathematics
774	13613005	RAHUL RAI	8.39	First Division	M.Sc. Applied Mathematics
775	13613006	RAHUL SAINI	8.26	First Division	M.Sc. Applied Mathematics
776	13613007	RAJAT KAUSHIK	8.039	First Division	M.Sc. Applied Mathematics

777	13613008	REETA YADAV		5.805		M.Sc. Applied Mathematics
778	13613009	REKHA RANI		5.844		M.Sc. Applied Mathematics
779	13613010	SANJEEV KUMAR		5.896		M.Sc. Applied Mathematics
780	13613011	SAURABH ARORA		6.684	First Division	M.Sc. Applied Mathematics
781	13613012	SHUBHANGI DWIVEDI		7.934	First Division	M.Sc. Applied Mathematics
782	13613013	VIKAS KUMAR SAINI		5.935		M.Sc. Applied Mathematics
783	13614001	AKANKSHA BIRULI		5.573		M.Sc. Applied Mathematics
784	13614002	AKANKSHA YADAV		5.646		M.Sc. Industrial Mathematics & Informatics
785	13614003	AMARJEET		6.562	First Division	M.Sc. Industrial Mathematics & Informatics
786	13614014	AMARJIT HATY		6.708	First Division	M.Sc. Industrial Mathematics & Informatics
787	13614004	ANJALI JAISWAL		9.253	First Division with Distinction	M.Sc. Industrial Mathematics & Informatics
788	13614005	ASHUTOSH UPADHAYAY		7.219	First Division	M.Sc. Industrial Mathematics & Informatics
789	13614006	BATUL BOMBAYWALA		8.688	First Division with Distinction	M.Sc. Industrial Mathematics & Informatics
790	13614007	JYOTI MAURYA		7.031	First Division	M.Sc. Industrial Mathematics & Informatics
791	13614008	NEHA SRIVASTAVA		7.219	First Division	M.Sc. Industrial Mathematics & Informatics
792	13614010	PRATIBHA VERMA		8.105	First Division	M.Sc. Industrial Mathematics & Informatics
793	13614011	PREETI VAID		7.74	First Division	M.Sc. Industrial Mathematics & Informatics
794	13614012	STUTI SRIVASTAVA		6.708	First Division	M.Sc. Industrial Mathematics & Informatics
795	13615001	ABHIJIT SEN		6.625	First Division	M.Sc. Industrial Mathematics & Informatics
796	13615002	ANIL KUMAR		7.3	First Division	M.Sc. Physics
797	13615004	DEEPAK KUMAR		6.175		M.Sc. Physics
798	13615005	DEEPAK RAJPUT		7.038	First Division	M.Sc. Physics
799	13615006	GARIMA ARORA		8.375	First Division	M.Sc. Physics
800	13615008	HITU SINGH		8.438	First Division	M.Sc. Physics
801	13615009	LATA BISHT		7.862	First Division	M.Sc. Physics
802	13615010	PIYUSH MADAN		7.275	First Division	M.Sc. Physics
803	13615011	PRABHAKAR		6.262		M.Sc. Physics
804	13615012	PRIYA		8.95	First Division with Distinction	M.Sc. Physics
805	13615013	RAJNISH S SINGH		6.325		M.Sc. Physics
806	13615014	RAKESH KUMAR		6.588	First Division	M.Sc. Physics
807	13615015	SHADAB		5.488		M.Sc. Physics
808	13615016	SHITAL CHAUHAN		7.625	First Division	M.Sc. Physics
809	13615017	SHRIKANT		6.475		M.Sc. Physics
810	13615018	VAIBHAV KHULBEY		6.438		M.Sc. Physics

811	13615019	VISHAL CHOUDHURY	7.375	First Division	M.Sc. Physics
812	13615020	YAMINI	7	First Division	M.Sc. Physics
813	12550001	ANKUR SHARMA	7.629	First Division	M.Sc. Physics
814	13550001	MANISH KUMAR	6.41		M.Tech. Solid State Electronic Materials
815	13550002	NARESH CHANDRA GUPTA	8.262	First Division	M.Tech. Solid State Electronic Materials
816	13550003	PANKAJ TRIVEDI	8	First Division	M.Tech. Solid State Electronic Materials
817	13550005	RAMAN KAPOOR	7.328	First Division	M.Tech. Solid State Electronic Materials
818	13550007	SOUVIK AGASTI	8.082	First Division	M.Tech. Solid State Electronic Materials
819	12811001	ADESH PAL	5.722		M.Tech. Solid State Electronic Materials
820	12811002	ADITYA NAAG	7.308	First Division	Master of Computer Applications
821	12811003	ANKITA SAWLANA	8.684	First Division with Distinction	Master of Computer Applications
822	12811004	ANURAG MISHRA	6.09		Master of Computer Applications
823	12811005	ARVIND KUMAR	5.639		Master of Computer Applications
824	12811006	ASHISH DASS	6.105		Master of Computer Applications
825	12811007	ASHOK KUMAR	5		Master of Computer Applications
826	12811008	AVINASH KUMAR	9.038	First Division with Distinction	Master of Computer Applications
827	12811009	BERNADIT SHASHI EKKA	8.135	First Division	Master of Computer Applications
828	12811010	BHAGYASHREE NIRKHIWALE	8.301	First Division	Master of Computer Applications
829	12811012	BIJAY KANSHI	6.947	First Division	Master of Computer Applications
830	12811013	DEEPAK GARG	8	First Division	Master of Computer Applications
831	12811014	HEENA RANA	7.128	First Division	Master of Computer Applications
832	12811015	JAYARANI GARG	9.85	First Division with Distinction	Master of Computer Applications
833	12811016	KULDEEP TRIPATHI	5.925		Master of Computer Applications
834	12811017	LAMTEI MINOT UNWAN	5.609		Master of Computer Applications
835	12811018	MAHENDRA KUMAR SHARMA	5.744		Master of Computer Applications
836	12811019	NAGENDRA KUMAR YADAV	7.707	First Division	Master of Computer Applications
837	12811020	NAVNEET KUMAR	5.481		Master of Computer Applications
838	12811021	NITESH TARANI	9.045	First Division with Distinction	Master of Computer Applications
839	12811022	NITIN GUPTA	7.496	First Division	Master of Computer Applications
840	12811023	PANKAJ KUMAR	6.759	First Division	Master of Computer Applications
841	12811024	PARASHURAM KUMAR	5.09		Master of Computer Applications
842	12811026	PRIYANSHU SHARMA	6.045		Master of Computer Applications
843	12811027	PULKIT KUMAR	8.774	First Division with Distinction	Master of Computer Applications
844	12811028	PUNEET KUMAR	6.271		Master of Computer Applications

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845	12811029	RAHUL ARYA	6.782	First Division	Master of Computer Applications
846	12811030	RAHUL KUMAR TIWARY	7.782	First Division	Master of Computer Applications
847	12811031	RAHUL SONI	6.233		Master of Computer Applications
848	12811033	RAKSHIT CHAUHAN	7.263	First Division	Master of Computer Applications
849	12811034	RAVI SHEKHAR	7.534	First Division	Master of Computer Applications
850	12811035	SANJOY KUMAR SARDAR	5.515		Master of Computer Applications
851	12811036	SHAIKESH KUMAR	5.406		Master of Computer Applications
852	12811037	SHARDUL SINGH	7.278	First Division	Master of Computer Applications
853	12811038	SHASHANK KAUSHIK	7.797	First Division	Master of Computer Applications
854	12811039	SHASHWAT SHEKHAR	6.917	First Division	Master of Computer Applications
855	12811040	SHIVAM MISHRA	6.654	First Division	Master of Computer Applications
856	12811041	SUNIL KUMAR	6.188		Master of Computer Applications
857	12811042	SUNITA	8.053	First Division	Master of Computer Applications
858	12811043	SWATI GUPTA	8.88	First Division with Distinction	Master of Computer Applications
859	12811044	VAIBHAV TOMAR	8.316	First Division	Master of Computer Applications
860	12811045	VIJAY SINGH RAJPUT	7.165	First Division	Master of Computer Applications
861	12811046	VIPUL DUBEY	6.211		Master of Computer Applications
862	13810001	AAKANKSHA GUPTA	7.447	First Division	Master of Business Administration
863	13810002	ABHILASH CHOUDHARY	5.316		Master of Business Administration
864	13810004	ABHISHEK KUMAR	6.215		Master of Business Administration
865	13810005	ADITYA SINGH	8.421	First Division	Master of Business Administration
866	13810006	AGAM GUPTA	8.211	First Division	Master of Business Administration
867	13810007	AMAN SHARMA	6.013		Master of Business Administration
868	13810008	AMAR PRASAD KESHARI	6.772	First Division	Master of Business Administration
869	13810009	AMEY PANKE	7.776	First Division	Master of Business Administration
870	13810010	ANCHIT DAS	6.513	First Division	Master of Business Administration
871	13810011	ANISHA BALANI	8.039	First Division	Master of Business Administration
872	13810012	ANKIT	6.845	First Division	Master of Business Administration
873	13810013	ANSHUL AGGARWAL	7	First Division	Master of Business Administration
874	13810014	ANUBHAV SATPATHY	6.25		Master of Business Administration
875	13810015	ANUPAM SANYAL	6.053		Master of Business Administration
876	13810016	APURVA SOOD	8.842	First Division with Distinction	Master of Business Administration
877	13810017	ARCHANA SINGH	7.658	First Division	Master of Business Administration
878	13810018	ARJUN SANTOSH G	5.592		Master of Business Administration

879	13810019	ASHISH KUMAR JAISWAL	6.882	First Division	Master of Business Administration
880	13810020	ASHISH PANDEY	6.368		Master of Business Administration
881	13810021	ASHUTOSH KUMAR SARRAF	7.908	First Division	Master of Business Administration
882	13810022	BAJAAD SUNIL KAMALJEET	6.658	First Division	Master of Business Administration
883	13810023	BHAWNA	6.921	First Division	Master of Business Administration
884	13810024	BORRA KOMAL S VENKATESH	6.539	First Division	Master of Business Administration
885	13810025	CHAULKAR MANDAR SURESH	7.145	First Division	Master of Business Administration
886	13810026	CHUGH SAAGAR JAIRAM	7.658	First Division	Master of Business Administration
887	13810027	DHINESH N	6.487		Master of Business Administration
888	13810028	DHRUV KADIAN	7.632	First Division	Master of Business Administration
889	13810029	EESHA GUPTA	8.25	First Division	Master of Business Administration
890	13810030	GAURAV KUMAR GUPTA	6.526	First Division	Master of Business Administration
891	13810031	GAURAV MITTAL	8.25	First Division	Master of Business Administration
892	13810032	GAURAV TOMER	6.737	First Division	Master of Business Administration
893	13810033	GURPREET SINGH	6.868	First Division	Master of Business Administration
894	13810034	HEENA BANSAL	7.829	First Division	Master of Business Administration
895	13810035	INDERPREET BANSAL	6.895	First Division	Master of Business Administration
896	13810036	ISHA PATIL	7.899	First Division	Master of Business Administration
897	13810037	KAKADIYA DHAVALKUMAR	7.618	First Division	Master of Business Administration
898	13810038	KANDAVALLI RAJESH	6.263		Master of Business Administration
899	13810039	KARAN GUPTA	7.868	First Division	Master of Business Administration
900	13810040	KARTIK KHAMESRA	8.289	First Division	Master of Business Administration
901	13810041	KARTIK YADAV	6.342		Master of Business Administration
902	13810042	KULDEEP SINGH	6.882	First Division	Master of Business Administration
903	13810043	KUMAR GAURISH	6.053		Master of Business Administration
904	13810044	KUNAL BANSAL	6.789	First Division	Master of Business Administration
905	13810045	LALA MEHUL KISHORKUMAR	6.842	First Division	Master of Business Administration
906	13810046	MAKWANA KAUSHIK	6.329		Master of Business Administration
907	13810047	MATTA ARVIN SINGH	5.763		Master of Business Administration
908	13810048	MEHTA DHWANI BHAVEN	7.684	First Division	Master of Business Administration
909	13810049	MOHD FARAZ	6.789	First Division	Master of Business Administration
910	13810050	MOHIT CHAUDHARY	7.079	First Division	Master of Business Administration
911	13810051	MOHIT JHAVAR	7.789	First Division	Master of Business Administration
912	13810052	MONICA SINGH	7.908	First Division	Master of Business Administration

913	13810053	MUKESH KUMAR	5.961		Master of Business Administration
914	13810054	NERALLA RAMA RAVI THEJA	7.539	First Division	Master of Business Administration
915	13810055	NILLOY GHOSHAL	8.487	First Division	Master of Business Administration
916	13810056	NITUMONI DAS	6.684	First Division	Master of Business Administration
917	13810057	PAREKH KUNJESH	8.461	First Division	Master of Business Administration
918	13810058	PARESH CHANDRA PATRA	7.141	First Division	Master of Business Administration
919	13810059	PARSHANT RANGA	6.5	First Division	Master of Business Administration
920	13810060	PAWAN ARORA	8.763	First Division with Distinction	Master of Business Administration
921	13810061	PRASHANT PANDEY	7.803	First Division	Master of Business Administration
922	13810062	PRATIK AGRAWAL	6.184		Master of Business Administration
923	13810063	PRIYA YADAV	8.171	First Division	Master of Business Administration
924	13810064	PRIYADARSHI MAYANK	6.882	First Division	Master of Business Administration
925	13810065	RAJ NARAYANAN S	5.908		Master of Business Administration
926	13810066	RAKESH RANJAN KUMAR	6.5	First Division	Master of Business Administration
927	13810067	SAMARTH SRIVASTAVA	7.816	First Division	Master of Business Administration
928	13810068	SATYARATHA SINGH	6.658	First Division	Master of Business Administration
929	13810069	SAURABH SINGH	7.237	First Division	Master of Business Administration
930	13810070	SHASHI KIRAN LUGUN	6.038		Master of Business Administration
931	13810071	SHIFIA MITTAL	7.711	First Division	Master of Business Administration
932	13810072	SHIVANI SINGH	7.105	First Division	Master of Business Administration
933	13810073	SHRISHTY	8.316	First Division	Master of Business Administration
934	13810074	SHUBHAM ARORA	8.105	First Division	Master of Business Administration
935	13810075	SUDESHNA NASKAR	6.632	First Division	Master of Business Administration
936	13810077	SUJEEV KUMAR PARASA	5.5		Master of Business Administration
937	13810078	T VAMSHI KRISHNA	6.11		Master of Business Administration
938	13810079	UDIT BHARDWAJ	7.066	First Division	Master of Business Administration
939	13810080	VAIBHAV AGARWAL	7.447	First Division	Master of Business Administration
940	13810081	VIGNESH B	7.532	First Division	Master of Business Administration
941	13810082	VIKAS SANGWAN	6.092		Master of Business Administration
942	13810083	VIPIN KUMAR	6.671	First Division	Master of Business Administration
943	13810084	VIPUL PARIKH	7.408	First Division	Master of Business Administration
944	13810085	Y.PRAVEEN	5.763		Master of Business Administration
945	14547002	BAHATI BALEKELE	7.35	First Division	Post Graduate Diploma Irrigation Water Management

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List of Ph.D. Degree Recipients 2015

1	10909002	JAVED DHILLON	AH	SCHEDULING OF WIND-PSP GENERATION UNDER DAY-AHEAD MARKET	Dr. Arun Kumar Dr. S.K. Singhal
2	10909003	MOHIT BANSAL	AH	OPTIMAL PLANNING OF INTEGRATED RENEWABLE ENERGY SYSTEMS	Dr. R. P. Saini Dr. D.K. Khatod
3	10909015	TABISH ALAM	AH	INVESTIGATION OF HEAT TRANSFER ENHANCEMENT BY USING V-SHAPED PERFORATED BLOCKS IN A RECTANGULAR SOLAR AIR HEATER DUCT	Dr. R.P. Saini Dr. J.S. Saini
4	10910012	DORESHOR KHWAIRAKPAM	AR	EVALUATION OF URBAN RENEWAL PROJECTS UNDER JNNURM FOR SUSTAINABLE URBAN DEVELOPMENT IN INDIA	Dr. R. Shankar Dr. Manhua Mukherjee
5	10910003	NEHA BANSAL	AR	MULTIHAZARD URBAN RISK ASSESSMENT	Dr. Mahua Mukherjee Dr. Ajay Gairola
6	11910001	SHAILA BANTANUR	AR	SUSTAINABILITY ASSESSMENT OF HIGHER EDUCATIONAL RESIDENTIAL CAMPUSES	Dr. Mahua Mukherjee Dr. R. Shankar
7	10910005	SHAILZA	AR	ENERGY EFFICIENT AND THERMALLY COMFORTABLE APARTMENTS IN INDIAN COMPOSITE CLIMATE	Dr. S.Y. Kulkarni Dr. P.S. Chani
8	11910004	VILAS KESHAV BAKDE	AR	AFFORDABLE HOUSING FOR THE WEAKER SECTION IN NAGPUR CITY	Dr. S.Y. Kulkarni
9	10926001	ANOOP KUMAR	AS	ANALYSIS OF SHOCK WAVES AND OTHER NON-LINEAR EVOLUTION EQUATIONS	Dr. Rajan Arora
10	08926012	CHHOTU RAM	AS	CORROSION POTENTIAL OF SOME INDUSTRIAL EFFLUENTS	Dr. Ajay Kumar Singh Dr. Chhaya Sharma
11	11926002	GANGA RAM	AS	A STUDY ON MILD SOLUTIONS FOR SOME FRACTIONAL FUNCTIONAL DIFFERENTIAL EQUATIONS	Dr. Jaydev Dabas
12	12926003	INDU CHAUHAN	AS	CHEMI-BIOACTIVE PAPER FOR PHOTOCATALYTIC AND ANTIBACTERIAL APPLICATIONS	Dr. Paritosh Mohanty
13	09926005	SANJAY KUMAR	AS	ELECTRONIC SPECTRA AND TRANSPORT BEHAVIOR IN MULTILAYER GRAPHENE	Dr. Ajay
14	10926005	SANJAY YADAV	AS	NUMERICAL AND ANALYTICAL SOLUTIONS OF SOME NON-LINEAR PARTIAL DIFFERENTIAL EQUATIONS	Dr. Rajan Arora
15	10921021	ANITA SENGAR	BM	A STUDY ON EVOLVING PERSPECTIVES OF RURAL MARKETING	Dr. Vinay Sharma
16	10921002	ARUNA B. BHAT	BM	LEADERSHIP STYLE AND CONFLICT LEVELS AS PREDICTORS OF ORGANISATIONAL LEARNING	Dr. M.K. Barua Dr. Santosh Rangnekar
17	10921001	AVINASH CHANDRA JOSHI	BM	ROLE OF EMOTIONAL INTELLIGENCE AND WORKPLACE SPIRITUALITY ON PERSONAL EFFICACY	Dr. Mukarsh Kumar Barua Dr. Santosh Rangnekar

Sl. No.	Enr. No.	Name	Topic	Name of Supervisor	
				Dr. Vinay Sharma	
18	12921027	KAPIL KUMAR JOSHI	CLIMATE CHANGE MITIGATION THROUGH MANAGEMENT OF PINE FOREST BIO RESIDUE IN N-W HIMALAYAS	Dr. Usha Lenka	
19	11921004	MINISHA GUPTA	A STUDY OF INNOVATION PROCESS IN INDIAN PHARMACEUTICAL COMPANIES	Dr. Santosh Rangnekar	
20	12921028	MOHIT YADAV	QUALITY OF WORK LIFE AND ROLE CLARITY AS PREDICTORS OF ORGANIZATIONAL CITIZENSHIP BEHAVIOUR	Dr. M.K. Barua	
21	10921007	RAJESH KATIYAR	MEASUREMENT OF SUPPLY CHAIN PERFORMANCE IN SELECT AUTOMOTIVE INDUSTRIES IN INDIA	Dr. Santosh Rangnekar	
22	11921002	RUBY SANGAR	ROLE SATISFACTION AND PSYCHOLOGICAL EMPOWERMENT AS DETERMINANTS OF TALENT MANAGEMENT	Dr. Usha Lenka	
23	11921012	SANIYA CHAWLA	ENABLERS OF LEARNING ORGANIZATION-A CASE OF MANAGEMENT INSTITUTES IN INDIA	Dr. Vinay K.Nangia Dr. Rajat Agarwal	
24	09921005	SANJEEV ARORA	PERFORMANCE MEASUREMENT AND STRATEGY PROCESS OF AUTO COMPONENT MANUFACTURERS	Dr. J.P. Singh	
25	10921009	SHAKTIKANTA NAYAK	ANALYSIS OF CORRELATION, NETWORK & QUANTUM PRINCIPLES IN FINANCE AND DECISION MAKING	Dr. Usha Lenka	
26	11921003	VANDANA	IMPACT OF SOCIALIZATION AGENTS ON PESTER POWER AND MATERIALISM AMONG CHILDREN	Dr. Santosh Rangnekar	
27	12921040	VANEET KASHYAP	IMPACT OF EMPLOYER BRANDING AND SERVANT LEADERSHIP ON EMPLOYEE RETENTION	Dr. Ashwani Kumar Sharma Dr. Pravindra Kumar	
28	09911013	ANAMIKA SINGH	STUDIES ON PEROXIREDOXIN ANTIOXIDANT SYSTEM FROM CANDIDATUS LIBERIBACTER ASIATICUS	Dr. Ashwani Kumar Sharma	
29	09911014	BIBEKANANDA KAR	STUDIES ON β -GLUCOSIDASE AND ACID PHOSPHATASE ENZYMES OF HYDROLASE FAMILY	Dr. Sanjoy Ghosh	
30	079252	GAURAV CHAUDHARY	PROCESS DEVELOPMENT FOR BIOETHANOL PRODUCTION FROM LIGNOCELLULOSIC BIOMASS: KANS GRASS	Dr. Partha Roy	
31	09911003	KUMAR NIKHIL	BIOLOGICAL EVALUATION OF A NOVEL PTEROSTILBENE-DERIVATIVE AS POTENT ANTICANCER AGENT	Dr. Naveen Kumar Navani	
32	08911002	LAMBADI PARAMESH RAMULU	APTAMERS FOR ADULTERANT DETECTION AND NANOBASED STRATEGIES FOR PATHOGEN CONTROL	Dr. Shailly Tomar	
33	09911010	MEGHA AGGARWAL	MOLECULAR CHARACTERIZATION OF AURA VIRUS CAPSID PROTEIN		

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	Name						Name of Supervisor
34	09911011	NARENDER KUMAR	BT	ENDOCRINE MODULATING ACTIVITIES OF SOME ENVIRONMENTAL AND INDUSTRIAL CHEMICALS			Dr. Partha Roy
35	10911001	NARESH KUMAR	BT	STRUCTURAL, COMPUTATIONAL AND BIOLOGICAL STUDIES OF FERULIC ACID AND ITS AMIDE DERIVATIVES			Dr. Vikas Pruthi
36	09911019	NIDHI SHARMA	BT	STUDIES ON A METAL UPTAKE PROTEIN FROM CANDIDATUS LIBERIBACTER ASIATICUS			Dr. Ashwani Kumar Sharma
37	079262	PAVAN KUMAR	BT	MODELLING AND SIMULATION OF LARGE SCALE STREPTOKINASE PRODUCTION USING <i>E. coli</i> AS A HOST			Dr. Sanjoy Ghosh
38	08911010	PRABHAT PRATAP SINGH TOMAR	BT	STUDIES ON MULTIFUNCTIONAL LOW MOLECULAR WEIGHT HETERODIMERIC PROTEINS			Dr. Ashwani Kumar Sharma
39	09911020	RAJBALA YADAV	BT	IN SILICO STUDIES AND FUNCTIONAL VALIDATION OF SALT INDUCIBLE S6PDH GENE IN RICE			Dr. Ramasare Prasad Dr. M.R. Maurya
40	08911014	SAMTA SAROJ	BT	BIOCHEMICAL AND MOLECULAR STUDIES ON THE DEGRADATION OF AZO DYES BY <i>Penicillium Oxalicum</i>			Dr. R.P. Singh Dr. R. Prasad
41	09911022	SHILPI KUMARI	BT	HETEROLOGOUS EXPRESSION, PURIFICATION AND BIOPHYSICAL CHARACTERIZATION OF RGP FROM GUAR			Dr. G.S. Randhawa Dr. S.K. Tripathi
42	09911023	SONALI DHINDWAL	BT	STRUCTURAL STUDIES OF ENZYMES INVOLVED IN BIOREMEDIATION			Dr. Pravindra Kumar Dr. Shailly Tomar
43	09911025	SWATI VERMA	BT	GENETIC TRANSFORMATION OF CLUSTER BEAN (CYAMOPSIS TETRAGONOLOBA)			Dr. G.S. Randhawa Dr. Vikas Pruthi
44	09914018	AJAY CHOURASIA	CE	PERFORMANCE EVALUATION OF CONFINED MASONRY BUILDINGS UNDER CYCLIC LATERAL LOADS			Dr. Pradeep Bhargava Dr. N.M. Bhandari Dr. S.K. Bhattacharya
45	10914005	AJMAL HUSSAIN	CE	FLOW CHARACTERISTICS OF SIDE ORIFICES AND INTAKES IN OPEN CHANNELS			Dr. Z. Ahmad Dr. C.S.P. Ojha
46	10914006	ANKIT CHAKRAVARTI	CE	SCOUR IN SEDIMENT MIXTURES UNDER SUBMERGED CIRCULAR VERTICAL JETS			Dr. R.K. Jain Dr. Z. Ahmad
47	10914011	BANTI AMARSHAH GEDAM	CE	LONG TERM BEHAVIOUR OF HIGH PERFORMANCE CONCRETE BRIDGES			Dr. N.M. Bhandari Dr. Akhil Upadhyay
48	10914010	DANIE ROY A B	CE	STRENGTHENING OF HEAT DAMAGED REINFORCED CONCRETE ELEMENTS			Dr. Pradeep Bhargava Dr. Umesh Kumar Sharma
49	09914005	ETISHREE AGARWAL	CE	ASSESSMENT OF GROUNDWATER REGIME USING GEOSPATIAL AND FLOW MODELING TECHNIQUES			Dr. R.D. Garg Dr. S.K. Srivastav (Dehradun)
50	11914004	GAURAV TIWARI	CE	INFLUENCE OF TARGET SPAN AND BOUNDARY CONDITIONS ON BALLISTIC RESISTANCE			Dr. P.K. Gupta Dr. M.A. Iqbal

Sl. No.		Student		Topic		Name of Supervisor	
68	10914025	SNIGDHENDUBALA PRADHAN	CE	AQUEOUS ORGANICS: IDENTIFICATION AND ASSESSMENT OF ADSORPTION BY K _{ow} AND SUVA	Dr. Pradeep Kumar Dr. Indu Mehrotra		
69	11914013	SUNITA KUMARI	CE	MODELING OF LIQUEFACTION USING COUPLED FINITE ELEMENT ANALYSIS	Dr. V. A. Sawant		
70	08914017	SURENDRA PAL SINGH	CE	VIRTUAL 3D CITY MODEL BY USING GEOMATICS TECHNIQUES	Dr. Kamal Jain Dr. V. Ravibabu Mandla		
71	11914027	TUSHAR KANTI DEY	CE	OPTIMUM DESIGN OF FRP LAMINATED BRIDGE DECKS HAVING DIFFERENT CORE CONFIGURATIONS	Dr. Anupam Chakrabarti Dr. Umesh Kumar Sharma		
72	08914013	VANDITA SRIVASTAVA	CE	INFORMATION EXTRACTION ON TREES FROM VERY HIGH RESOLUTION SATELLITE IMAGES	Dr. P. K. Garg Dr. R. D. Garg		
73	11914014	VIRENDRA KUMAR VERMA	CE	STUDY OF CONCRETE FILLED UPVC TUBES AS COLUMNS IN SEVERE ENVIRONMENT	Dr. P. K. Gupta		
74	10914029	ZIYAD ABDUL-NABI KHAUDHAIR RAOOF KUBBA	CE	STRUCTURAL BEHAVIOUR OF RECYCLED CONCRETE FILLED STEEL TUBULAR COLUMNS	Dr. Ashok Kumar Ahuja Dr. Pramod Kumar Gupta		
75	08912010	AMIT RAI	CH	MODELING AND RESPONSE SURFACE ANALYSIS OF SUPERCRITICAL FLUID EXTRACTION OF VEGETABLE OILS	Dr. Bikash Mohanty Dr. Ravindra Bhargava		
76	10912012	BHUMICA AGARWAL	CH	STUDIES ON CO-REMOVAL OF PHENOL AND CYANIDE FROM COKE WASTEWATER	Dr. C. Balomajunder		
77	10912001	GANGAWANE KRUNAL MADHUKAR	CH	CONVECTIVE FLOW AND HEAT TRANSFER ANALYSIS BY USING THERMAL LATTICE BOLTZMANN METHOD	Dr. Ram Prakash Bharti Dr. Surendra Kumar		
78	10912002	JYOTI	CH	TREATMENT OF BISPHENOL-A CONTAMINATED WATER BY ADVANCED OXIDATION PROCESSES	Dr. I.M. Mishra Dr. Vineet Kumar		
79	10912003	RICHA AGARWAL	CH	NON-NEWTONIAN FLOW AND HEAT TRANSFER AROUND TRIANGULAR BLUFF BODIES	Dr. Amit Kumar Dhimam		
80	10912018	SATYANARAYANA MURTY PUDI	CH	HYDROGENOLYSIS OF GLYCEROL TO 1,2- PROPANEDIOL OVER SUPPORTED COPPER AND NICKEL CATALYSTS	Dr. Shashi Kumar Dr. Prakash Biswas		
81	11912012	SUNIL KUMAR	CH	STUDIES ON SOLVENT EXTRACTIVE DESULFURIZATION OF GAS OIL	Dr. Vimal Chandra Srivastava Dr. Shrikant Madhusudan Nanoti		
82	11915005	SANCHIKA GUPTA	CS	A LIGHTWEIGHT INTRUSION DETECTION SYSTEM FOR CLOUD INFRASTRUCTURE	Dr. Padam Kumar		
83	10913015	ABHISHEK BAHETI	CY	FLUORENE BASED ORGANIC DYES FOR DYE SENSITIZED SOLAR CELLS	Dr. K.R. Justin Thomas		
84	10913016	ADDANKI VENKATESWARARAO	CY	CARBAZOLE-BASED ORGANIC DYES FOR DYE-SENSITIZED SOLAR CELLS	Dr. K.R. Justin Thomas		
85	10913004	HIMANSHU CHASTA	CY	VOLTAMMETRIC SENSORS FOR BIOMOLECULES AND DRUGS	Dr. R.N. Goyal		

Sl. No.	Ref. No.	Author	Discipline	Topic	Supervisor
86	09913004	JAY SINGH MEENA	CY	COMPUTATIONAL STUDIES ON OLEFIN METATHESIS REACTIONS	Dr. P.P. Thankachan
87	08913009	M N K PRASAD BOLISETTY	CY	BENZOTHIADIAZOLE DERIVATIVES FOR PHOTOVOLTAIC DEVICES	Dr. Kaushik Ghosh Dr. K.R. Justin Thomas
88	10913021	MANOJ KUMAR	CY	DESIGN & SYNTHESIS OF PROSPECTIVE ANTIMALARIALS BY (4+1) MULTICOMPONENT REACTION	Dr. Anuj Sharma Dr. V.K. Gupta
89	11913002	NAVEEN KUMAR	CY	SYNTHESIS AND CATALYTIC PERFORMANCE OF IMMOBILIZED VANADIUM AND MOLYBDENUM COMPLEXES	Dr. Mannar R. Maurya
90	10913024	NIKITA CHAUDHARY	CY	CATALYTIC ROLE OF IMMOBILIZED VANADIUM COMPLEXES IN OXIDATION REACTIONS	Dr. Mannar R. Maurya
91	08913010	RADHA RAMAN MAURYA	CY	SYNTHESIS AND STRUCTURAL STUDIES OF BENZIMIDAZOLE BASED SALTS AND THEIR METAL COMPLEXES	Dr. U.P. Singh
92	09913014	RAJAN KUMAR	CY	SOME ASPECTS OF CHEMISTRY OF RUTHENIUM WITH POLYDENTATE LIGANDS	Dr. G. Bhattacharjee Dr. Kaushik Ghosh
93	11913004	SARITA DHAKA	CY	SYNTHESIS, CHARACTERIZATION AND CATALYTIC ASPECTS OF DIOXIDOMOLYBDENUM(VI) COMPLEXES	Dr. Mannar R. Maurya
94	11913010	SAURABH KUMAR YADAV	CY	NANOMATERIAL BASED SENSORS FOR THE DETERMINATION OF BIOMOLECULES AND DRUGS	Dr. R.N. Goyal Dr. D. Kaur
95	09913007	SHIKHA NARANG	CY	SYNTHESIS AND STRUCTURAL STUDIES OF SUPRAMOLECULES USING N-HETEROCYCLIC LIGANDS	Dr. Shailly Tomar Dr. Uday P. Singh
96	08913015	SUDHIR KUMAR GUPTA	CY	SYNTHESIS AND PHYSICO-CHEMICAL PROPERTIES OF BIOTEMPLATED β -FeOOH NANOSTRUCTURES	Dr. Anil Kumar
97	09929001	MADAN MOHAN ROUT	DM	PROBABILISTIC SEISMIC HAZARD ASSESSMENT OF NORTHWEST AND CENTRAL HIMALAYAN REGION	Dr. J.D. Das Dr. Kamal
98	10915004	ASHUTOSH NANDI	EC	SIMULATION AND MODELLING OF MULTIGATE MOSFETS FOR ANALOG APPLICATIONS	Dr. Sudeb Das Gupta Dr. A.K. Saxena
99	09915006	BALJIT KAUR	EC	TIMING MODELS FOR EFFICIENT CHARACTERIZATION OF NANOSCALE VLSI SINGLE STAGE STANDARD CELLS	Dr. Anand Bulusu Dr. Sanjeev Manhas
100	11915002	BRIJESH R. IYER	EC	NON-INVASIVE DETECTION OF HUMAN VITAL SIGNS USING CONCURRENT DUALBAND RF SENSOR	Dr. N.P. Pathak Dr. Debashis Ghosh
101	10915005	MAHESHWARAM SATISH	EC	DESIGN AND ANALYSIS OF VERTICAL NANOWIRE CMOS DEVICES AND CIRCUITS	Dr. S. Manhas Dr. B. Anand
102	10915006	MANOJ KUMAR MAJUMDER	EC	PERFORMANCE ANALYSIS OF GRAPHENE BASED INTERCONNECTS AND THROUGH SILICON VIAS	Dr. B.K. Kaushik Dr. S.K. Manhas

Sr. No.	Roll No.	Name of Candidate	Branch	Topic	Name of Supervisor
103	10915009	POOJA MISHRA	EC	SAR POLARIMETRY FOR CHARACTERIZATION AND RETRIEVAL OF EARTH AND LUNAR SURFACE	Dr. Dharmendra Singh
104	12915004	PRAJAPATI PRAVINBHAI RATILAL	EC	INVESTIGATIONS ON POLARIZATION AGILE PLANAR ANTENNAS WITH DEFECTED GROUND STRUCTURES	Dr. M.V. Kartikeyan Dr. A.Patnaik
105	11918001	AJAY SHIV SHARMA	EE	GENE ONTOLOGY DATA MINING AND SYSTEMS BIOLOGY OF CANCER	Dr. Rajendra Prasad Dr. Hari Om Gupta
106	09918019	AMBARISHA MISHRA	EE	INVESTIGATIONS ON SENSORLESS PMSM DRIVE	Dr. Pramod Agarwal Dr. S.P. Srivastava
107	09918024	AMIT KUMAR SINGH	EE	DESIGN OF CONTROL SCHEMES FOR DISTILLATION COLUMN	Dr. Barjeev Tyagi Dr. Vishal Kumar
108	09918026	CHARU SHARMA	EE	PLACEMENT OF PHASOR MEASUREMENT UNITS AND CONTROL OF ROTOR ANGLE STABILITY IN POWER SYSTEMS	Dr. Barjeev Tyagi
109	11918005	DEEP GUPTA	EE	DENOISING AND SEGMENTATION OF ULTRASOUND MEDICAL IMAGES	Dr. R.S. Anand Dr. Barjeev Tyagi
110	11918006	DHANESH KUMAR SAMBARIYA	EE	SMALL SIGNAL STABILITY ENHANCEMENT USING POWER SYSTEM STABILIZER	Dr. Rajendra Prasad
111	09918005	GITANJALI MEHTA	EE	ANALYSIS AND DESIGN OF PHOTOVOLTAIC AND FUEL CELL BASED CONVERTER SYSTEMS	Dr. S.P. Singh
112	09918027	HIMANSHU CHAUDHARY	EE	ROBOT MANIPULATOR CONTROL USING INTELLIGENT AND EVOLUTIONARY COMPUTING TECHNIQUES	Dr. Rajendra Prasad Dr. N. Sukavanam
113	09918020	KALPANA SAINI	EE	PROCESSING OF ECHOCARDIOGRAPHIC IMAGES WITH REFERENCE TO MITRAL REGURGITATION	Dr. Manoj Kumar Rhoti Dr. M.L. Dewal
114	09918009	LAL BAHADUR PRASAD	EE	INTELLIGENT ADAPTIVE OPTIMAL CONTROL OF DYNAMICAL SYSTEMS	Dr. Hari Om Gupta Dr. Barjeev Tyagi
115	10918023	M. GERMIN NISHA	EE	NONLINEAR MODEL PREDICTIVE CONTROL USING LEARNING MACHINES	Dr. G.N. Pillai
116	09918029	NEERAJ GUPTA	EE	PROBABILISTIC ANALYSIS OF POWER SYSTEM WITH WIND GENERATORS	Dr. Vinay Pant Dr. Biswarup Das
117	10918025	VIKRAMADITYA DAVE	EE	DEVELOPMENT OF NANOSTRUCTURED DIELECTRIC HYDROPHOBIC THIN FILMS FOR HIGH VOLTAGE INSULATOR	Dr. Hari Om Gupta Dr. Ramesh Chandra
118	10918013	VYAS BHARGAV YASHVANTRAI	EE	PROTECTION OF SERIES COMPENSATED TRANSMISSION LINES	Dr. R.P. Maheshwari Dr. Biswarup Das
119	10917001	AKANSHA MEHROTRA	EQ	DETECTION OF TSUNAMI INDUCED CHANGES FROM SATELLITE IMAGES USING NEURAL NETWORKS	Dr. Kirat Pal Dr. M.J. Nigam
120	885603	ANIL KUMAR SRIVASTAVA	EQ	SEISMIC MICROZONATION OF AN URBAN HABITAT	Dr. D.K. Paul Dr. M.L. Sharma

S. No.	Registration No.	Author	Topic	Category	Reviewer
121	08917001	ANSHU TOMAR	SEISMIC ASSESSMENT AND RETROFITTING OF HISTORICAL BRICK MASONRY BUILDINGS	EQ	Dr. D.K.Paul Dr. Pankaj Agarwal
122	10917002	DARAKHSHAN SAHAR	NUMERICAL SIMULATION OF SITE AND SITE-CITY INTERACTION EFFECTS ON GROUND MOTION	EQ	Dr. J.P.Narayan
123	10917012	KRISHNA KANT SINGH	DETECTION OF EARTHQUAKE INDUCED CHANGES USING DIGITAL IMAGE PROCESSING	EQ	Dr. Kirat Pal Dr. M.J.Nigam
124	11917002	NARAYAN ROY	UNCERTAINTY IN SITE CHARACTERIZATION USING SURFACE WAVE TECHNIQUE	EQ	Dr. Ravi S.Jakka Dr. H.R.Wasan
125	078454	RAJIV SACHDEVA	APPLICATION OF ANN IN STRONG GROUND MOTION PREDICTION	EQ	Dr. Ashok Kumar Dr. M.L.Sharma
126	11917011	ROHTASH KUMAR	EARTHQUAKE SOURCE PARAMETERS AND ATTENUATION CHARACTERISTICS OF ARUNACHAL REGION	EQ	Dr. S.C.Gupta
127	11917004	ROSHAN KUMAR	TIME-FREQUENCY ANALYSIS OF SEISMIC SIGNALS	EQ	Dr. Ashok Kumar Dr. P.Sumathi
128	10917005	SACHIN BALASAHEB KADAM	SEISMIC EVALUATION AND RETROFIT OF MASONRY BUILDINGS	EQ	Dr. Yogendra Singh
129	078455	SANJAY KUMAR JAIN	STUDY OF INTRINSIC AND SCATTERING ATTENUATION IN THE GARHWAL HIMALAYA	EQ	Dr. Ashwani Kumar Dr. S.C.Gupta
130	068602	SANJAY KUMAR SINGH	COMPUTER VISION APPLIED TO DIGITAL SEISMOLOGICAL DATA	EQ	Dr. Kirat Pal Dr. M.J.Nigam
131	10917006	SHRABONY ADHIKARY	EFFECT OF SOIL CONDITIONS ON THE SEISMIC RESPONSE OF STRUCTURES	EQ	Dr. D.K.Paul Dr. Yogendra Singh
132	09917005	SYED NURUSSYIDYIN MADANI WAHEED ASHRAF	NONLINEAR SEISMIC SOIL-STRUCTURE INTERACTION USING SCALED BOUNDARY FINITE ELEMENT METHOD	EQ	Dr. B.K.Maheshwari
133	11916002	AMAR AGARWAL	STRUCTURAL STUDIES IN LONAR CRATER, INDIA AND LOCKNE CRATER, SWEDEN	ES	Dr. D.C.Srivastava Dr. R.O.Greiling
134	09916015	ANJALI SINGH	IMPACT OF URBANIZATION ON GROUNDWATER IN LUCKNOW AREA, INDIA	ES	Dr. G.J.Chakrapani Dr. S.K.Srivastava
135	09916001	ASHVINI KUMAR	ATTENUATION CHARACTERISTICS OF UTTARAKHAND HIMALAYA USING STRONG MOTION DATA	ES	Dr. Anand Joshi Dr. Amita Sinhal
136	10916019	DIPENDU SAHA	INTEGRATED GEOPHYSICAL MAPPING OF SEDIMENT BELOW DECCAN TRAPS IN CHAMBAL VALLEY	ES	Dr. Rambhatla G.Sastry Dr. J.N.Prabhakarudu
137	09916014	NANDITA SINGH	SEDIMENT FLOW MODELING IN BHAGIRATHI RIVER USING ARTIFICIAL NEURAL NETWORKS	ES	Dr. G.J.Chakrapani
138	10916006	NEERAJ SRIVASTAVA	GEOLOGY OF LOWELL CRATER REGION ON THE MOON: ANALYSIS OF REMOTE SENSING DATA	ES	Dr. R.P.Gupta Dr. J.N.Goswami

			Supervisor		
139	09916018	REET KAMAL TIWARI	ES	REMOTE SENSING STUDIES OF CHHOTA-SHIGRI GLACIER, HIMALAYAS	Dr. R.P.Gupta Dr. M.K.Arora
140	09916019	ROHAN KUMAR	ES	TERRAIN ANALYSIS FOR LANDSLIDE HAZARD ZONATION IN TEHRI RESERVOIR RIM REGION USING GIS	Dr. R. Anbalagan Dr. V.N.Singh
141	079409	SAJU VARGHESE	ES	GENESIS OF GOLD MINERALIZATION IN WYNAD, SOUTHERN GRANULITE TERRAIN, INDIA	Dr. R. Krishnamurthi Dr. V.Ravikant Dr. K.L.Pruseth
142	11916012	SANDEEP	ES	MODELLING OF STRONG MOTION GENERATION AREA USING SEMI EMPIRICAL TECHNIQUE	Dr. Anand Joshi Dr. Kamal
143	09916021	SUJATA PARIDA	ES	ENGINEERING GEOLOGICAL EVALUATION OF RESERVOIR SLOPES	Dr. R.Anbalagan Dr. M.N. Viladkar
144	10919011	AAKANKSHA KATARIA	HS	OCB: A FUNCTION OF HIGH-PERFORMANCE HR PRACTICES, PSYCHOLOGICAL CLIMATE & WORK ENGAGEMENT	Dr. Renu Rastogi Dr. Pooja Garg
145	10919015	HAPPY	HS	RESILIENCE, SUBJECTIVE WELL-BEING AND COMMITMENT AS PREDICTORS OF OCB	Dr. Pooja Garg
146	079852	MANU	HS	THE DEPICTION OF 'LOTUS' IN MUGHAL ARCHITECTURE : A CRITICAL STUDY	Dr. Ila Gupta Dr. Nagendra Kumar
147	08919004	NALIN SINGH NEGI	HS	IMPACT OF OUT-MIGRATION OF HUSBANDS ON LEFT BEHIND WIVES- A STUDY OF RURAL GARHWAL	Dr. D.K. Nauriyal Dr. Babita Sinha
148	09919009	NIVEDITA SHARMA	HS	CONTRACT FARMING IN PUNJAB: INSTITUTIONAL FRAMEWORK, DETERMINANTS AND EFFICIENCY	Dr. S.P. Singh
149	10919016	SHIVANI	HS	QUALITY OF WORK LIFE AS A PREDICTOR OF TRUST AND SUBJECTIVE WELL- BEING OF EMPLOYEES	Dr. Renu Rastogi Dr. Pooja Garg
150	10919017	SOHINI	HS	SOCIAL EXCLUSION OF THE ELDERLY: A STUDY OF JHANSI DISTRICT IN UTTAR PRADESH	Dr. A.J.Mishra
151	09920001	MANOJ CHANDRA GARG	HY	PERFORMANCE EVALUATION OF PV DRIVEN NF-RO HYBRID WATER TREATMENT SYSTEM	Dr. Himanshu Joshi
152	09920002	MURUMKAR ASMITA RAMKRISHNA	HY	IMPACT OF CLIMATE CHANGE ON HYDROMETEOROLOGICAL VARIABLES IN BHIMA BASIN (INDIA)	Dr. D.S.Arya
153	08920003	VINIT KUMAR JAIN	HY	OBJECTIVE ASSESSMENT OF INDICES AND VULNERABILITY TO DROUGHT	Dr. M.K.Jain Dr. R.P.Pandey
154	079655	MUKESH KUMAR	IIC	SYNTHESIS AND CHARACTERIZATION OF SiC THIN FILMS FOR SPINTRONIC APPLICATIONS	Dr. Ramesh Chandra

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S. No.	Enrollment No.	Student Name	Grade	Project Title	Supervisor
155	10915002	AMIT TRIPATHI	MA	NUMERICAL SOLUTIONS OF SOME PARTIAL DIFFERENTIAL EQUATIONS USING B-SPLINE FUNCTIONS	Dr. R.C.Mittal
156	09922001	AMITA BHAGAT	MA	PERFORMANCE ANALYSIS OF RETRIAL QUEUEING SYSTEMS	Dr. Madhu Jain
157	09922003	DEEP SINGH	MA	A STUDY OF SOME CRYPTOGRAPHICALLY SIGNIFICANT BOOLEAN FUNCTIONS AND THEIR GENERALIZATIONS	Dr. Maheshanand
158	09922004	DEEPIKA SAINI	MA	3D RECONSTRUCTION OF FREE-FORM SHAPED OBJECTS IN STEREO VISION USING NURBS	Dr. Sanjeev Kumar
159	08922006	DEV DATTA	MA	MATHEMATICAL MODELING OF RESPIRATORY MECHANICS	Dr. Tilak Raj Gulati
160	09922021	FATEH SINGH	MA	A STUDY OF MECHANICAL AND STRUCTURAL PROPERTIES OF APPLE AND POTATO	Dr. Pratibha
161	09922007	HIMANSHU AGARWAL	MA	MULTIPURPOSE INVISIBLE AND VISIBLE DIGITAL IMAGE WATERMARKING SCHEMES	Dr. V.K.Katiyar
162	10922004	JOLLY PURI	MA	DEVELOPMENT OF DEA IN UNCERTAIN ENVIRONMENTS WITH EFFICIENCY MEASUREMENT OF INDIAN BANKING SECTOR	Dr. V.K.Katiyar
163	10922006	KAMLESH JANGID	MA	MATHEMATICAL STUDY FOR TWO EQUAL COLLINEAR CRACKS WEAKENING A PIEZOELECTRIC PLATE	Dr. B.P. Singh
164	10922017	MANIA	MA	NUMERICAL SIMULATIONS OF PROBLEMS OF FLOW, HEAT AND MASS TRANSFER IN NANOFLLUIDS	Dr. R.Bhargava
165	08922026	MANISH KUMAR KHANDELWAL	MA	STABILITY OF NON-ISOTHERMAL POISEUILLE FLOW IN A VERTICAL CHANNEL	Dr. Anupam Chakrabarti
166	09922024	NIRMAL YADAV	MA	ERROR ESTIMATION OF DISCRETE CONVOLUTION BACKPROJECTION ALGORITHM FOR DISCRETE RADON TRANSFORM	Dr. Premananda Bera
167	09922026	POOJA RAJ VERMA	MA	MATHEMATICAL MODELS FOR MODE-III CRACKS IN PIEZOELECTRIC/PIEZO-ELECTRO-MAGNETIC STRIP	Dr. Tanuja Srivastava
168	11922005	RACHNA BHATIA	MA	NUMERICAL SOLUTIONS OF SOME PARTIAL DIFFERENTIAL EQUATIONS USING B-SPLINE	Dr. R.R.Bhargava
169	08922017	RAM KEVAL	MA	MATHEMATICAL MODELING OF HEPATITIS C VIRAL KINETICS	Dr. R.C.Mittal
170	09922016	SARITA PIPPAL	MA	ANALYTICAL AND NUMERICAL STUDIES OF NATURAL CONVECTION IN A CAVITY: A THERMAL NON-EQUILLIBRIUM APPROACH	Dr. Sunita Gakkhar
					Dr. Sandeep Banerjee
					Dr. Dr. Premananda Bera

S. No.				Topic		Author	
171	11922009	SATHISH KUMAR A	MA	ON THE RATE OF CONVERGENCE OF CERTAIN LINEAR POSITIVE OPERATORS	Dr. P.N.Agarwal		
172	10922011	SATWANTI DEVI	MA	GEOMETRIC PROPERTIES OF INTEGRAL TRANSFORMS OF A SECOND ORDER DIFFERENTIAL INEQUALITY	Dr. A.Swaminathan		
173	079558	SAURABH KAPOOR	MA	STABILITY OF THERMOSOLUTAL MIXED CONVECTION IN A VERTICAL PIPE FILLED WITH POROUS MEDIUM	Dr. Premananda Bera		
174	08922024	SHAILESH KUMAR SRIVASTAVA	MA	SOME PROBLEMS ON TRIGONOMETRIC APPROXIMATION IN L_p ($p \geq 1$) SPACES	Dr. Uday Singh		
175	09922018	T. MANJULA	MA	TESTING AND OPTIMIZATION OF SOFTWARE RELIABILITY GROWTH MODELS	Dr. Madhu Jain Dr. Tilak Raj Gulati		
176	09923008	A. ARUL PETER	ME	STUDY OF HEAT AND MOISTURE TRANSPORT THROUGH CONCRETE EXPOSED TO ELEVATED TEMPERATURES	Dr. Umesh Kumar Sharma Dr. K.Murugesan		
177	09923009	ABHINAV GUPTA	ME	CONDENSATION HEAT TRANSFER OF R-134a INSIDE HELICALLY COILED HORIZONTAL TUBES	Dr. Akhilesh Gupta Dr. Ravi Kumar		
178	09923001	AJAI KUMAR SAHANI	ME	DESIGN FOR ASSEMBLY- STACK UP OF GEOMETRICAL TOLERANCES FOR COST OPTIMIZATION	Dr. P.K.Jain Dr. Satish Chand Sharma		
179	11923001	AMIT BANSAL	ME	FUSION JOINING OF ADVANCED MATERIALS USING MICROWAVE HYBRID HEATING	Dr. A.K.Sharma Dr. Pradeep Kumar		
180	10923012	ARIJIT KUNDU	ME	FLOW BOILING HEAT TRANSFER OF REFRIGERANTS THROUGH INCLINED TUBE	Dr. Ravi Kumar Dr. Akhilesh Gupta		
181	10923003	ATUL KUMAR	ME	REMAINING LIFE PREDICTION OF MACHINE ELEMENT USING REVERSE ENGINEERING APPROACH	Dr. P.K.Jain Dr. P.M.Pathak		
182	10923013	FAISAL HASAN	ME	SOME PERFORMANCE ISSUES FOR A RECONFIGURABLE MANUFACTURING SYSTEM	Dr. Dinesh Kumar Dr. P.K.Jain		
183	11923028	GOR MEHULKUMAR MAHENDRABHAI	ME	DYNAMIC MODELING AND CONTROL OF QUADRUPED ROBOT WITH COMPLIANT LEGS	Dr. P.M.Pathak		
184	11923029	GUDIPADU VENKATESH	ME	PERFORMANCE ANALYSIS OF ULTRASONIC ASSISTED ABRASIVE FLOW MACHINING PROCESS	Dr. A.K.Sharma Dr. Pradeep Kumar		
185	09923005	KAMAL SHARMA	ME	NUMERICAL SIMULATION OF CRACK GROWTH PROBLEMS USING EFGM/XFEM	Dr. B.K.Mishra Dr. Indra Vir Singh		
186	11923005	KISHORE DEBNATH	ME	MACHINING BEHAVIOR OF FIBER-REINFORCED POLYMER COMPOSITES	Dr. Inderdeep Singh Dr. Akshay Dvivedi		
187	12923009	KUSHARE PRASHANT BHANUDAS	ME	PERFORMANCE OF MULTILOBE NON-RECESSED HYDROSTATIC/HYBRID JOURNAL BEARINGS	Dr. Satish C.Sharma		
188	10923014	LALIT THAKUR	ME	AN INVESTIGATION ON THERMAL SPRAY WEAR RESISTANT NANOSTRUCTURED COATING	Dr. Navneet Arora		

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Sl. No.	Roll No.	Name	Discipline	Topic	Supervisor
189	11923006	MANJOT SINGH CHEEMA	ME	AN ULTRASONIC MICROMACHINING APPROACH TO FABRICATE MICROCHANNELS ON GLASS	Dr. Apurba Kumar Sharma
190	10923007	MIHIR KUMAR SUTAR	ME	DESIGN DEVELOPMENT AND CONTROL OF MINIATURE ROBOT FOR IN VIVO BIOPSY	Dr. Akshay Divedi
191	08923018	MOHAMMAD ASIF	ME	EXPERIMENTAL AND NUMERICAL INVESTIGATION OF THERMAL CONTACT CONDUCTANCE	Dr. N.K.Mehta Dr. P.M.Pathak
192	11923037	MOHIT TYAGI	ME	STUDY AND ANALYSIS OF THE ISSUES OF SUPPLY CHAIN PERFORMANCE SYSTEM WITH CSR CONSIDERATIONS	Dr. Andaliib Tariq Dr. Krishna Mohan Singh
193	11923007	NAGVENDRA KUMAR KANOJE	ME	DYNAMIC ANALYSIS OF RAIL WHEEL STRUCTURE DUE TO DEFECTS	Dr. Dinesh Kumar Dr. Pradeep Kumar
194	11923033	PANCHAL MITESHBHAI BIPINBHAI	ME	VIBRATION ANALYSIS OF SINGLE WALLED BORON NITRIDE NANOTUBE BASED MASS SENSOR	Dr. S.P.Harsha Dr. S.C.Sharma
195	11923038	SACHIN KUMAR	ME	CRACK GROWTH SIMULATIONS IN DUCTILE MATERIALS USING XFEM/COUPLED FE-EFGM	Dr. S.H. Upadhyay
196	11923011	SANJAY KUMAR SINGH	ME	NUMERICAL AND EXPERIMENTAL INVESTIGATIONS ON PARALLEL FLOW THREE-FLUID HEAT EXCHANGER	Dr. B.K.Mishra Dr. Indra Vir Singh
197	09923019	SAROJRANI PATTNAIK	ME	REDUCTION OF SHRINKAGE AND POROSITY DEFECTS IN INVESTMENT CASTING	Dr. P.K. Jha Dr. Manish Mishra
198	11923015	UMESH KUMAR VISHWAKARMA	ME	DEVELOPMENT OF EDM PROCESS VARIANTS AND ANALYSIS OF THEIR EFFECTS ON PERFORMANCE MEASURES	Dr. D. B. Karunakar Dr. P.K.Jha
199	10923016	VENKATESWARLU DEVURI	ME	EXPERIMENTAL AND NUMERICAL MODELING OF TOOL DESIGN EFFECTS ON FSW OF AL-Zn AND Al-Cu ALLOYS	Dr. Pradeep Kumar Dr. Akshay Divedi
200	11923035	VIKAS KUMAR	ME	EFFECT OF WHOLE BODY VIBRATION ON ACTIVITY COMFORT AND BIODYNAMIC RESPONSE	Dr. M.M.Mahapatra Dr. S.P.Harsha Dr. N.R.Mandal
201	10923017	VINEET KUMAR	ME	AN INVESTIGATION OF MECHANICAL AND FRACTURE BEHAVIOR OF ULTRAFINE GRAINED 6082 AL ALLOY	Dr. I.V.Singh Dr. B.K.Mishra
202	09924009	ASHISH WAMANRAO SELOKAR	MT	EROSION STUDIES ON NITRONIC STEELS FOR UNDERWATER PART APPLICATIONS	Dr. Ujjwal Prakash Dr. D.B.Goel
203	10924002	DEEPA MUDGAL	MT	DEVELOPMENT OF COATINGS FOR INCINERATOR ENVIRONMENT USING D-GUN TECHNIQUE	Dr. Satya Prakash Dr. Surendra Singh
204	09924012	NIDHI RANA	MT	HIGH TEMPERATURE CORROSION BEHAVIOUR OF THERMALLY SPRAYED NANOCOATINGS	Dr. Satya Prakash Dr.R.Jayaganthan
205	09924013	P. NAGESWARA RAO	MT	PROCESSING-STRUCTURE-PROPERTY CORRELATION IN ULTRAFINE GRAINED 6061 ALUMINIUM ALLOY	Dr. R.Jayaganthan

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S. No.	Name	Deptt.	Topic	Remarks
206	09924014 PARITOSH DUBEY	MT	SYNTHESIS AND DEVELOPMENT OF HARD AND TOUGH NANOCRYSTALLINE METAL NITRIDE COATINGS	Dr. Devendra Singh Dr. Ramesh Chandra
207	10924005 PREETI MAKKAR	MT	WEAR AND CORROSION BEHAVIOUR OF ELECTROLESS NI-P BASED NANOCOMPOSITE COATINGS	Dr. R.C. Agarwala Dr. Vijaya Agarwala
208	10924009 RASHMI MITTAL	MT	CHARACTERIZATION OF SPRAY DEPOSITED COLD ROLLED Al-Si-Pb ALLOYS	Dr. Devendra Singh
209	10924013 RAVI KANT	MT	DEVELOPMENT AND CHARACTERIZATION OF FeAl BASED COMPOSITES	Dr. Ujjwal Prakash Dr. V. Agarwala
210	078854 SANTANU DAS	MT	MICROSTRUCTURAL, MECHANICAL AND THERMOPHYSICAL PROPERTIES OF Th-U ALLOYS	Dr. B.S.S. Daniel Dr. G.P. Chaudhari
211	08924010 SIDHARTH JAIN	MT	DEVELOPMENT OF SHORT STEEL FIBER REINFORCED ALUMINIUM BASED COMPOSITES BY P/M ROUTE	Dr. V. Agarwala Dr. K. Chandra
212	11924004 SUNIL KUMAR RAJPUT	MT	THERMOMECHANICAL PROCESSING OF PLAIN LOW CARBON AND MICROALLOYED STEELS	Dr. G.P. Chaudhari Dr. S.K. Nath
213	10924010 SUNKULP GOEL	MT	MECHANICAL BEHAVIOUR OF UFG ZIRCALOY-2 PROCESSED BY CRYOROLLING: EXPERIMENTS & SIMULATION	Dr. I.V. Singh Dr. R. Jayaganthan
214	09924007 VINOD KUMAR JEEENAGER	MT	EFFECT OF MICROSTRUCTURAL MODIFICATION ON THE ENERGY ABSORPTION CAPACITY OF ALUMINIUM FOAM	Dr. B.S.S. Daniel Dr. Vivek Pancholi
215	10915011 SMRITI AGARWAL	NT	INVESTIGATIONS ON MM-WAVE IMAGING RADAR FOR SHAPE AND FAULT DETECTION OF TARGETS	Dr. Dharmendra Singh
216	10926011 ANSHU ANJALI SINGH	PE	NATURAL FIBER/POLYOLEFIN COMPOSITES WITH IN-SITU FIBER/MATRIX INTERFACIAL ADHESION	Dr. Sanjay Palsule
217	08926002 DEVESH KUMAR SHUKLA	PE	POLY (ETHER-ETHER KETONE) FUNCTIONALIZATION FOR FUEL CELL MEMBRANE APPLICATION	Dr. Vijay Kumar Dr. Y.S. Negi
218	10926004 ROHIT BANSAL	PE	IPO UNDERPRICING AND POST IPO PERFORMANCE ANALYSIS: EVIDENCE FROM INDIAN CAPITAL MARKET	Dr. Ashu Khanna
219	10926014 SWETA KUMARI GUPTA	PE	CADAVER GOAT-LUNG FOR TISSUE ENGINEERING APPLICATIONS	Dr. Narayan Chandra Mishra
220	09927002 BABITA	PH	APPLICATION SPECIFIC MULTILAYER OPTICAL STRUCTURES	Dr. Vipul Rastogi
221	08927012 N. VENU GOPAL	PH	LOCALIZED SURFACE PLASMON MEDIATED PROPERTIES OF Ag AND Ag/ZnO MULTILAYER THIN FILMS	Dr. Anirban Mitra
222	09927009 POOJA DEVI	PH	A STUDY OF ATMOSPHERIC MOISTURE AND WATER MIXING USING STABLE ISOTOPIC TECHNIQUES	Dr. Ashok Kumar Jain Dr. Someshwer Rao

S. No.			Topic		Name of Supervisor	
223	09927010	POTHURAJU THIRUPATHAIAH	PH	SEASONAL VARIATION OF SOME IMPORTANT ATOMIC OXYGEN DAYGLOW EMISSIONS	Dr. Vir Singh	
224	09927011	RAMANDEEP	PH	MAGNETIC AND ORBITAL ORDER IN FRUSTRATED SPINEL SYSTEMS	Dr. Tashi Nautiyal Dr. Tulika Maitra	
225	10927005	RHINE KUMAR ARAYAKKANDI KEECHIPRATH	PH	GIANT RESONANCES BUILT ON EXCITED STATES OF NUCLEI	Dr. P. Arumugam	
226	09927017	SUDESH	PH	STUDY OF SUPERCONDUCTING PROPERTIES OF MgB2 AND Fe-CHALCOGENIDE SUPERCONDUCTORS	Dr. Ghanshyam Das Verma	
227	08926001	ARVIND KUMAR SHARMA	PP	PULPING STUDIES OF EUCALYPTUS TERETICORNIS AND DENDROCALAMUS STRICTUS	Dr. Dharam Dutt Dr. T.K.Roy (N.Delhi)	
228	08926004	POONAM	PP	STUDIES ON ENZYMIC ASPECTS OF MICROBIAL ORIGIN AND BIO-BLEACHING OF HARDWOODS	Dr. C.H.Tyagi Dr. Dharm Dut	
229	08926005	RAJNI SHARMA	PP	ELECTROCHEMICAL TREATMENT AND RECYCLING OF PULP AND PAPER MILL WASTEWATER	Dr. Satish Kumar Dr. Chhaya Sharma	
230	08926006	RASHMI SINGH	PP	STUDIES ON CELLULASE PRODUCTION FOR ENZYME-ASSISTED REFINING OF PULP	Dr. Bijan Choudhary Dr. Nishi Kant Bhardwaj	
231	08926009	SNEH GAUTAM	PP	FABRICATING NANOFIBROUS COMPOSITE SCAFFOLDS FOR SKIN AND BONE TISSUE ENGINEERING	Dr. Narayan Chandra Mishra	
232	09914004	DINESH CHANDRA BALA	TS	GPR BASED PAVEMENT LAYER EVALUATION AND UTILITY DETECTION	Dr. S.S.Jain Dr. R.D.Garg	
233	079151	LAXMI NARAYAN THAKURAL	WR	STREAMFLOW MODELING AND IMPACT OF CLIMATE CHANGE FOR BEAS BASIN IN HIMALAYA	Dr. S.K.Mishra Dr. Sanjay Kumar Jain Dr. R.D.Singh (NIH)	
234	08928001	N. SIVAKUMAR	WR	TECHNO-ECONOMIC STUDY OF AN EXISTING PUMPED STORAGE PLANT	Dr. Narayana Prasad Padhey Dr. Devadutta Das	
235	10928006	SANJAY ANANDRAO BURELE	WR	EXPERIMENTAL INVESTIGATIONS ON CHANNELIZATION OF RIVER KOSI FROM CHATRA TO NIRMALI	Dr. Nayan Sharma Dr. Z.Ahmad Dr. I.D.Gupta	
236	09928007	SARITA GAJBHIYE	WR	INVESTIGATION OF SOME CRITICAL ASPECTS OF RAINFALL-RUNOFF- SEDIMENT YIELD MODELLING	Dr. S.K.Mishra Dr. Ashish Pandey	
237	10928011	SHIULEE CHAKRABORTY	WR	LONG TERM CHANGES IN IRRIGATION WATER REQUIREMENT	Dr. S.K.Mishra Dr. U.C.Chaube Dr. R.P.Pandey(NIH)	

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Biotechnology

1. Subject Code: BTN- 467 **Course Title:** High Throughput Sequencing

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:** DEC

8. Pre-requisite: Nil

9. Objectives: This course will provide details on next generation sequencing technology and its application in human health and disease.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Genome sequencing technology: Introduction to high throughput biology, concept on next generation sequencing, brief overview to select and prepare samples for next generation sequencing.	4
2.	Platform used for high throughput sequencing: Library constructions for Illumina, HiSeq and MiSeq next generation sequencing platform, single read, paired-end read, mate-pair, targeted resequencing technology.	6
3.	Genome sequencing project: Overview on Human, Mouse, Drosophila and Arabidopsis genome sequence.	6
4.	RNA sequencing: Preparation of mRNA library for sequencing. Removal of rRNA from samples. Isolation of small RNA (miRNA and piRNA) from animal cells, small RNA sequencing and exome sequencing.	6
5.	Gene expression studies: Multiplexed gene expression, miRNA expression, and copy number variation analysis. Genome wide association study, single nucleotide polymorphism. ChIP-seq, third generation sequencing.	8
6.	Protein sequencing: Isolation and preparation of protein samples for sequencing. Comparative proteomics. Stable isotope labeling by amino acids in cell culture (SILAC) and isobaric tags for relative and absolute quantification (ITRAQ) method in proteomic research.	8

7.	Metagenomics: Bacterial genome sequencing, Microbiome 16S rRNA sequencing, and barcode multiplexing.	4
	Total	42

11. Suggested Books:

S. No.	Author(s)/Title/Publisher	Year of publication/ Reprint
1.	Brown S.M., "Next-Generation DNA Sequencing Informatics", Cold Spring Harbor Laboratory Press.	2013
2.	Gorodkin J., Ruzzo W.L., "RNA Sequence-Structure and Function: Computational And Bioinformatic Methods", Springer.	2014
3.	Campbell M., Heyer L. J., Discovering Genomics, Proteomics and Bioinformatics (2 nd Edition)", Benjamin/Cummings.	2006
4.	Brown S.M., "Essential of Medical Genomics (2 nd edition)", Wiley-Blackwell.	2009

Grading System

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

The academic performance of a student shall be graded on a 10-point scale. The letter grades and their equivalent grade points are listed in Table-5:

Table - 5: STRUCTURE FOR GRADING OF ACADEMIC PERFORMANCE

Academic Performance	Grades	Grade Points
Exceptional Good	O	10
Excellent	A	10
Very Good	B+	9
Good	B	8
Fair	C+	7
Average	C	6
Below Average	D+	5
Marginal	D	4
Fail due to poor performance	F	0
Fail due to short attendance	FS	0
Pass in Audit Courses	AP	-
Fail in Audit Courses	AF	-
Incomplete	I	-
Continued Project	X	-
Satisfactory	S	-
Unsatisfactory	U	-

Explanation:

'F' Grade

The 'F' grade denotes poor performance, i.e. failing a course. In case a student is awarded a failing grade in a course, he/she may appear in re-examination.

If 'F' grade has been awarded in a core course, he/she shall have to repeat the course. For the other (elective) courses in which 'F' grade has been awarded, the student may take the same course or any other course from the same category. Further, 'F' grade secured in any course stays permanently on the grade card.

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



'FS' Grade

The 'FS' grade is awarded in case the student is detained due to poor attendance. In case a student is awarded 'FS' grade in a course, he/she is not allowed to appear in re-examination.

AP/AF Grades

These grades are awarded to an audit course as specified in Appendix-E4. These grades are not counted in the computation of SGPA/CGPA.

'I' Grade

This refers to an 'incomplete' grade, which is required to be converted into a regular letter grade as provided in section 29(2) of Regulations for the UG, IDD, and IMD programmes. The guidelines for the award of 'I' grade are given in Appendix-B3.

'X' Grade

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

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

The letter Grades awarded to a student in all the courses (except audit courses) shall be converted into a semester and cumulative performance index called the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), to be calculated by the procedures given in Appendix-B of these regulations.

$$\text{S.G.P.A} = \frac{\sum_{i=1}^n C_i \times P_i}{\sum_{i=1}^n C_i}$$

Where,

C_i = Number of credits of the i course of a semester for which SGPA is to be calculated

P_i = Grade point obtained in i course

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

$$\text{C.G.P.A} = \frac{\sum_{i=1}^m C_i \times P_i}{\sum_{i=1}^m C_i}$$

Where,

C_i = Number of credits of the i course, up to the semester for which CGPA is to be calculated. **The CGPA shall be calculated taking all the subjects registered including a course in which 'F' grade is awarded till date starting from the beginning but if the student has cleared a course, in which the student had backlog, the new grade will replace the old grade while calculating CGPA.**

P_i = Grade point earned in i course.

$i = 1, \dots, m$; represent the number of courses in which a student was registered till date.



General Guidelines for the Award of Grades

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

- (i) All evaluations of different components of a course shall be done in marks for each student.
- (ii) The marks of various components shall be reduced to approved weights as indicated in the scheme of Teaching and Examination and added to get total marks secured on a 100-points scale. The rounding off shall be done only once and on the higher side.
- (iii) The method suggested in Appendix-B1 shall be used for the award of grades.
- (iv) 'A' and 'O' grades together shall not be given for not more than 10% (rounded off to near integer value) of the class strength. The 'O' grade shall be given only if a student has done exceptionally well as compared to other students of 'A' grade.
- (v) The student who was awarded 'FS' grade in a subject due to short attendance will not be awarded any grade point and the student has to clear the subject as a back paper.
- (vi) The provisional grades shall be awarded by the Coordination Committee of the course consisting of all the teachers involved in that course. The Course Coordinator shall have full responsibility for this purpose.
- (vii) The grades so awarded shall be moderated by a Grade Moderation Committee of a Department/ Academic Centre. This committee will finalize the grades and display a copy of the grades awarded on the Notice Board of the Department/ Centre. The grades should be finalized, displayed and communicated to academic section as per the academic calendar. The students shall be given 3-4 days' time to apply for scrutiny of grades. The departments shall submit the modified grades, if any, to the academic section within seven days from the last date of displaying the grades on the Notice Board of the Department/Centre. No change shall be accepted after the due date, in any case. The Chairman, Grade Moderation Committee shall retain the records of all the marks and grades and shall send one copy of all records to the Chairman, DAPC.
- (viii) For a student to get passing grade, he/she will have to appear in End Term Examination.
- (ix) After the re-examination student can be given maximum 'C' grade, keeping the cut-offs same as before.
- (x) The procedures for evaluation and award of grades for project, training, seminar and technical communication shall be as given in the Appendix E1-E5 of Regulations for the UG, IDD, and IMD programmes.
- (xi) The Dissertation shall be presented before an Examination Board for evaluation, as per procedure given in Appendix-E6. For Dissertation and Seminar, each student will be evaluated individually and the grades shall be awarded by the examination board. The examination board may decide the cut-offs for different grades.

Statistical Method for the Award of Grades

The statistical method shall invariably be used, with marginal adjustment for natural cut-off. The mean ($\bar{X}$) and the standard deviation of marks obtained of all the students in a course shall be calculated and used to convert the marks into normal variate (Z). The normalized marks (Z) shall be arranged in decreasing order to work out ranges for different letter grades.

$$Z = \frac{X - \bar{X}}{\sigma}$$

where X = Actual marks obtained;

$\bar{X}$ = Mean of marks and

σ = Standard deviation.

The grade boundaries are left to the discretion of grade moderation committee. However, each course coordinator, in consultation with the Grade Moderation Committee, may decide a suitable set of boundaries for a particular course for the award of grades. One possible set of boundaries for Z variate is mentioned in the Table-6 below:

Table-6: Possible Set of Boundaries for Z Variate

Lower Range of Z	Grade	Upper Range of Z
> 3.0	O	-
> 1.5	A	≤ 3.0
> 1.0	B+	≤ 1.5
> 0.5	B	≤ 1.0
> 0.0	C+	≤ 0.5
> -0.75	C	≤ 0.0
> -1.5	D+	≤ -0.75
> -2.5	D	≤ -1.5
-	F	≤ -2.5

The above table indicates only the suggested boundaries of variate Z. Course coordinator can change the boundaries of variate Z, if required and present before the Grade Moderation Committee for its acceptance.



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: PHN-785 Course Title: **Classical Mechanics and Electrodynamics**

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: Both 7. Subject Area: Pre-PhD

8. Pre-requisite: NIL

9. Objective: A course on Classical Mechanics and Classical Electrodynamics

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Review of Newton's program for tackling problems in statics and kinematics: Variable mass problems, Central forces, Applications to planetary and stellar systems.	8
2.	Canonical Transformations: Equations of canonical transformations and examples, symplectic approach, Poisson brackets and equation of motion, conservation laws, angular momentum. Constraints, Generalized Coordinates, Problems involving Lagrangian and Hamiltonian formulation of Classical mechanics.	7
3.	Special relativity: Relativistic Lagrangian and Hamiltonian function, Relativistic kinematics of collisions and collision threshold energies.	6
4.	Boundary -Value Problems in Electrostatics: Laplace equation, Legendre equation and Legendre polynomials, Expansion of Greens function, solution of potential problems with the Greens function expansion. Maxwell's Equations: Maxwell's equations, vector and scalar potentials, Green functions for wave equations. Plane EM Waves and Propagation: Plane waves in non-conducting medium, Reflection and refraction of EM waves at plane interface between two dielectrics, polarization, dispersion characteristics of dielectric, conductors and plasma.	8
5.	Collisions between charged particles: Quick review of (modified) Bessel functions (of the first and second kinds); Electromagnetic field in a medium due to incident charged particle moving with constant velocity; energy loss in a charged particle moving near -a harmonically bound charged particle; Cherenkov radiation and singular vector potential.	4

6.	Radiation from accelerated charges: Retarded and advanced Green's functions; Lienard-Wiechert potentials; Larmor's formula and its relativistic generalization (Lienard's result); relativistic enhancement of power by a particle in circular motion relative to rectilinear motion; angular distribution of radiation and distribution in frequency and solid angle for a relativistic particle in instantaneous circular motion; Thomson scattering; Bremsstrahlung (double differential intensity distribution of radiation emitted during interaction of the lighter charged particle with a fixed field, polarization and spectrum integrated over solid angles).	7
7.	Cavities and Wave Guides: Transverse electric and magnetic fields, TEM modes, TM and TE modes and solutions of Helmholtz equation in wave guides and cut-off frequencies.	2
Total		42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Goldstein H, "Classical Mechanics", Narosa	2001
2.	Rana W.C. and Jog P.S, "Classical Mechanics", Tata McGraw Hill	1991
3.	Kleppner and Kolenkow, "An Introduction to Mechanics", Cambridge University Press, 2 nd Ed.	2013
4.	J. D. Jackson, "Classical Electrodynamics", Wiley, 3 rd Ed.	2007
5.	Griffiths D J, "Introduction to Electrodynamics", Prentice Hall	1999
6.	Capri A.Z. and Panat P.V., "Introduction to Electrodynamics" Narosa Publication House	2002
7.	Franklin J., "Classical Electromagnetism", Pearson Education	2007

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Physics

1. Subject Code: PHN-786 Course Title: Advanced Quantum and Statistical Mechanics

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: 0 ETE: 50 PRE: 0

5. Credits: 4 6. Semester: Both Subject Area: Pre-Ph.D

8. Pre-requisite: NIL

9. Objective: A course on Advanced Quantum and Statistical Mechanics

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Classical and Quantum Statistical Mechanics: Macro and microstates, phase space; Liouville's Theorem. Microcanonical, canonical and grand canonical ensembles Quantum mechanical ensemble theory, the density matrix and partition function with examples. Symmetric and Antisymmetric Wavefunctions. Microcanonical ensemble of ideal Bose, Fermi and Boltzmann gases, derivation of Bose, Fermi and Boltzmann statistics; Grand Partition function of ideal Bose and Fermi gases	11
2.	Ideal Bose and Fermi Systems: Thermodynamic behaviour of an ideal Bose gas; Bose condensation; Liquid Helium; Blackbody radiation and Planck's law of radiation; Thermodynamic behaviour of an ideal Fermi gas; Electrons in metals, specific heat and Pauli susceptibility of electron gas.	10
3.	Rotations and Addition of Angular Momenta: Rotation Matrices and the Spherical Harmonics, Coupling and addition of Angular Momenta, Rotation Matrices for Coupling Two Angular Momenta, Wigner Eckart Theorem; Angular Momentum.	5
4.	Three-Dimensional Problems: 3D Problems in Cartesian Coordinates and spherical coordinates, Central Potential: General Treatment, The Free Particle in Spherical Coordinates, The Spherical Square Well Potential, The Isotropic Harmonic Oscillator, The Hydrogen Atom, Effect of Magnetic Fields on Central Potentials	6
5.	Perturbation Theory: Time-Independent Perturbation Theory, The Variational Method, The Wentzel-Kramers-Brillouin Method, Time-	6

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	Dependent Perturbation Theory, Adiabatic and Sudden Approximation, Interaction of Atoms with Radiation	
6.	Scattering Theory: Scattering and Cross Section, Scattering Amplitude of Spinless Particles, The Born Approximation, Partial Wave Analysis, Scattering of Identical Particles	4
Total		42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/ Reprint
1.	Patharia R K "Statistical Mechanics" (2 nd Ed.), Pergaman press	2001
2.	Huang K "Statistical Mechanics" (2 nd Ed., 2 nd reprint), John Wiley & Sons	2003
3.	Landau L.D. and Lifshitz E M "Statistical Mechanics", Butteworth-Heinemaun	1998
4.	Griffiths D J, "Introduction to Quantum Mechanics", 2 nd Ed, Pearson Eduction	2005
5.	Bransden B H and Joachain C J, "Quantum Mechanics", 2 nd Ed, Pearson Eduction	2000
6.	Zettili N, "Quantum Mechanics: Concepts and Applications", 2 nd Ed, John Wiley	2009

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **PHN-788** Course Title: **Advanced Characterization Techniques**

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: **0** 7. Subject Area: **Pre-PhD**

8. Pre-requisite: **Nil**

9. Objective: To introduce different experimental techniques.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Vacuum Science and Technology: Introduction and basics of vacuum science, Rotary, Diffusion, Turbo molecular, Getter and Cryo pumps. McLeod, Bourdon, Diaphragm, Capacitance, Thermal conductivity gauge (pirani), Cold cathode ionization gauge (Penning), Hot cathode ionisation and Bayard Alpert gauges. Partial pressure measurement, leak detection, gas flow through pipes and apertures, effective pumping speed, vacuum components. Applications: Thermal evaporation, e-beam evaporation, Sputtering, Pulsed laser deposition	7
2.	Cryogenics: Properties of materials at low temperature, Cryogenic fluids, Gas liquifiers, cryogenic fluid baths, cryostat design, closed cycle He refrigerator (CCR), Single and double cycle He ³ refrigerator, He ³ -He ⁴ refrigerator, Magnetic refrigerator, Low temperature thermometry	5
3.	Measurement Techniques-I: Working principles of different sensors, signal processing and lock-in detection. Photomultiplier tubes, Charge coupled devices. Principles and applications of X-ray diffraction, Superconducting Quantum interference Devices (SQUID), Vibrating sample magnetometer, Measurement of electrical conductivity in different materials- insulators, metals and semiconductors using four probe method, Electron microscopes (SEM, TEM), Energy dispersive spectroscopy, Differential thermal analysis (DTA), Thermogravimetric analysis (TGA).	11

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4	Measurement Techniques-II: Principles and applications of LASERS, Spectrophotometer, Fourier transform-Infrared (FT-IR) spectrometer, Optical microscope, Interferometry, Photometry, Imaging techniques, Raman spectroscopy, Photoluminescence.	6
5	Measurement Techniques-III: Properties of radiation detectors: operation mode, pulse height spectra, energy resolution, detection efficiency and dead time. Ionization chambers, Scintillation detectors: Inorganic and Organic scintillators, photomultiplier tube, Response of scintillation detectors to gamma-rays and neutrons. Application of scintillation detectors, Linear and circular accelerators, Nuclear reactor: neutron source and power generator, Applications in tracing, material modification, sterilization, material modification; neutron activation analysis, medicine: CT, PET, SPECT, MRI	13
	Total	42

11. Suggested Books.

S. No.	Name of Authors/Book/Publisher	Year of Publication/ Reprint
1.	A. Roth, "Vacuum Technology", Elsevier .	1990
2.	Ohring Milton, " The Materials Science of thin films", Academic Press, INC.	1991
3.	G. K. White , "Experimental Techniques in Low Temperature Physics", Clarendon,	1993
4.	Guglielmo Ventura & Lara Risegari " The Art of Cryogenics-Low-Temperature Experimental Techniques" Elsevier.	2008
5.	A. Kent " Experimental low-temperature physics" MacMillan	1993
6.	A. D. Helfrick and W.D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI	1976
7.	Willard, H. H., Merritt, L. L. and Dean, J. A., "Instrumental Methods of Analysis", CBS publications.	1991
8.	A. Ghatak and K.Thyagarajan, Optical Electronics, C.U.P.	1989
9.	Egerton, R. F., "Physical Principles of Electron Microscopy", Springer.	2008
10.	Fultz, B. and Howe, J. M., "Transmission Electron Microscopy and Diffractometry of Materials", Springer.	2007
11.	Culity, B. D., "Elements of X-ray Diffraction", Addison-Wesley.	2001
12.	Glenn F. Knoll, "Radiation Detection and Measurement" 4 th Ed.	2010
13.	W.R. Leo, "Techniques for Nuclear and Particle Physics experiments", Springer-Verlag	1994

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: Department of Physics

1. Subject Code: PHN-789 Course Title: Mathematical and Computational Techniques

2. Contact Hours (per week): L: 3 T: 0 P: 2

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

4. Relative Weightage: CWS: 15 PRS: 25 MTE: 20 ETE: 20 PRE: 20

5. Credits: 4 6. Semester: Autumn/Spring 7. Subject Area: Pre-PhD

8. Pre-requisite: NIL

9. Objective: To familiarize the students with computational techniques and train them in computing physics problems

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Review of Legendre and associated Legendre equations, Hermite equation, Laguerre and associated Laguerre equations, Bessel's equation, Hypergeometric equations and their solutions and related properties, Green's function and Fourier transform techniques and their applications, Complex variables and evaluation of integrals	10
2.	Programming in FORTRAN or C++ language. To solve various problems of Physics utilizing the following numerical methods along with computer programming of the problem as well as running them on computers	15
3.	Numerical interpolation through Newton's formula, Lagrange's and Gauss's central difference formula. Numerical Integration by Trapezoidal, Simpson's, Gauss quadrature formulae, Numerical differentiation by Newton-Gregory forward polynomial and Spline interpolating polynomials. Matrix algebra and solution of linear equations	10
4.	Numerical solutions of differential equations using initial value problems, Runge Kutta and other methods, Least square polynomial approximation and evaluation of two to three dimensional integrals using Simpson's and Monte Carlo methods.	7
Total		42

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11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Arfken G. B. and Weber H. J., "Mathematical Methods for Physicists", 5 th Ed. Academic Press.	2005
2.	Whittaker E.T. and Watson E.W., "A Course of Modern Analysis", Cambridge University Press	2008
3.	Wolfram S, "The Mathematica Book," 5 th Ed., Wolfram Media	2003
4.	Gerald C F and Wheatley P O, "Applied Numerical Analysis", 7 th Ed, Addison Wesley	2003
5.	J M McCormick and M G Salvadori " Numerical Methods in FORTRAN" Prentice-Hall,	1964
6.	Press, W H, Teukolsk, S A, Vetterling, W T and Flannery, B P, "Numerical Recipes in Fortran 77: The Art of Scientific Computing", Cambridge University Press; 3 rd Ed.	2007

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Electronics & Communication Engineering**

1. Subject Code: **ECN - 556** Course Title: **RF System Design and Analysis**

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: **Spring** 7. Subject Area: **PEC**

8. Pre-requisite: **Knowledge of RF and Mixed Signals**

9. Objective: To provide comprehensive description of RF transceiver design used in wireless communication system and introducing RF for wireless radios.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Review of Network Parameters and Transmission Lines: Network parameters and representations, network properties in terms of lossless, reciprocity and symmetry, transmission line equivalent circuit and Telegrapher's equations.	5
2.	Introduction to RF System Design for Wireless Radios: Overview of link budget calculations, Radio Architectures and Design Considerations, configuration and frequency planning in superhetrodyne radios, design considerations in low and zero-IF architecture, band-pass sampling radio architecture, polar vs. Cartesian techniques in wireless transmitters, frequency synthesis techniques.	10
3.	RF System Analysis and Design: Sensitivity and noise figure in receivers, intermodulation characteristics, receiver dynamic range, modulation accuracy, phase noise and effect on error vector magnitude, waveform quality factor, noise emission and calculation, adjacent and alternate channel power, multi-tone techniques.	8
3.	RF Transmission lines based design: Microstrip and related Transmission Lines, review of smith chart, lumped and transmission line matching networks, impedance transformers, filter design, low pass prototype characteristics, frequency scaling, Richards transform, Kuroda identities, some common microstrip filters: end, edge coupled etc.	9
4.	RF Active Circuit Design: Review of RF amplifier design, power match condition, transistor stability, maximum stable gain and maximum	10

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	available gain, bilateral conjugate match, noise figure design, power gain match, Introduction to power amplifier design, basic classes of operation, tuned load architecture.	
	Total	42

11. Suggested Books:

Sl.No.	Name of Reference Books / Authors	Year of Publication/ Reprint
1.	Z. Awang, "Microwave Systems Design" Springer.	2014
2.	QizhengGu "RF System Design of Transceivers for wireless communications," Springer.	2005
4.	Gonzalez, G., "Microwave Transistor Amplifiers Analysis And Design" 2 nd Ed., Prentice Hall.	1997
5.	D.M. Pozar, Microwave Engineering, 4th Edition, Wiley.	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Electronics & Communication Engineering**

1. Subject Code: **ECN-557**

Course Title: **RF Power Amplifier and Transmitter Design**

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:Spring

7. Subject Area: PEC

8. Pre-requisite: **Knowledge of RF and Mixed Signals**

9. Objective: To develop basic understanding of various RF techniques in the design of RF power amplifier and transmitters used in wireless communication system.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Overview of Wireless Transmitters: Design specifications and requirements, homodyne, heterodyne and digital -IF architectures; frequency generation techniques, Direct digital synthesizers.	6
1.	Basics of RF Amplifier Design: Review of transmission lines and s-parameters; review of smith chart and matching networks; basics of RF amplifier design based on s-parameters; power match condition for power amplifiers. CAD design problems.	7
2.	Fundamentals of Power Amplifier: design parameters for power amplifiers; distortions parameters; devices for power amplifier; Basic classes of operation: linear and reduced conduction angle mode (A, B, AB, C); tuned load architecture, Switch mode Power Amplifiers: Class E, Class F, inverse Class F, harmonic-matching techniques.	9
3.	Measurement techniques in Power amplifier Design: load-pull, basics of device modeling (FET, HBT, HEMT), non-linear vector network analyzer and PA design based on model extraction.	6
4.	Efficiency Enhancement Techniques: load modulation, Doherty Power amplifier: Multi-stage, multi-way; pulse load modulation, out-phasing techniques: LINC (linear amplification using nonlinear components); Envelope elimination and restoration, Envelope tracking; power combination techniques.	8

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5. -	Architectural solutions for Linearized transmitters: Nonlinear distortion and mitigation: intermodulation distortion, feed-forward cancellation, digital and analog pre-distortion for PA.	6
Total		42

11. Suggested Books:

Sl.No.	Name of Reference Books / Authors	Year of Publication
1.	Andrei Grebennikov, Nathan O. Sokal, Marc J Franco, "Switchmode RF and Microwave Power Amplifiers," Second Ed., AP publication.	2012
2.	Roblin, P., "Nonlinear RF Circuits and Nonlinear Vector Network Analyzers," The Cambridge University Press.	2011
3.	Paolo Colantonio, Franco Giannini, and Ernesto Limiti, "High Efficiency RF and Microwave Solid State Power Amplifiers", 1st Ed., John Wiley & Sons, Ltd.	2009
4.	Cripps, S., "RF Power Amplifiers for Wireless Communications", 2nd Ed., Artech House.	2006
5.	Kennington, P.B., "RF and Baseband Techniques for Software Defined Radio", 2nd Ed., Artech House.	2005
6.	Gonzalez, G., "Microwave Transistor Amplifiers Analysis And Design" 2nd Ed., Prentice Hall.	1994



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: MECHANICAL & INDUSTRIAL ENGINEERING DEPARTMENT

1. Subject Code : MIN-611 Course Title: Nanomechanics to Multiscale Modeling
2. Contact Hours : L:3 T:1 P:0
3. Examination Duration (Hrs): Theory : 3 Practical :0
4. Relative Weightage : CWS : 25 PRS : 0 MTE: 25 ETE : 50 PRE : 0
5. Credits : 4 6. Semester :Spring/Autumn 7. Subject Area : DEC
8. Pre-requisite : Nil
9. Objective: This course will demonstrate the feasibility of atomistic modeling to understand material behavior. It will also offer students a chance to learn about the basics of molecular dynamics, finite element based atomistic modeling, nanomechanics and mechanism behind the brittle and ductile nature of materials. This course will help students develop their own finite element based atomistic model or molecular dynamics based model to simulate mechanical properties at nanoscale.

10. Details of course:

S.No.	Contents	Contact Hours
1.	Introduction to mechanics, crystal structure, lattices, bravais lattices of materials, slip planes, principal slip planes, dislocations, edge and screw dislocation	4
2.	The Cauchy Born rule, calculation of elastic properties of atomic lattices	2
3.	Empirical atomistic models for materials, Inter atomic interactions, Different types of interatomic potentials 'e.g. LJ 6-12, EAM, Tersoff, REBO, AIREBO etc.	10
4.	Molecular statics, energy minimization, implementing molecular statics, application to crystals and crystalline defects.	4
5.	Introduction to classical molecular dynamics, MD algorithm, integration scheme, different ensembles (NPT, NVE, NVT), pressure and temperature control, virial stress.	8
6.	Mechanics of ductile and brittle materials, crack tip plasticity, dislocation emission, bond breaking, grain boundaries, symmetric tilt grain boundaries.	8
7.	Multiscale modeling, sequential & concurrent multiscale models, finite element based multiscale models, coupling of MD with FEM	6
- 97 - Total		42

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11. Suggested references/books:

S.No.	Author(s)/Title/Publisher	Year of publication
1.	E.D.Tadmor, R.E.Miller " Modeling Materials"	2011
2.	Hirth, J.Price " Theory of dislocations"	1991
3.	D.C.Rapport " The art of molecular dynamics simulations"	2004

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Appendix 'I'
Item No. Senate/62.11



गेट-जैम कार्यालय
भारतीय प्रौद्योगिकी संस्थान रुड़की
रुड़की - 247667 (उत्तराखण्ड)

GATE-JAM Office
Indian Institute of Technology Roorkee
Roorkee - 247667 (Uttarakhand)

प्रा. जी. जे. चक्रपाणी, अध्यक्ष	डा. पी. एम. पाठक, उपाध्यक्ष	डा. राजदीप चटर्जी, उपाध्यक्ष
Prof. G.J. Chakrapani, Chairman	Dr. P.M. Pathak, Vice-Chairman	Dr. Rajdeep Chatterjee, Vice-Chairman
Phone: 01332-284531	Fax: 01332-285707	E-mail: gate@iitr.ac.in Website: www.iitr.ac.in

No. IITR/Reporting Item/JAM 2016

Dated: 18th Sept. 2015

**Registrar, IITR &
Secretary, IITR Senate**

AR(MS)

Sub: Reporting items related to JAM 2016 in IIT Roorkee Senate.

The following two new items related to IITR JAM 2016 may please be reported in IITR Senate. The items had prior approval of the respective Departments.

JAM 2016

Test Paper (Test paper code)	Academic Programme(s)	Minimum Educational Qualification(s) for Admission	
		Essential subjects in Bachelor's Degree along with minimum duration	Essential subjects at (10+2) level
Biotechnology (BT)	M.Sc. Biotechnology	Any branch / Subject	Mathematics
Mathematics (MA)	M.Sc. Economics	Mathematics as one of the core subjects	No Restrictions
Mathematical Statistics (MS)	M.Sc. Economics	Mathematics as one of the core subjects	No Restrictions

G. J. Chakrapani
(G.J. Chakrapani)
Chairman, GATE-JAM 2016

PROGRAM CODE : 121 – B.Tech. (Polymer Science and Engineering)

DEPARTMENT : Polymer Science and Engineering Program

YEAR : I

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
Semester-I (Autumn)														
1.	MAN-001	Mathematics-I	BSC	4	3	1	0	3	0	25	-	25	50	-
2.	PEN-101	Introduction to Polymer Science and Engineering	PCC	2	2	0	0	0	0	-	-	100	-	-
3.	CEN-105	Introduction to Environmental Studies	GSC	3	3	0	0	3	0	25	-	25	50	-
4.	HSN-001A HSN-001B	Communication skills (Basic) Communication skills (Advanced)	HSSC	2	1	0	2	2	0	25	-	25	50	-
5.	HSN-002	Ethics and Self-Awareness	HSSC	2	1	1	0	2	0	25	-	25	50	-
6.	CYN-009	Polymer Chemistry	BSC	4	3	1	0	3	0	25	-	25	50	-
7.	PEN-103	Computer Programming and Numerical Methods	ESC	4	3	0	2	3	0	15	25	20	40	-
		Total		21	16	03	4							
Semester-II (Spring)														
1.	MAN-002	Mathematical Methods	BSC	4	3	1	0	3	0	25	-	25	50	-
2.	CHN-102	Material and Energy Balance	PCC	4	3	1	0	3	0	25	-	25	50	-
3.	CHN-106	Thermodynamics and Chemical Kinetics	PCC	4	3	1	0	3	0	25	-	25	50	-
4.	PEN-102	Properties of Polymers	PCC	3	3	0	2/2	2	0	20	20	20	40	0
5.	CYN-011	Polymer Characterization	BSC	2	2	0	0	2	0	25	-	25	50	0
6.	EEN-112	Electrical Science	ESC	4	3	1	2/2	3	0	20	20	20	40	0
7.	CYN-013	Polymer Chemistry Lab	BSC	2	0	0	4			-	100	-	-	-
		Total		23	17	4	6							

D

PROGRAM CODE : 121 – B.Tech. (Polymer Science and Engineering)

DEPARTMENT : Polymer Science and Engineering Program

YEAR : II

Teaching Scheme			Contact Hours/Week			Exam Duration (Hrs.)		Relative Weights (%)						
S.No	SUBJECT CODE	COURSE TITLE	Subject Area	Credits	Contact Hours/Week			Theory	Practical	CWS	PRS	MTE	EFE	PRE
					L	T	P							
Semester-III (Autumn)														
1.	CHN-201	Heat Transfer	PCC	4	3	1	2/2	3	0	20	20	20	40	0
2.	CHN-211	Fluid and Fluid Particle Mechanics	PCC	4	3	1	2/2	3	0	20	20	20	40	0
3.	PEN-201	Polymer Engineering Thermodynamics	PCC	4	3	1	0	3	0	25	-	25	50	-
4.	PEN-203	Polymer Blends	PCC	3	2	1	0	2	0	25	-	25	50	-
5.	MIN-108	Mechanical Engineering Drawing	ESC	4	2	0	4	0	4	-	25	25	-	50
6.	HSN-ELE	Any one course from 'Humanities and Social Science Elective Course'	HSSMEC	3	3	0	0	3	0	25	-	25	50	-
		Total		22	16	4	6							
Semester-IV (Spring)														
1.	CHN-212	Mass Transfer	PCC	4	3	1	2/2	3	0	20	20	20	40	0
2.	PEN-202	Polymer Reaction Engineering	PCC	4	3	1	2/2	3	0	20	20	20	40	0
3.	PEN-204	Polymer Rheology and Processing	PCC	3	2	1	2/2	2	0	20	20	20	40	0
4.	PEN-206	Polymer Production Engineering	PCC	3	3	0	0	3	0	15	0	35	50	-
5.	PEN-208	Elastomer Science and Engineering	PCC	3	2	0	2	3/2	0	15	25	20	40	0
6.	MTN-106	Materials Science	ESC	4	3	1	0	3	0	25	-	25	50	-
		Total		21	16	4	5							

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PROGRAM CODE : 121 – B.Tech. (Polymer Science and Engineering)

DEPARTMENT : Department of Polymer Science and Engineering

YEAR : III

Teaching Scheme				Contact Hours/Week				Exam Duration (Hrs.)		Relative Weights (%)				
S.No	SUBJECT CODE	COURSE TITLE	Subject Area	Credits	Contact Hours/Week			Theory	Practical	CWS	PRS	MTE	ETE	PRE
					L	T	P							
Semester-V (Autumn)														
1.	CHN-303	Process Dynamics and Control	PCC	4	3	1	2/2	3	0	20	20	20	40	0
2.	PEN-301	Polymer Product Processing and Engineering	PCC	4	3	1	2/2	3	0	20	20	20	40	0
3.	PEN-303	Process Equipment Design	PCC	4	3	0	2	4	0	15	25	20	40	0
4.	PEN-391	Technical Communication	PCC	2	0	2	0	0	0	-	100	-	-	-
5.	PEN-ELE1	Departmental Elective Course-I	PEC	4	3	1	0	3	0	25	-	25	50	-
6.	OEC	Open Elective Course	OEC	3	3	0	0	3	0	25	-	25	50	-
		Total		21	15	5	4							
Semester-VI (Spring)														
1.	PEN-302	Modeling and Simulation of Polymers	PCC	4	3	0	2	3	0	15	25	20	40	-
2.	PEN-304	Polymer Composites	PCC	3	2	0	2	2	0	15	25	20	40	-
3.	CHN-310	Process Utilities, Economics and Plant Design	PCC	3	3	0	0	3	0	25	0	25	50	0
4.	PEN-ELE2	Departmental Elective Course-II	PEC	4	3	1	0	3	0	25	-	25	50	-
5.	MSC1/DHC1	Minor Specialization Course-I	MSC/DHC	4	3	1	0	3	0	25	-	25	50	-
		Departmental Honours Course-I												
6.	PEN-300	Industry Oriented Problem	PCC	3	-	-	-	-	-	-	-	-	-	100
7.	BM-ELE	Any one course from 'Management Studies'	HSSMEC	4	3	1	0	3	-	25	-	25	50	-
8.	PEN-399	Educational Tour	PCC	0	-	-	-	-	-	-	-	-	-	-
		Total		20/24	17	3	4							

*Open book examinations of four hours duration

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PROGRAM CODE : 121 – B.Tech. (Polymer Science and Engineering)

DEPARTMENT : Department of Polymer Science and Engineering

YEAR : IV

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
Semester-VII (Autumn)															
1.	PEN-DEC3	Department Elective Course-III	PEC	4	3	1	0	3	-	-	25	-	25	50	-
2.	PEN-DEC4	Department Elective Course-IV	PEC	4	3	1	0	3	-	-	25	-	25	50	-
3.	MSC2/DHC2	Minor Specialization Course-II/ Departmental Honours Course-II	MSC/DHC	4	3	1	0	3	-	-	25	-	25	50	-
4.	MSC3/DHC3	Minor Specialization Course-III/ Departmental Honours Course- III	MSC/DHC	4	3	1	0	3	-	-	15	-	35	50	-
5.	PEN-499	Training Seminar	PCC	2	-	2	-	-	-	-	-	100	-	-	-
6.	PEN-400A	Project	PCC	4	-	2	-	-	-	4	-	-	-	-	100
		Total		14/22											
Semester-VIII (Spring)															
1.	PEN-ELE5	Department Elective Course-V	PEC	4	3	1	0	3	-	-	25	-	25	50	-
2.	PEN-ELE6	Department Elective Course-VI	PEC	4	3	1	0	3	-	-	25	-	25	50	-
3.	MSC4/DHC4	Minor Specialization Course-IV/ Departmental Honours Course-IV	MSC/DHC	4	3	1	0	3	-	-	25	-	25	50	-
4.	MSC5/DHC5	Minor Specialization Course-V Departmental Honours Course-V	MSC/DHC	4	3	1	0	3	-	-	25	-	25	50	-
5.	PEN-402	Project	PCC	8	-	-	-	-	-	-	-	-	-	-	100
		Total		16/24											

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List of Electives

Category I

Autumn/Spring Semesters	Name of Electives Course
Course No.	
CHN-322	Optimization of Chemical Engineering Processes
CHN-323	Computer Application in Chemical Engineering
CHN-324	Computational Fluid Dynamics
CHN-325	Process Integration
PEN-325	Transport Phenomena in Polymeric Solutions

Category 2

Autumn/Spring Semesters	Name of Elective Course
Course No.	
PEN-401	Bio-Polymer Engineering
PEN-402	High Performance and Special Polymers
PEN-403	Electronic and Conducting Polymers
PEN-404	Polymer Film Technology
PEN-405	Polymeric Membrane Technology
PEN-406	Advanced Polymer Composites
PEN-407	Advanced Extrusion and Compounding
PEN-408	Paint and Coating Engineering
PEN-409	Polymer Fiber Technology
PEN-410	Adhesive and Sealants Technology
PEN-411	Rubber Product Technology
PEN-412	Polymer Colloids
PEN-413	Polymer Nanocomposites
PEN-414	Advanced Process Control
PEN-415	Polymer and Tissue Technology
PEN-417	Polymer Degradation and Stability
PEN-418	Polymers Recycling and Environment
PEN-419	Polymer for Packaging Technology
PEN-420	Polymers for Smart & Memristive Materials
PEN-421	Applications of Polymer in Drug Delivery
CYN-422	Polymer Physics

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Mathematics

1. Subject Code: MAN-001

Course Title: Mathematics I

2. Contact Hours: L: 3

T: 1

P: 0

3. Examination Duration (Hrs.):

Theory :3

Practical:0

4. Relative Weightage: CWS:25

PRS:0

MTE:25

ETE:50

PRE:0

5. Credits: 4

6. Semester: Autumn

7. Subject Area: BSC

8. Pre-requisite: None

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

10. Details of Course:

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

11. Suggested Books:

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

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

- NAME OF DEPTT/CENTRE: **Department of Polymer & Process Engineering**
1. Subject Code: **PEN-101** Course Title: **Introduction to Polymer Science and Engineering**
2. Contact Hours: L: 2 T: 0 P: 0
3. Examination Duration (Hrs.): Theory:2 Practical:0
4. Relative Weightage: CWS :0 PRS :0 MTE : 100 ETE : 0 PRE : 0
5. Credits: 2 6. Semester: Spring 7. Subject Area: PCC
8. Pre-requisite: Nil
9. Objective: To impart introductory knowledge of polymer engineering
10. Details of Course:

S. No.	Particulars	Contact Hours
1	Introduction: Types of polymers; Blends; Composites; Materials and applications of polymers	1
2	Engineering Polymers: Types of engineering polymers; Thermoplastics; Thermosets; Elastomers; Polyolefins; Polyethylene; Polypropylene	5
3	High Performance Polymers: Types of high performance polymers; Polyesters; Polycarbonate; Polyamide; Polyetherimides; Poly-amide-imide; High temperature Resistant polymers; Lyotropic and thermotropic liquid crystal polymers	5
4	Polymer Engineering: Polymerization engineering; Polymer Processing; Additives; Polymer products; Processing; Introduction to rheology and various polymer processing techniques and equipments	6
5	Polymeric Systems and Materials Polymer blends; Polymer Composites; Rubbers and elastomers; Films and fibers; Bio; bio-degradable and bio-medical polymers and functional polymers	6
6	Applications of Polymers: Applications of polymers in commodity products as: Engineering materials in automobiles; Aerospace;	5

	Electronics; Medical and other applications; Conducting polymers	
	Total	28

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	H. S. Kaufman, J. J. Falcetta, "Introduction to Polymer Science & Technology" SPE Textbook, John Wiley & Sons	2010
2	D. J. Williams, "Polymer Science & Engineering", Prentice Hall, Inc.	2010
3.	V. R. Gowariker, N. V. Vishwanathan, Jaydev Sreedhar, "Polymer Science", New Age (I)	2011



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT/CENTRE:

Department of Civil Engineering

Course Title: Introduction to Environmental Studies

1. Subject code: CEN-105
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: 00
5. Credits: 3 6. Semester: Autumn 7. Subject Area: GSC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of environmental pollution and its control.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Overview: Environment and Natural Processes; Development (Resource Utilization & Waste Generation); Environmental issues; Concept of Sustainable Development; Issues affecting future development (population, urbanization, health, water scarcity, energy, climate change, toxic chemicals, finite resources etc.); Environmental units	6
2.	Air -Water interaction: (Liquid phase-gas phase equilibrium) Henry's Law Constant with units, Dimensionless Henry's Law Constant	3
3.	Water -Soil Interaction: Carbonate System (Alkalinity and buffer capacity); Major ions in water; Natural Organic Matter (NOMs); Water quality parameters; Physical processes (Mass Balance); Spatio-temporal variation in quality of river water, lake water, groundwater; Water quality standards	9
4.	Wetlands, water treatment and wastewater treatment	6
5.	Air resources: Atmosphere; Air pollutants; Emissions and control of air pollutants; Atmospheric meteorology and dispersion; Transport of air (global, regional, local); A/ iratmospheric stability; Plume shape; Gaussian modeling; Air quality standards	9
6.	Land pollution and solid waste management	3
7.	Ecosystem: Structure and function; Energy flow in ecosystem; Materia flow in ecosystem; Biodiversity and ecosystem health; Bio-amplification and bio-magnification	3
8.	Hazardous Waste: Definition; Classification; Storage and management; Site remediation; Environmental Risk: assessment, and management	3
Total		42

11. Suggested Books:

S. No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	Davis M.L. and Cornwell D. A. Introduction, " to Environmental Engineering", McGraw Hill, New York 4/e	2008
2.	Masters G.M., Joseph K. and Nagendran R Introduction. " t o Environmental Engineering and Science", Pearson Education, New Delhi. 2/e	2007
3.	Peavy H. S., R owe D.R. and Tchobanoglous G., "Environmental Engineering", McGraw Hill, New York	1986
4.	Mines R. O. and Lackey L. W. Introduction"" to Environmental Engineering", Prentice Hall, New York	2009
5.	Miheicic J. R. and Zimmerman J. B. " Environmental Engineering: Fundamentals, Sustainability, Design" John Wiley and Sons, Inc.	2010

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: HSN-001A Course Title: Communication Skills (Basic)

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

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

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

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

8. Pre-requisite: Nil

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

10. Details of Course:

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

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

List of Practical:

1. Ice-breaking Exercises
2. Assignments on Time and Tense, Agreement, Active-Passive
3. Laboratory Session on Narration, Use of Determiners, Prepositions & Phrasal Verbs, Revisionary Exercises & Quiz
4. Laboratory Session on Synonyms, Antonyms, Homonyms
5. Assignments and Practice Sheets on One-word Substitutes, Idioms and Phrases, Collocations, Abbreviations of Scientific and Technical Words
6. Laboratory Session on Practice of sounds, Intonation and Stress, Listening Comprehension
7. Individual presentation, debates, Extempore & Turncoats
8. Exercises in Composition and Comprehension

11. Suggested Books:

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

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: HSN-001B Course Title: Communication Skills (Advanced)

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

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

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

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

8. Pre-requisite: Nil

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

10. Details of Course:

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

List of Experiments:

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

11. Suggested Books:

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

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: HSN-002 Course Title: Ethics and Self-awareness

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

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

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

5. Credits : 2

6. Semester: Autumn

7. Subject Area: HSSC

8. Pre-requisite: Nil

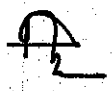
9. Objective: To introduce the concepts pertaining to ethical and moral reasoning and action and to develop self - awareness.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Introduction: Definition of ethics;E A pproaches t othics:E Psychological, Philosophical, Social.	1
2	Psycho-social theories of moral development: View of Kohlberg; Morality and Ideology, Culture and orality,M Morality i n everyday context.	3
3	Ethical Concerns: Work Ethics and Work Values, BusinessEthics, Human values in organizations.	3
4	Self-Awareness: Self Concept: Johari Window, Self and Culture, Self Knowledge, Self-Esteem; Perceived elfS-control, S elf-serving bi as, Self-presentation, Self-growth: Transactional Analysis and Life Scripts.	4
5.	Self Development: Character strengths and virtues, Emoti intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).	3
Total		14

11. Suggested Books:

S.No.	Name of Authors / Books / Publishers	Year of Publication
1.	Hall, Calvin S., Lindzey, Dardner., & Cambell, B., "Theories of Personality", Hamilton Printing Company.	1998
2.	Car Alan, "Positive Psychology: The Science of Happiness and Human Strengths", Brunner-Routledge.	2004
3.	Leary M.R., "The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Oxford University Press.	2004
4.	Louis P. P., "The Moral Life: An Introductory Reader in Ethics and Literature", Oxford University Press.	2007
5.	Corey, G., Schneider Corey, M., & Callanan, P. "Issues. and Ethics in the Helping Professions", Brooks/Cole.	2011
6.	Snyder, C.R., Lopez, Shane, J., & Pedrotti, J.T., "Positive Psychology" Sage, 2 nd edition.	2011



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT/CENTRE:

Department of Chemistry

1. Subject code: CYN-009

Course Title: Polymer Chemistry

2. Contact Hours:

L: 3

T: 1

P: 0

3. Examination Duration (Hrs): Theory: 3

Practical: 0

4. Relative Weightage: CWS: 25

PRS: 0

MTE: 25

ETE: 50

PRE: 0

5. Credits: 4

6. Semester: Autumn

7. Subject Area: BSC

8. Pre-requisite: Nil

9. Objective: To familiarize students with polymeric materials and its importance.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Polymeric materials: Historical development of polymers, classification and nomenclature of polymers. Homopolymers, copolymers, block copolymers, polymer blends, inorganic polymers, and composites. Bio- and non-bio-degradable polymers. Soluble and insoluble polymers. Specialty of polymers in comparison to low molecular weight materials. Macromolecules <i>versus</i> polymers.	4
2.	Polymer structures: Linear, branched and cross-linked polymers. Polymer chain configuration, conformation and tacticity. Size of polymer chains and estimates of polymer chain size. Polymer chain interactions and cohesive energy density. Polymer chain polarity and its effect on physical properties of polymers—density, crystallinity and solubility.	6
3.	Molecular weights and properties of polymers: Molecular weight and degree of polymerization, weight average and number average molecular weight, sedimentation and viscosity average molecular weight, polydispersity and size of polymer molecule. Molecular weight dependence physical properties of polymers. Hydrodynamic radii of polymers and its relation with molecular weight of polymers. Amorphous polymers and crystalline polymers. Glass transition and melting temperatures. Degree of crystallinity and mesophase polymers.	8
4.	Polymerization methods: Purity and polymerizability of monomers, common initiators, inhibitors and chain transfer agents used in polymerization, bulk polymerization and auto acceleration. Solution polymerization and role of the solvent. Suspension and emulsion polymerization. Interfacial and phase transfer polymerization and its advantages. Effect of methods of polymerization on properties of the polymers.	10
5.	Polymer reactions and mechanisms of polymerization: Polymer chain hydrolysis, acidolysis, aminolysis and alcoholysis. Hydrogenation, addition, substitution, cyclization and chemical cross-linking reactions. Polymer chain functionality and gelation, physical and chemical degradation. Classification of polymerization reactions, free radical and ionic chain polymerization, addition and step growth polymerization, coordination polymerization, Zeigler-Natta catalysis and polymer chain tacticity.	8
6.	Commercial polymers and their applications: Polyethylene, high and low density polyethylene, ultrahigh molecular weight polyethylenes, polycarbonates, nylons,	6

	amino and epoxy based resins and their commercial importance, thermosetting and thermoplastic polymers and their applications.	
	Total	42

11. Suggested Books:

S. No.	Name of Authors/Book/ Publisher	Year of Publication/ Reprint
1	Flory, P.J., "Principles of Polymer Chemistry", Cornell University Press, Ithaca, New York.	1953
2	Fried, J.R., "Polymer Science and Technology", Prentice Hall, U. K.	2002
3	Odean, G., Principles of Polymerization, 4 th Edition, John Wiley & Sons, New Jersey	2004
4	Young R.J., Lovell, P.A., "Introduction to Polymers" 3 rd Edition, CRC Press, Taylor and Francis Group	2011
5	Carraher, Jr C.E. "Introduction to Polymer Chemistry" 3 rd Edition CRC Press, Taylor & Francis group.	2012

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: PEN-103 Course Title: Computer Programming and Numerical Methods

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

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

4. Relative Weightage: CWS 15 PRS 25 MTE 20 ETE 40 PRE 0

5. Credits: 4 6. Semester: Autumn 7. Subject Area: ESC

8. Pre-requisite: Nil

9. Objective: To introduce object oriented programming using C++ language and numerical analysis

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Basic Computer Fundamentals: Introduction to computer systems - CPU organization, ALU, registers, memory and input-output devices; Number system: binary and hexadecimal; Fixed and Floating point numbers; Errors and Approximations	4
2.	Basic Programming in C++: Concepts of algorithm & flow charts; Input/output, constants, variables, expressions and operators; Naming conventions and styles; Conditions and selection statements; Looping and control structures; File input/output, header files, string processing; Preprocessor directives such as #include, #define, #ifdef, #ifndef; Compiling and linking.	6
3.	Modular Programming: Functions (void and value returning), parameters, scope and lifetime of variables, passing by value, passing by reference, passing arguments by constant reference; Design of functions and their interfaces, recursive functions; Function overloading and default arguments; Library functions; Matters of style, naming conventions, comments	6
4.	Aggregate Data-types: Arrays and pointers; Structures; Dynamic data and pointers, dynamic arrays.	4
5.	Object Oriented Programming: Classes and Objects; Constructors and Destructors; Operator Overloading and Type Conversions; Inheritance: extending classes; Pointers; Virtual Functions; Polymorphism; Manipulating Strings; Use of Pointers in linked arrays.	8
6.	Solution of Linear and Non-Linear Equation: Direct methods	6

	such as Gaussian elimination and Thomas algorithm for tri-diagonal systems; Iterative methods such as Jacobi method and Gauss-Seidel method; Single variable using Bisection method and Newton-Raphson method; Application of Newton-Raphson to two variables	
7.	Numerical Interpolation, Differentiation and Integration: Difference tables, forward, central and backward difference interpolation; Interpolating polynomials; Differentiation formulas; Trapezoidal rule, Simpson's rule	4
8.	Solution of Ordinary Differential Equations: Initial value problems (IVPs), Euler Method and Runge-Kutta method	4
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	Balaguruswamy, E., "Object Oriented Programming with C++", Tata McGraw Hill Education, 5th Edition.	2011
2.	Lafore, R., "Object Oriented Programming with C++", Pearson, 4th Edition.	2008
3.	Dietel, H. M. and Dietel, P. J., "C++ How to Program", Prentice Hall, 8th Edition.	2011
4.	Sastry, S. S., "Introductory Methods of Numerical Analysis", PHI Learning, 5th Edition.	2012
5.	Chapra, S. C., "Applied Numerical Methods with MATLAB for Engineers and Scientists", Tata McGraw Hill Education, 3rd Edition.	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Mathematics

1. Subject Code: MAN-002

Course Title: Mathematical 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: Spring

7. Subject Area: BSC

8. Pre-requisite: Nil

9. Objective: To provide knowledge of essential mathematical tools applied in solving ordinary and partial differential equations, initial and boundary value problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Ordinary Differential Equations: Solution of linear differential equations with constant coefficients. Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables. Method of variation of parameters, Introduction to series solution method.	10
2.	Partial Differential Equations: Formation of first and second order partial differential equations. Solution of first order partial differential equations: Lagrange's equation, Four standard forms of non-linear first order equations.	6
3.	Laplace Transform: Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals. Convolution theorem, Initial and final value theorem. Laplace transform of periodic functions, error functions, Heaviside unit step function and Dirac delta function. Applications of Laplace transform.	10
4.	Z - Transform: Z - transform and inverse Z-transform of elementary functions, Shifting theorems, Convolution theorem, Initial and final value theorem. Application of Z- transform to solve difference equations.	5
5.	Fourier series: Trigonometric Fourier series and its convergence. Fourier series of even and odd functions. Fourier half-range series. Parseval's identity. Complex form of Fourier series.	5
6.	Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals. Fourier transform, Fourier sine and cosine transforms and their elementary properties. Convolution theorem. Application of Fourier transforms to BVP.	6
Total		42

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11. Suggested Books:

S.No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Kreyszig, E., "Advanced Engineering Mathematics", Johan Wiley & Sons	2011
2.	Jain, R. K. and Iyenger, S. R. K., "Advanced Engineering Mathematics", Narosa Publishing House	2009
3.	Amarnath, T., "An Elementary Course in Partial Differential Equations", Narosa Publishing House (II Edition)	2012
4.	Hildebrand F. B., "Methods of Applied Mathematics", Courier Dover Publications	1992
5.	Rao, K. S., "Introduction to Partial Differential Equations", PHI Learning Pvt. Ltd. (II Edition)	2010
6.	Sneddon, I. N., " Elements of Partial Differential Equations", McGraw-Hill Book Company	1988
7.	Simmons, G. F. and Krantz, S. G., "Differential Equations: Theory, Technique and Practice", Tata McGraw-Hill Edition	2007

PE

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **CHN-102** Course Title: **Material and Energy Balance**

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

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

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

5. Credits: 4 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To provide basic knowledge of principles of material and energy balances applied to chemical engineering systems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Units and dimension in chemical engineering, units conversion of dimensional equations, stoichiometric and composition relations, concept of degrees of freedom and linear independence of a set of equations.	5
2.	Material Balance: Concept of material balance, open and closed systems, steady state and unsteady state, multiple component system, selection of a basis, problem solving strategy.	4
3.	Material Balance without chemical Reaction for Single and Multiple Units: Conservation of mass/atom, material balance for systems without polymer reactions involving single unit and multiple units.	5
4.	Material Balance with chemical Reaction for Single and Multiple Units: Concept of excess reactant, extent of reaction, material balance for systems with polymer reactions involving single unit and multiple units.	6
5.	Recycle, Bypass, Purge and Industrial Applications: Calculations for a cyclic processes involving recycle/ purge/ bypass, material balances involving gases, vapors, liquids and solids and use of real gas relationships, material balance involving gases, vapors, liquids & solids and uses of real gas relationships, vapor-liquid equilibrium and concepts of humidity & saturation, analysis of systems with bypass, recycle and purge, analysis of processes involving condensation, crystallization and vaporization.	7

6.	Energy Balance: Conservation of energy with reference to general energy balance with and without polymer reactions, chemical engineering problems involving reversible processes and mechanical energy balance.	4
7.	Applications of Energy Balance: Calculations of heat of change of phase (solid – liquid & liquid – vapor), heat of reaction, heat of combustion, heat of solutions and mixing, determination of temperatures for adiabatic and non-adiabatic reactions, use of psychometric and enthalpy- concentration diagrams.	6
8.	Simultaneous Material and Energy Balances: Degrees of freedom analysis for multicomponent systems, combined steady state material and energy balances for units with multiple sub-systems.	3
9.	Unsteady State Material and Energy Balances: Transient materials and energy balances involving with and without chemical reactions.	2
Total		42

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Himmelblau D.M. and Riggs J. B., "Principles and Calculations in Chemical Engineering", 8 th Ed., Prentice Hall of India.	2012
2.	Felder R.M. and Rousseau R.W., "Elementary Principles of Chemical Processes", 3 rd Ed., John Wiley.	2005
3.	Bhatt B.I. and Vora S.M., "Stoichiometry", 5 th Ed., Tata McGraw-Hill	2010
4.	Narayanan K.V. and Lakshmikutty B., "Stoichiometry and Process Calculations", Prentice Hall of India.	2006
5.	Hougen D.A., Watson K.M. and Ragatz R.A., "Chemical Process Principles", Part-I, 2 nd Ed., CBS Publishers.	1995

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemical Engineering

1. Subject Code: CHN-106 Course Title: Thermodynamics and Chemical Kinetics

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

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

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

5. Credits: 4 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To provide basic knowledge of thermodynamics and chemical kinetics to chemical engineering students.

10. Details of Course:

S.No.	Contents	Contact Hours
1.	Introduction: Thermodynamic system, surroundings, state, process, properties, equilibrium, heat and work.	02
2.	Properties of Pure Simple Compressible Substance: P-V-T surface, P-V, T-V and T-P diagrams. Equations of state for ideal and real gases. Virial equation of state, van der Waals and Redlich-Kwong equations of state; Use of Thermodynamic tables.	06
3.	First Law of Thermodynamics: Energy balance for closed systems. Various forms of energy balance. Specific heat, internal energy, enthalpy, and specific heat of ideal gases. Application of first law to non-flow isochoric, isobaric, isothermal, and adiabatic and polytropic processes. Conservation of mass for a control volume, mass and volume flow rates, mass balance for steady flow processes, flow work, steady flow energy equation. Application to various practical systems viz. nozzles, diffusers, etc. Transient Analysis.	05
4.	Second Law of Thermodynamics: Second law, reversible and irreversible processes, Clausius and Kelvin Planck statements. Carnot cycle, Clausius inequality, entropy as a property, principle of increase of entropy. Calculation of entropy change.	06
5.	Thermodynamic Cycles: Otto, Diesel, Rankine cycles and their	03

	applications.	
6.	Rate Expression and Reaction Mechanism: Use of pseudo steady state approximation to get rate expression from mechanism, temperature-dependence of reaction rate-collision theory, transition state theory, thermodynamics and Arrhenius law.	04
7.	Interpretation of Kinetic Data of Batch Reactors: Constant volume and variable volume batch reactions, Integral and differential methods of analysis of data of uni, bi and tri-molecular irreversible reactions. Reversible reactions, homogeneously catalysed, auto-catalysed, series and parallel reactions. Estimation of rate constants and its temperature-dependence.	08
8.	Solid-Catalysed Fluid Reactions: Characterization of catalyst, Physical and chemical adsorption, various reaction steps, Langmuir-Hinshelwood kinetics.	04
9.	Kinetics of Bio-Chemical Reactions: Kinetics of enzyme catalysed reactions, substrate and product inhibition, effect of temperature and pH on enzyme catalysed reactions.	04
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Çengel Y.A. and Boles M.A., "Thermodynamics: An Engineering Approach", 6 th Ed., McGraw Hill.	2008
2.	Smith J.M., Van Ness H.C. and Abbott M.M., "Introduction to Chemical Engineering Thermodynamics", 7 th Ed., McGraw Hill.	2005
3.	Borgnakke C. and Sonntag R.E., "Fundamentals of Thermodynamics", 7 th Ed., John Wiley and Sons.	2009
4.	Levenspiel O., "Chemical Reaction Engineering", 3 rd Ed., John Wiley.	2000
5.	Fogler H.S., "Elements of Chemical Reaction Engg.", 4 th Ed., Prentice Hall of India.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: PEN-102 Course Title: Properties of Polymers

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

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

4. Relative Weightage: CWS:15 PRS:25 MTE:20 ETE:40 PRE:0

5. Credits: 3 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To impart knowledge of properties of polymers, their testing and characterization

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to Polymer Characterization: Overview of properties useful for complete characterization of Polymers, Copolymers, – Thermal, Mechanical, Optical and Electrical, Chemical and Morphological.	2
2.	Amorphous Polymers: Free volume and free volume theory, Kinetic nature of glass transition, pressure and path dependence of polymeric glasses, Gibbs Dimarzio Theory, Factors affecting glass transition temperature, secondary sub glass transition temperature, Physical ageing, Five regions of viscoelastic behavior,	5
3.	Crystalline Polymers & polymer Crystallization: Fundamentals and thermodynamics of polymer crystallization, Structure of crystalline polymers, Structural factors affecting crystallizability and crystallinity of polymers, Spherulites, Helix Structure, Chain folding, Polymer single Crystal,	5
4.	Thermal Properties and Characterization: Operating Principles and Theory behind Characterization by Differential Scanning Calorimetry (DSC) and Thermo-gravimetric Analysis (TGA); Melting Point related Tests, Glass Transition Temperature and Factors affecting it; Testing and measurements of Heat Deflection Temperature (HDT), Vicat Softening point (VSP), Torsion Pendulum Test, Thermal	7

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	Conductivity and Expansion, Brittleness Temperature; Measurements related to Flammability.	
5.	Dynamic Mechanical Thermal Properties: Damping, storage and loss modulus, dissipation factor, loss tangent, loss factor, retardation times, thermal, frequency, and force amplitude effects on dynamic properties, characterization of dynamic mechanical properties of polymers.	6
6.	Mechanical Properties and Characterization: Tensile, Compressive and Flexural Mechanical Response of Polymers: Stress-strain behavior, Models, Cold drawing, Strain hardening, Characterization of Tensile, Compressive & Flexural mechanical nature of polymers. Tensile and Compressive strength measurements, Fracture and Strength of Polymers, Measurements of Impact property, Notch sensitivity and testing procedures. Surface Mechanical Properties and Tests- Tests and measurement related to Hardness- Durometer/Shore Hardness, Vicker Scale; Abrasion Properties & tests, Co-efficient of friction measurements; Long-Term Mechanical Properties and measurements- Creep, stress-relaxation and fatigue resistance, etc.	9
7.	Optical and Electrical Property Characterization: Operating Principles of Equipments and Theory behind Measurements of- Refractive Index, Specular Gloss using Gloss meter, Luminous Transmittance and Haze, Color, Birefringence, Clarity and Photo-elasticity; Surface and volume resistivity, dielectric constant, dissipation factor.	4
8.	Non-Destructive Testing: Operating Principles and Procedure of Techniques- Ultrasonic measurements, Liquid-penetration Techniques, Magnetic particle testing, Radiography and Microwave based NDT, Thermal methods and Laser Holography.	4
Total		42

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11. List of Practicals :

1. Determination of T_c , T_g and T_m of polymer (using DSC).
2. Determination of degradation profile and filler content of a polymer (using TGA).
3. Study of Mechanical Stress-strain behavior of a polymer under tension
4. Study of Mechanical Stress-strain behavior of a polymer under and compression.
5. Determination of Impact strength of a polymer by Izod method.
6. Determination of Impact strength of a polymer by Charpy method.
7. Study of Dynamic Mechanical Behavior of a Polymer

12. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication/Reprint
1.	Craver C. D. "Polymer Characterization", ACS.	1983
2.	Nayak S. K., Yadav, S. N, Mohanty, S., "Fundamentals of Plastics Testing", Springer.	2010
3.	Korschwitz J., "Polymer Characterization and Analysis", John Wiley & Sons.	1990
4.	Shiers J., "Practical Polymer Analysis", John Wiley & Sons.	2000

AE

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject code: **CYN-011** Course Title: **Polymer Characterization**

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

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

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

5. Credits: **2** 6. Semester: **Spring** 7. Subject Area: **BSC**

8. Pre-requisite: **Nil**

9. Objective: It will familiarize the students to learn methods of synthesizing different types of polymers and characterize using array of physical techniques.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Preliminary Survey: Identification of polymer materials; molecular architecture; need for optical characterization, diffraction techniques, microstructure analysis.	2
2.	Spectroscopic technique: Interaction of electromagnetic radiation with matter; Atomic and molecular spectroscopy and Instrumentation, viz., UV-visible spectroscopy, Infrared and Raman spectroscopy.	6
3.	Nuclear magnetic resonance (NMR) spectroscopy. Principle of magnetic resonance, experimental technique, Applications of NMR to polymers, NMR of Polymers in solid state, two dimensional NMR, NMR imaging.	4
4.	Diffraction techniques: Theory of X-ray diffraction (XRD), Generation and properties of X-ray, Applications of XRD to polymer characterization; Alternate diffraction techniques viz., electron diffraction, neutron diffraction.	8
5.	Microscopic technique: Theoretical concepts in optical microscopy, fluorescent microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, instrumentation and applications.	8
	Total	28

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11. Suggested Books:

S.No.	Name of Authors/Book/ Publisher etc.	Year of Publication/ Reprint
1	Campbell, D., Pethrick, R.A., White J.R., "Polymer Characterization Physical Techniques", Stanley Thornes (Publishers) Ltd. 2 nd Edition	2000
2	Skoog, D.A., Holler, F.J., Crouch S.R., Principles of Instrumental Analysis", 6 th Edition, Thomson Brooks	2006
3	West A.R., "Solid State Chemistry and its Applications" John Wiley & Sons, India	2013
4	Slayter, E.M., Slayter, H.S., "Light and Electron Microscopy" Cambridge University Press.	1997

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **EEN-112** Course Title: **Electrical Science**

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

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

4. Relative Weight: CWS: 20 PRS: 20 MTE: 20 ETE: 40 PRE: 0

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

8. Pre-requisite: Nil

9. Objective: To introduce the students to the fundamentals of Electrical Engineering concepts of network analysis, principles of electrical machines, basics of electrical measurement and measuring instruments.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Energy Resources and Utilization: Conventional and non-conventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization.	5
2.	Network Fundamentals: Types of Sources and elements, Kirchoff's Laws, Mesh and Node Analysis of D.C. Networks, Network Theorems: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Theorem, Star-Delta Transformation.	5
3.	A.C. Fundamentals: Concept of phasor, impedance and admittance; Mesh and Node analysis of AC networks; Network theorems in AC networks; Active and reactive power in AC circuits; Resonance in series AC circuits; Power factor correction.	4
4.	Three-phase A.C. Circuits: Analysis of 3-phase balanced star-delta circuits, Power in 3-phase Circuits.	2
5.	Measurement of Electrical Quantities: Measurement of Voltage, Current, and Power; Measurement of 3 phase power; Energy meters.	5
6.	Single Phase Transformer: Introduction to magnetic circuit concepts, Basic constructional features, operating principle, phasor diagram, equivalent circuit, voltage regulation; Eddy current and Hysteresis losses, efficiency; Open circuit and Short Circuit tests.	5

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7.	D.C. Machines: Principle of operation, constructional features; Emf and torque equations; Types of excitation; Generator characteristics; Starting and speed control of D.C. motors.	5
8.	AC Machines: Three-phase Induction Motor - Operating principle, constructional features, torque-speed characteristics, starting and speed control; Single-phase Induction Motor - Operating principle, constructional features, torque-speed characteristics, starting methods.	5
9.	Industrial Applications and Control: Various industrial loads, traction, heating, lighting; Concept of power electronic control of AC and DC motors.	6
Total		42

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Mukhopadhyaya P., Pant A.K., Kumar V. and Chittore D.S., "Elements of Electrical Science", M/s Nem Chand & Brothers.	1997
2.	Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall of India.	2002
3.	Dubey G. K., "Fundamentals of Electric Drives", 2 nd Ed., Narosa Publishing House.	2007
4.	Alexander C.K., Sadiku M.N.O., "Fundamentals of Electric Circuits", McGraw Hill, 5 th Edition.	2012
5.	Chapman, Stephen, J., "Electric Machinery Fundamentals", McGraw Hill Book Company.	1985
6.	Hughes Edward, "Electrical & Electronic Technology", Pearson Publishing, 8 th edition.	2002

AE

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Chemistry

1. Subject code: CYN-013

Course Title: Polymer Chemistry Laboratory

2. Contact Hours: L: 0

T:0

P: 4

3. Examination Duration (Hrs.):

Theory:0

Practical :0

4. Relative Weightage: CWS:0 PRS:100 MTE: 0 ETE:0 PRE:0

5. Credits: 2

6. Semester: Spring

7. Subject Area: BSC

8. Pre-requisite: Nil

9. Objective: It will familiarize the students to learn methods of synthesizing and characterization of different types of polymers.

10. Details of the Course:

List of Practicals

1. Emulsion polymerization of styrene
2. Precipitation Polymerization of Acrylonitrile
3. Synthesis of Isotactic and Syndiotactic PMMA/ Copolymerization of MMA and Styrene (anionic, cationic, block)
4. Synthesis of Polyurethane Foams
5. Synthesis of Nylon 6,6
6. MFI of synthesized polymers
7. Synthesis of High Syndiotactic Polystyrene by Homogeneous Ziegler-Natta Catalysis
8. Characterization of the synthesized polymers by UV-Visible spectroscopy and Infrared spectroscopy
9. Determination of various molecular weight of synthesized polymers by DLS, viscosity and relate them with GPC experiment
10. Determination of T_c, T_g and T_m of polymer using DSC
11. Determination of degradation profile and filler/inter content of/in a polymer using TGA,
12. Raman spectroscopic characterization of polymers
13. Morphological study by optical, electron microscopy and AFM
14. NMR and XRD studies of monomers and polymers

11. Suggested Books:

S.No.	Name of Authors/Book/ Publisher etc.	Year of Publication/ Reprint
1.	Campbell, D., Pethrick, R.A., White J.R., "Polymer Characterization Physical Techniques", 2 nd Edition, Stanley Thornes (Publishers) Ltd.	2000
2.	Skoog, D.A., Holler, F.J., Crouch S.R., Principles of Instrumental Analysis", 6 th Edition, Thomson Brooks.	2006
3.	West A.R., "Solid State Chemistry and its Applications" John Wiley & Sons, India	2013
4.	Slayter, E.M., Slayter, H.S., "Light and Electron Microscopy" Cambridge University Press.	1997

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **CHN-201** Course Title: **Heat Transfer**

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

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

4. Relative Weight: **CWS:20** **PRS:20** **MTE :20** **ETE:40** **PRE:0**

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

8. Pre-requisite: **Nil**

9. Objective: To provide basic knowledge about heat transfer and its processes used in
Chemical Process Industries

10. Details of Course:

S. No.	Contents	Contact Hour
1.	Introduction: Heat transfer modes, their rate equations.	1
2.	Radiation: Mechanism of radiation and its laws, black and grey body behavior, shape factors- determination using equations and charts, relationship between shape factors, heat transfer between non-black bodies, concept of surface- and space- resistance with concept of insulated and large surfaces, use of radiation shields, radiation through absorbing and transmitting gases.	8
3.	Conduction: Use of extended surfaces, two-dimensional steady state conduction, Thermal insulation- materials for cold and hot applications and thickness calculations, introduction to transient conduction, Biot number, use of Heisler charts.	6
4.	Convection: Concept and significance of boundary layer, boundary layer similarity and analogy, convection coefficients, free and forced convection, empirical correlations- internal and external flows.	6
5.	Heat Exchangers: Types and selection, overall heat transfer coefficient, parallel and counter current flow, LMTD, F_T correction factor, analysis and design using effectiveness-NTU method.	4
6.	Boiling: Characteristics, nucleate pool- and forced convection-boiling, boiling mechanism and curve, heat transfer correlations, heat pipes.	4
7.	Condensation: Mechanism and types of condensation of vapor with and without non-condensable gases, Nusselt equation for film wise condensation on vertical surfaces and its extension to inclined and horizontal surfaces and tubes, condensation number,	5

	film condensation inside horizontal tube.	
8.	Evaporator: Classification and use of evaporators in process industries, effect of boiling point rise and hydrostatic head on evaporator performance, liquor flow sequences, calculations for multiple effect evaporator system.	4
9.	Crystallization: Mechanism, crystallization from mixed solutes, particle size distribution of crystals and parameters effecting it, some major types of crystallizers, crystallizer calculations.	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/ Publisher	Year of Publication
1.	Holman J.P., "Heat Transfer", 10 th Ed., McGraw Hill	2009
2.	Bergman T.L., Lavine A.S., Incropera F.P. and DeWitt D.P., "Introduction to Heat Transfer", 6 th Ed., Wiley	2011
3.	Cengel Y.A. and Ghajar A.J., "Heat and Mass Transfer: Fundamentals and Applications", 4 th Ed., McGraw Hill	2010
4.	Kreith F., Manglik R.M. and Bohn M., "Principles of Heat Transfer", 7 th Ed., Cengage Learning	2010

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Chemical Engineering**

1. Subject Code: **CHN-211** Course Title: **Fluid and Fluid Particle Mechanics**

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

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

4. Relative Weightage: CWS:20 PRS:20 MTE:20 ETE:40 PRE:0

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

8. Pre-requisite: Nil

9. Objective: To provide knowledge of particle size analysis, size reduction, separation of particles by filtration, sedimentation and flow through porous media.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Particle Size Reduction and Analysis: Theory of crushing and grinding, crushing and grinding equipment and their selection. Sieve analysis, size distribution, size averaging and equivalence, size estimation in sub-sieve range,	6
2.	Storage of Solids : Bins, silos, hoppers, Janseen's equation.	2
3.	Fluid Handling Machinery and Flow Measurement: Pumps; Blowers and compressors- classification, operating and performance characteristics, selection criteria and design specifications; Constant area and constant head meters; Weirs and notches.	7
4.	Particle Mechanics : Motion of particles in fluid, effect of particle shape, Stock's law, hindered settling, jigging and classification	4
5.	Sedimentation and Flotation: Gravity and centrifugal sedimentation, design of sedimentation tanks and continuous thickeners, mechanism of flotation, flotation agents, coagulants and flotation equipment.	6
6.	Filtration : Flow through filter media and formation of cakes, washing and drying of cake, filter aids, selection of filtration equipment, constant rate and constant pressure filtration.	4
7.	Flow Through Packed Beds : Characteristics of packings, flow of a single fluid through a packed bed, problems of channeling and wetting, counter-current gas-liquid flow through packed beds-loading and flooding	5

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	characteristics.	
8.	Fluidization and Solid Conveying : Fluidization characteristics, aggregative and particulate fluidization, voidage and minimum fluidization velocity, voidage correlations, gas-solid fluidization characteristics; Pneumatic and hydraulic transport of solids-general characteristics and flow relations	8
	Total	42

11. List of Practicals:

1. Plate and frame filter press
2. Flow through packed bed
3. Flow through fluidized bed
4. Batch Sedimentation
5. Elutriation
6. Crushing and grinding experiments
7. Flow meters
8. Pumps Characteristics

12. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Backhurst J. R. and Harker J. H., "Coulson and Richardson Chemical Engineering", Vol. II", 5 th Ed., Butterworth-Heinemann.	2002
2.	Brown G. G., "Unit Operations", CBS publishers.	1995
3.	Narayanan C.M. and Bhattacharya B.C., "Mechanical Operations for Chemical Engineers-Incorporating Computer Aided Analysis", Khanna publishers.	1992
4.	McCabe W. L., Smith J. C. and Harriott P., "Unit Operations of Chemical Engineering", 7th Ed., McGraw Hill.	2005

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF THE PROGRAM: Department of Polymer and Process Engineering

1. Subject Code: PEN-201 Course Title: Polymer Engineering Thermodynamics

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

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

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

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

8. Pre-requisite: Nil

9. Objective: To understand the thermodynamics to polymer.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Laws of thermodynamics, PVT behavior of fluids – Gibb's phase rule.	3
2.	Thermodynamic Properties of Homogeneous Fluids: Fundamental property relations, Maxwell's relations, Residual properties and their estimation, two phase systems.	4
3.	Thermodynamic Properties of Mixtures or Solutions: Property relationships for systems of variable composition; chemical potential, partial molar properties, fugacity and fugacity coefficients – pure species and species in a mixture, fugacity in ideal solutions, activity coefficients, excess properties.	6
4.	Glassy, Crystalline and molten state of polymers: States of matter, Glassy, crystalline and Molten states of polymers, Bonding and Confirmations.	5
5.	Thermodynamics glass transition temperatures & characteristics: Equilibrium melting temperature, melting temperature of polymer crystals, Factors affecting the melting temperatures, Entropy and chain flexibility, nature of glass transition, Thermodynamics of glass transition, Free volume theory.	6

6.	Polymer chain conformations and Phase transitions: Chain end-end distance, Conformations available to a chain, Random flight model for polymer, order of phase transitions, Feynman's method, Theory of rubber elasticity.	6
7.	Theories for polymer solutions: Polymer solutions, Miscible and immiscible blends, Regular solution theory, Flory- Huggins theory.	5
8.	Thermodynamics of polymer solutions: Theories of mixing, Solubility parameters and enthalpy of mixing, Phase behavior, Phase equilibria in polymer solutions, Critical fluctuations and spinodal decomposition, Group contribution methods for solubility parameters, Osmotic pressure- Molecular weight measurement, Viscosity of dilute solution	7
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1	Smith J.M., Van Ness H.C. and Abbott M.M., "Introduction to Chemical Engineering Thermodynamics", 7 th Ed., McGraw Hill.	2005
2	Polymer chemistry, 2 nd edition, P. C. Hiemenz and T. P. Lodge, CRC press, Boca Raton.	2007
3	Essentials of Polymer Science and Engineering, Mike Coleman, Paul Painter, DesTech Publications	2008
4	Introduction to polymer science and chemistry: A problem solving approach, ManasChanda, CRC/Taylor & Francis, Boca Raton.	2006
5	Fundamentals of polymer engineering, 2 nd edition, Anil Kumar, Rakesh K. Gupta, Marcel Dekker (Taylor & Francis)	2011

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **PEN-203** Course Title: **Polymer Blends**

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

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

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

5. Credits: **3** 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: **Nil**

9 Objective: **To impart knowledge of principles, properties, and applications of polymer blends**

10 Details of Course:

S. No.	Contents	Contact Hours
1	Introduction: Introduction to polymer solutions, polymer blends, rubber toughened plastics, interpenetrating networks, molecular composites.	2
2	Miscibility and Phase Separation: Polymer-polymer miscibility, thermodynamic theories of miscibility, factors governing miscibility, prediction and enhancement of miscibility; Immiscible systems and phase separation; binodal and spinodal decomposition.	5
3	Compatibility and Compatibilization: Immiscible and compatible systems; compatibility and compatibilization; compatibilization by block, graft and random copolymers, compatibilization by functional polymer, compatibilization by reactive blending	5
4	Blends of Semi-Crystalline Polymers: Blends of an amorphous polymer / a semi-crystalline polymer; structure and morphology of a blend of an amorphous polymer / a semi-crystalline polymer; crystallization in a blend of an amorphous polymer / a semi-crystalline polymer; blends of two semi-crystalline polymers, structure and morphology of a blend of two semi-crystalline polymers; crystallization in a blend of two semi-crystalline polymers	4
5	Rubber Toughened Polymers: Toughening mechanism, rubber	6

	toughening, processing, structure, properties and morphology of rubber toughened polymers.	
6	Molecularly Reinforced Polymer Blends: Molecular composites, self reinforced LCP blends, macromolecular nano composites, rigid polymer, flexible polymer solvent ternary systems, solution processing, melt processing, properties, applications.	4
7	Interpenetrating Networks: Introduction, processing, properties, and applications.	2
Total		28

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Hope P. and Folkes B.M., "Polymer Blends and Alloys", Blackie.	1993
2.	Paul D.R. and Sperling H.S., "Multicomponent Polymer Materials", ACS.	2005
3.	Paul D. R. and Newman S., "Polymer Blends", Vol-1&2 Academic Press.	2008
4.	Utracki L. A., "Polymer Alloys and Blends", Hanser.	2007

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE: **Department of Mechanical and Industrial Engineering**

1. Subject Code: **MIN-108** Course Title: **Mechanical Engineering Drawing**

2. Contact Hours: L: 2 T: 0 P: 4

3. Examination Duration (Hrs.): Theory: 0 Practical: 4

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

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

8. Pre-requisite: Nil

9. Objective: The course objective is to teach the basic concepts of Mechanical Engineering Drawing to the students. The emphasis is on to improve their power imagination.

Details of Course:

S. No.	Contents	Contact Hours
1	General Instructions : Sheet Layout, Line Symbols and Groups, Preferred Scales, Technical Sketching	1
2	Types of projections: Reference Planes and Quadrants, Orthographic Projection	2
3	Projection of point and lines	3
4	Projection of plane figures	2
5	Projection of solids	2
6	Section of solid and development	2
7	Shape Description(External): Multiplanar Representation, Systems of Projection, Sketching of Orthographic Views from Pictorial Views, Conventional Practices, Precedence of Views , Precedence of Lines	2
8	Uniplaner Representation: Sketching of Pictorial Views (Isometric and Oblique) from Multiplaner Orthographic Views	2
9	Shape Description (Internal): Sectioning as an Aid to Understanding internal features, Principles of Sectioning, Types of Sections, Section Lines, Cutting Plane Lines and Conventional Practices	3
10	Size Description: Dimensioning, Tools of Dimensioning, Size and Position Dimensions, Unidirectional and Aligned Systems, Principle and Practices of Dimensioning,	4
11	Conventional Representation: Representation and	1

	Identification of Common Machine Elements and Features	
12	Introduction to Solid Modeling	4
	Total	28

Practical Exercises:

Topics	Practice Classes of Two Hour Duration
Projection of points and lines	04
Projection of plane figures	02
Projection of solids	03
Section and development	02
Sketching of Orthographic Views from Pictorial Views	04
Sketching of Pictorial Views (Isometric and Oblique) from Multiplanar Orthographic Views, Missing Lines Exercise, Missing Views Exercise	04
Sectioning Exercise	02
Dimensioning exercise	02
Identification Exercise	01
Solid Modeling, orthographic views from solid models	04

11. Suggested Books:

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

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemical Engineering

1. Subject Code: CHN-212 Course Title: Mass Transfer

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

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

4. Relative Weightage: CWS:20 PRS:20 MTE:20 ETE:40 PRE:0

5. Credits: 4 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To provide basic knowledge of mass transfer operations and their application in process industries.

10. Details of Course:

S.No	Contents	Contact Hours
1	Diffusion: Molecular and eddy diffusivity, diffusion through stagnant gas film, equimolal and countercurrent diffusion, diffusion through solids.	4
2	Interphase Mass Transfer: Theory of interphase mass transfer, overall and individual mass transfer coefficients.	5
3	Distillation: Principles of distillation; Batch and Continuous distillation with reflux; Conditions of feed; Number of stages, stage efficiency.	6
4	Solid- Liquid Extraction: Single and multiple-stage countercurrent extraction; Calculation of number of stages by graphical and analytical procedures.	5
5.	Liquid-Liquid Extraction: Triangular diagrams; Number of Stages.	4
6.	Absorption and Adsorption: Absorption from gas mixture; Selection of solvent; Number of stages, concepts of NTU and HTU; Principles and application of adsorption	7
7.	Humidification, Dehumidification and Drying: Humidification and dehumidification operation; Cooling towers; Mechanism and rate of drying, calculation for batch and continuous drying; Industrial applications.	9
8.	Membrane Separation: Introduction, Principles, and application.	2
	Total	42

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11. List of Experiments:

1. Batch Distillation
2. Liquid-liquid extraction
3. Solid-liquid extraction
4. Distillation in packed bed
5. Steam distillation
6. Diffusion of vapours in air
7. Batch dryer

12. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Treybal R.E., "Mass Transfer Operation", 3 rd Ed., McGraw Hill.	1980
2.	Brown G. G., "Unit Operations", CBS Publishers.	1995
3.	McCabe W. L., Smith J. C. and Harriott P., "Unit Operations of Chemical Engineering", 7th Ed., McGraw Hill.	2005

AE

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Department of Polymer Science and Engineering**

1. Subject Code: **PEN-202**

Course Title: **Polymer Reaction Engineering**

2. Contact Hours: **L: 3**

T: 1

P: 2/2

3. Examination Duration (Hrs.):

Theory:3

Practical :0

4. Relative Weightage: **CWS:20**

PRS:20

MTE:20

ETE:40 PRE:0

5. Credits: **4**

6. Semester: **Spring**

7. Subject Area: **PCC**

8. Pre-requisite: **Nil**

9. Objective: **To impart knowledge of application of reaction engineering for polymer production.**

10. Details of Course:

S. No.	Contents	Contact Hours
1	Ideal Reactors: Design equations for ideal reactors, namely batch, CSTR, plug flow, design equation for single reaction systems using batch and semi batch, CSTR, PFR and recycle reactor, auto catalytic reactions, reactor choice for single reaction	4
2	Design for multiple reactions: Parallel and series reactions, quantitative treatment of product distribution and of reactor size for different types of ideal reactors, selectivity and yield, selection of reactor for multiple reactions	4
3	Non-isothermal operation and stability of reactors: Non isothermal design of ideal reactors, hot spot in tubular reactor, auto-thermal process, steady state multiplicity, optimal temperature progression for first order reversible reaction	4
4	Non-ideal flow: Residence time distribution (RTD), role of RTD in determining reactor behavior, age distribution (E) of fluid, experimental methods for finding E, relationship between E and F curve, models for non-ideal flow-single and multi parameter models (axial dispersion, tanks in series), performance estimation of reactor using reactor models	5
5	Reaction Engineering of Step Growth Polymerization: MWD of condensation polymerization: ARB and $A_2 + B_2$ systems; advance stage of condensation polymerization, similarity solution step growth polymerization model	4
6	Reaction Engineering of Free Radical Polymerization: MWD of Free radical polymerization: Standard free radical polymerization; design of tubular reactors involving radical polymerization, solution of equations describing isothermal radical polymerization	5
7	Reaction Engineering of Ionic, Ziegler Natta, Copolymerization: Smith-Ewart and other models, average chain length estimation of stereoregular polymers, chain segment estimation and its distribution	5

8	Bulk, Solution and Precipitation Polymerizations: Modeling of bulk and solution polymerization reactor, precipitation polymerization: reactor modeling to interpret MWD of industrial polymers	5
9	Suspension and Emulsion Polymerization: Suspension Polymerization: Principles, of reactor modeling and MWD estimation; Modeling of emulsion reactors, prediction of MWD and solution viscosity, examples	6
Total		42

11. List of Practicals

- i. Study of kinetics of bulk polymerization
- ii. Study of kinetics of bulk polymerization in plug flow reactor
- iii. Study of kinetics of bulk polymerization in CSTR
- iv. Study of kinetics of emulsion polymerization in batch reactor
- v. To determine the percentage conversion of monomer and molecular weight distribution of polymer in batch reactor
- vi. Study of kinetics of emulsion polymerization in plugflow reactor
- vii. Study of kinetics of emulsion polymerization in CSTR

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Beisenberger J. A. and Sebastian D.H.; "Principles of Polymerization Engineering", John Wiley & Sons.	1983
2.	Odian G., "Principles of Polymerization", John Wiley & Sons.	2002
3.	Billmayer, F. W., Text Book of Polymer Science 3 rd Edition, Wiley Inter Science, New York	1984

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT/CENTRE: Department of Polymer Science and Engineering

1. Subject Code: PEN-204 Course Title: Polymer Rheology & Processing
2. Contact Hours: L: 2 T: 1 P: 2/2
3. Examination Duration (Hrs.): Theory:2 Practical :0
4. Relative Weightage: CWS:20 PRS:20 MTE:20 ETE:40 PRE:0
5. Credits: 3 6. Semester: Spring 7. Subject Area: PCC
8. Pre-requisite:
9. Objective: To impart knowledge of polymer processing technology and equipment.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Introduction to Polymer Rheology and processing: Introduction to various Rheological response functions, processing behavior of polymers with that of rheology	2
2.	Basic Rheological Concepts: Flow Classification: Steady Simple Shear Flow, Unsteady Simple Shear Flow, Extensional Flow; Non-Newtonian Flow Behavior: Newtonian Fluids, non-Newtonian Fluids, Viscoelastic Effects	3
3.	Continuum Aspect of Rheology: Phenomenological models to illustrate viscoelastic effects: Maxwell's Model, Voigt Model and Standard Linear Solid Model; Boltzmann's superposition theorem; Temperature dependence of Viscosity; Intrinsic viscosity of polymer solutions	5
4.	Rheological Models: Models for the Steady Shear Viscosity Function, Model for the Normal Stress Difference Function, Model for the Complex Viscosity Function, Model for the Dynamic Modulus Functions, Models for the Extensional Viscosity Function; Other Relationships for Shear Viscosity: Viscosity-Temperature Relationships, Viscosity-Pressure Relationship, Viscosity-Molecular Weight Relationship	7
5.	Rheometry: Rotational Viscometers: Cone and Plate Viscometer, Parallel-Disc Viscometer; Capillary Rheometers: Constant Plunger Speed Circular Orifice Capillary Rheometer, Constant Plunger Speed Slit Orifice Capillary Rheometer, Constant Speed Screw Extrusion Type Capillary Rheometers, Constant Pressure Circular Orifice Capillary Rheometer (Melt Flow Indexer); Extensional Viscometers: Filament Stretching Method, Extrusion Method	8
6.	Constitutive Theories and Equations for Suspensions and rheology of complex polymeric fluid: Importance of Suspension Rheology, Shear Viscous Flow: Effect of Shape, Concentration and Dimensions on the Particles, Effect of Size Distribution of the Particles	3
		Total 28

List of Practical:

1. Rheology of polymer by cone plate rheometer
2. Rheology of polymer by parallel plate rheometer
3. Study of Rheological behavior of Polymer gel
4. Study of rheological behavior of polymeric adhesives
5. Understanding of G' , G'' and $\tan\delta$ parameters for polymeric materials
6. Dynamic Mechanical Analysis of Polymeric materials
7. Rheological property estimation of Rubbery materials

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Larson R. G., "The Structure and Rheology of Complex Fluids", Oxford.	1998
2.	Bird R. B., Armstrong R. C. and Hassager O., "Dynamics of Polymeric Liquids", Volume I and II, John Wiley and Sons.	1987
3.	Montgomery T. Shaw, "Introduction to Polymer Rheology", John Wiley and Sons.	2011
4.	Piau J. M. and Agassant J. F., "Rheology of Polymer melt processing", Elsevier.	1996
5.	Shenoy A V, "Rheology of Filled Polymer Systems" Kluwer Academic Publishers	1999
6.	Han C D, "Rheology and Processing of Polymeric Materials" Vol-1, Oxford University Press	2007



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Polymer Science and Engineering

1. Subject Code: PEN-206

Course Title: Polymer Production Engineering

2. Contact Hours: L: 3

T: 0

P: 0

3. Examination Duration (Hrs.):

Theory:3

Practical :0

4. Relative Weightage: CWS:15 PRS:0 MTE:35 ETE:50 PRE:0

5. Credits: 3

6. Semester: Spring

7. Subject Area: PCC

8. Pre-requisite:

9. Objective: To impart knowledge of structure, properties processing and manufacturing of polymer materials.

10. Details of Course:

S. No.	Contents	Contact Hours
	Flow Diagrams, Unit Operations, Process , Economics, Industrial Production and Applications of :	
1	Polyolefins: Polyethylene, polypropylene	4
2	Vinyl Polymers: Poly (vinyl chloride)	2
3	Styrene Polymers: Polystyrene, ABS, SAN,	6
4	Thermosets : Epoxy, polyesters, polyurethanes, phenolic	7
5	Engineering Thermoplastics: Polyamides, polyesters, polycarbonates, polyethers,	7
6	High Performance Thermoplastics: Poly-ether-ether-ketone, polyphenylenesulphide, polysulphones, polyphenylene-oxides	7
6	Polyimides: Polyesterimides, polyetherimides, polybismelimides, poly-amide-imide	7
7	Fibre Forming Polymers : Aramid and polyester	2
	Total	42

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Brydson JA, "Plastic Materials", Newnes Butterworth	1989
2.	Campbell IM, "Introduction to Synthetic Polymers", Oxford University Press	2000
3.	Erhstein G, "Polymeric Materials", Hanser-Gardner, Cincinnati	2001

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Polymer Science and Engineering

1. Subject Code: PEN-208 Course Title: Elastomer Science and Engineering

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

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

4. Relative Weightage: CWS:15 PRS: 25 MTE:20 ETE:40 PRE:0

5. Credits: 3 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To impart knowledge of structure, properties, processing and applications of elastomers and rubbers.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Introduction: Definition of elastomers and requirements of polymer to be elastomer: effect of molecular weight and glass transition temperature (T _g), Interpreting the properties of elastomers	4
2	Essential properties of specific elastomers: Natural Rubber, Styrene Butadiene Rubber, Nitrile rubber, Ethylene-propylene rubbers, Polychloroprene rubber, Butyl rubber, Fluorocarbon Rubber, Polybutadiene Rubber, Polyurethane rubber, Chlorosulfonated polyethylene, Polyurethanes, silicone rubber and thermoplastic elastomers	7
3	Basic rubber compound: Definition of rubber compounding, process and principles of compounding, basic compound formula, Function of different compounding ingredients: gum rubber, curing agents, ZnO, stearic acid, fillers (black and non black), Accelerators, Antioxidants and antidegradants, Plasticizers and Miscellaneous, Compound design	7
4	Vulcanization of elastomers: Principles and theory of vulcanization, Definitions of different terms like scorch, cure/ over cure & study of curing, Different types of vulcanization systems, Sulfur and its role in vulcanization. Measurement of mooney viscosity and state of cure for rubber compound	4
5.	Mastication and mixing of rubber: Definition, objective of mixing and mastication, mixing equipments, different mixing process	2
6.	Engineering aspect of rubber product manufacturing: Tyre technology, conveyer belt technology, sealing ring technology and hose technology	4
	Total	28

List of Practicals

1. Identification of different rubbers
2. Processing of rubber in a two roll mill.
3. Processing of rubber with carbon black filler.
4. Processing of rubber with non black loading type filler.
5. Compounding of rubber with ingredients.
6. Vulcanization of rubber.
7. Mechanical properties of vulcanized rubber.

11. Suggested Books

S.No.	Name of Authors /Books/Publishers	Year of Publication
1.	Johnson P., "Rubber Processing: An Introduction", Hanser-Gardner.	2001
2.	Mark J.E., Erman B. and Eirich F.R., "Science & Technology of Rubber", Elsevier.	2003
3.	Morton M., "Rubber Technology", Van Norstrand-Reinhold.	1987
4.	Bhowmick, A.K. and Stephens H.L., "Handbook of elastomers" CRC Press, 2 nd Edition	2000
5.	Andrew Ciesielski, "An Introduction to Rubber Technology" Rapra Technology Limited, UK	1999
6.	Blow CM, "Rubber Technology & manufacture" Butterworths, London	1982

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT : Department of Metallurgical and Materials Engineering

1. Subject Code: MTN-106 Course Title: Materials Science
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: PCC
8. Pre-requisite: Nil
9. Objective: To impart basic knowledge about the Materials Science.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Introduction: Historical perspective of Materials Science. Why study properties of materials? Classification of materials. Advanced Materials, Future materials and modern materials.	2
2	Atomic Structure, Interatomic Bonding and Structure of Crystalline Solids: Atomic structure. Atomic bonding in solids, Crystal structures, Crystalline and non-crystalline materials. Miller indices. Anisotropic elasticity. Elastic behaviour of composites. Structure and properties of polymers. Structure and properties of ceramics.	2
3	Imperfections in Solids: Point defects. Theoretical yield point. Line defects and dislocations. Interfacial defects. Bulk or volume defects.	2
4	Mechanical Properties of Metals: Elastic deformation. Plastic deformation. Interpretation of tensile stress-strain curves, Yielding under multi-axial stress. Yield criteria and macroscopic aspects of plastic deformation.	4
5	Diffusion: Diffusion mechanisms. Steady and non-steady state diffusion. Factors that influencediffusion.	2
6	Dislocations and Strengthening Mechanisms: Dislocation and plastic deformation. Mechanisms of strengthening in metals.Recovery, recrystallization and grain growth. Strengthening by second phaseparticles. Optimum distribution of particles. Lattice resistance to dislocation motion.	4
7	Phase Diagrams: Equilibrium phase diagrams. Particle strengthening by precipitation. Precipitationreactions. Kinetics of nucleation and growth. The iron-carbon system. Phasetransformations. Transformation rate effects and TTT diagrams. Microstructure.	3
8	Failure: Fracture. Ductile and brittle fracture. Fracture mechanics. Impact fracture. Ductilebrittle transition. Fatigue. Crack initiation and propagation. Crack propagation rate.Creep. Generalized creep behaviour. Stress and temperature effects	4
9	Processing of Metals and Alloys: Types of metals and	2

	alloys. Fabrication of metals. Thermal processing of metals. Heat treatment. Precipitation hardening.	
10	Processing of Ceramics: Types and applications of ceramics. Fabrication and processing of ceramics.	2
11	Corrosion and Degradation of Materials: Corrosion of metals. Corrosion of ceramics. Degradation of polymers	3
12	Light microscopy: Introduction, concept of resolution, Airy rings, numerical aperture, magnification, depth of field, depth of focus, lens defects and their corrections, principles of phase contrast – bright-field and dark-field contrast, polarized light microscopy, Quantitative microscopy, estimation of grain size, grain boundary area, relevance of light microscopy ideas to electron microscopy.	3
13	X-ray diffractometry: Introduction, crystal geometry, lattice directions and planes, zone axis, interplanar spacing and angle, Stereographic projection, Bragg's condition of diffraction, X-ray scattering, application of X-ray diffraction – phase identification, estimation of grain size, particle size, residual stress.	3
14	Transmission electron microscopy (TEM): Principle, construction and operation of TEM, Interaction of electrons with specimen, reciprocal space and lattice, diffraction from finite crystal, preparation of specimens, bright and dark field imaging, selected area diffraction, indexing of diffraction patterns	2
15	Scanning electron microscopy (SEM): Principle, construction and operation of SEM, study of fractured surfaces, energy and wavelength dispersive spectroscopy.	2
16	Thermal analysis techniques: Principles of differential scanning calorimetry (DSC), differential thermal analysis (DTA), Dilatometry, Thermogravimetric analysis (TGA).	2
	Total:	42

11. Suggested Books:

S. No.	Name of Authors /Books/ Publisher	Year of Publication/ Reprint
1	Chawla K.K., Composite Materials: Science and Engineering 3 rd Ed., Springer	2012
2	"Composites", ASM Handbook, Vol. 21, 10 th Ed., ASM.	2001
3	W. D. Callister, Fundamentals of Materials Science and Engineering, Wiley	2011
4	Peter Hassen Material Science and Technology, Volume 5, Phase Transformation in Materials	2009
5	James F. Shackelford, Introduction to Materials Science for Engineers, 7th Edition, Pearson Prentice Hall	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **CHN-303** Course Title: **Process Dynamics & Control**

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

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

4. Relative Weight: **CWS: 20 PRS: 20 MTE: 20 ETE: 40 PRE: 0**

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

8. Pre-requisite: **Sufficient knowledge on material and energy balance and transport process**

9. Objective: **To acquaint the students about the dynamics and control strategies chemical process systems.**

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: The concept of process dynamics and control, review of Laplace transform methods, Laplace transform of disturbances and building functions, dynamic model building of simple systems.	5
2.	Linear Open Loop System: Physical examples of first order systems and their response for step, impulse and sinusoidal inputs, linearization of non linear models, response of first order system in series, examples of second order systems and their response, estimation of system parameters.	8
3.	Linear Closed Loop System: The control system and its elements, closed loop transfer functions, transient response of simple control systems, concept of stability and use of Routh – Hurwitz test for stability.	8
4.	Controllers: Modes of control action, control system and its closed-loop transfer function.	3
5.	Root Locus Method : Root locus treatment, response from root locus and its application to control system design.	4
6.	Frequency Response: Introduction to frequency response, Bode diagrams of simple systems, Bode stability criterion, control system design by frequency response, use of gain and phase margins.	5
7.	Process Application : Controller tuning rules, control of complex chemical processes and equipment, control valve sizing, introduction to real time computer control of process equipment.	5
8.	Advanced Control Methods : Introduction to state-space method, feed forward and ratio control, inferential control, control using digital computers-an introduction.	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors / Books / Publishers	Year of Publication/ Reprint
1.	Coughanowr D.R. and LeBlanc S. "Process System Analysis and Control", 3 rd Ed., McGraw Hill.	2008
2.	Stephanopoulos G. "Chemical Process Control – An Introduction to Theory and Practice", Prentice-Hall of India.	1990
3.	Seborg D. E., Edgar T. F. and Mellichamp D. A., "Process Dynamics Control", 2 nd Ed., John Wiley.	2004
4.	Bequette B. W., "Process Control – Modeling, Design and Simulation", Prentice-Hall of India.	2003

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-301** Course Title: **Polymer Processing**

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

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

4. Relative Weightage: CWS:20 PRS:20 MTE:20 ETE:40 PRE:0

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

8. Pre-requisite: **PEN-204**

9. Objective : To impart knowledge of polymer processing technology and equipment.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Introduction: Introduction to polymer processing, quantitative aspects of polymer product processing additives and compounding – fillers, plasticizers, antioxidants, colorants, flame retardants, stabilizers compounding, mixing and compounding equipment.	6
2.	Extrusion: Constructional details of extruders, Plasticating Single-Screw Extruders, twin screw extruders, dies and take - off equipment, post extrusion processing, calendering, laminating, Wire-Coating Extrusion	9
3.	Fiber Spinning: Fiber Spinning Processes, Melt Spinning Process, Wet and dry Spinning Process, Other Fiber Spinning Processes, High-Speed Melt Spinning, Spinnability	4
4.	Blow molding technology: Process, principles, Machine descriptions, principles of operations, molding parameters; Optimization of processing parameters and troubleshooting; Common molding faults and their correction, Types product processing technology	4
5.	Compression molding: Hydraulic presses, press capacity and pressure calculations, molding process	2

6.	Transfer molding: Molding process, advantages, disadvantages, Resin transfer molding, Rubber transfer molding technology, type of product processing	2
7.	Injection molding: Working principles of injection molding machine, temperature control, injection systems, starting and shut down procedures, process variables reaction injection molding, Injection Molding of Amorphous Polymers: flow pattern and governing system equation, molecular orientation during mold filling; Injection Molding of Semicrystalline Polymers: crystallization during molding, governing system equation, morphology of injected molded semicrystalline polymers, Reaction Injection Molding	8
8.	Miscellaneous Processing Technologies: Principles and operations of rotational molding, thermoforming, and foam processing machines and processing of plastic products by these processes.	4
9.	Tooling & Molds Tool making processes, die and die forming, compression molds, transfer molds, blow and extrusion dies, typical exercises in mold design and production, two plate mold, three plate mold, hot runner mold, insulated runner mold, runners, gates, mold making, mold cooling.	3
Total		42

List of Practicals

1. Processing of polymer by mini mixer rheocord.
2. Handling, transportation, mixing and pumping in a single screw extruder.
3. Compounding a polymer in a single screw extruder.
4. Processing a polymer in a batch mixer.
5. Processing a polymer in an internal mixer.
6. Compounding a polymer in a twin screw extruder.
7. Processing a polymer in injection molding machine.
8. Processing a polymer in a continuous mixer.

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11. Suggested Books:

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Chan R., Hassen P. and Kramer E., "Processing of Polymers", Wiley-VCH	1996
2.	Griskey R., "Polymer Process Engineering", Chapman & Hall	1992
3.	Grulke E., "Introduction to Polymer Process Engineering", Printice Hall.	1993
4.	McCrum N.G., "Principles of Polymer Engineering", Oxford University Press	1988
5.	Osswald T., "Polymer Processing Fundamentals", Hanser-Gardner	1998
6.	Tadmor Z. and Gogos C.G., "Principles of Polymer Processing", Wiley.	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-303 Course Title: Process Equipment Design

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

3. Examination Duration (Hrs.): Theory:4 Practical :0

4. Relative Weightage: CWS:15 PRS:25 MTE:20 ETE:40 PRE:0

5. Credits: 3 6. Semester: Autumn 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To impart knowledge of properties of polymers, their testing and characterization

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Shell-Tube Heat Exchangers: Basic Design procedure for heat transfer equipment, overall heat transfer coefficient and fouling factors, shell and tube exchangers-construction details, selection algorithm, design codes, mean temperature difference, general design considerations, tube-side heat transfer co-efficient and pressure drop, shell-side heat transfer co-efficient and pressure drop, various design methods.	9
2.	Condensers: Design of condensers for single vapors, heat transfer co-efficient correlations for condensation inside and outside of tubes of the vertical and horizontal condensers, design of desuperheater-cum-condenser and condenser-cum-sub-cooler, condensation of mixtures, pressure pressure drop in condensers.	5
3	Reboilers: Vaporizers and Evaporators: Pool boiling, convective boiling, selection of reboilers and vaporizers, design of reboilers, vaporizers and evaporators, drawing of evaporators.	5
4.	Extruder: Fundamentals of Extruder design and design process parameters for single/twin and multi-screw extruder; Design of screw, barrel/shaft and die; Details of design parameters such as screw profiles and pressures, Impact of these parameters on product quality, residence time, melt temperature, torque and energy requirements; Design of different processing sections in extruder-feeding zone, compression zone, mixing, transport, cooking; Extrusion process Optimization; Screw design effects on residence time and its distribution, Screw speed effect on processing; Limitations and challenges in scale up from laboratory	9

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	scale to production scale; Equipments available for Extrusion and Compounding	
5.	Injection: Fundamentals of design and design process parameters for Injection and Compression molding, Design of two plate and three plate type molds, injection, venting, runner and gates, calculation of number of cavities, hot runner mould. Computer software used in designing of molds and mold flow analysis to understand trace stress analysis in molds; Injection molding defects and how to avoid them; Design factors such as wall thickness, gate locations and gate design;	7
6	Compression Molding Compression moulds-positive, semi-positive and flash mould with horizontal and vertical flash, arrangement of loading shoes, simple two plate and three-plate moulds, split moulds; Design of Compounding elements-conveying elements, mixing elements (30deg and 90deg offset elements), extrusion elements, distributive flow elements, self-cleaning elements. Different pitches –standard, feed zone and compressing zone.	7
Total		42

- **Note: This is an OPEN BOOK EXAMINATION. The students are allowed to consult IS Codes, Text Books, Reference Books and Bound Lecture notes certified by the examiner concerned.**

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication/ Reprint
1.	Towler G. and Sinnott R.K., "Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design", 2 nd Ed., Butterworth-Heinemann	2012
2.	Seader J. D. and Henley E. J., "Separation Process Principles", 2 nd Ed., Wiley-India	2006
3.	I.S.; 4503-1967, Indian Standard Specification for Shell and Tube Type Heat Exchangers.	1983
4.	Hewitt G.F., Shires G.L and Bott T.R., "Process Heat Transfer", Begell House	1994
5	Sidney, Lery, James F. Carly, "Plastic Extrusion Technology Handbook", 2 nd Edition, Industrial Press Inc., US	1989
6	David O. Kazmer, "Injection Molding Design Engineering", Hanser Gardner Publications.	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-302 Course Title: Modelling and Simulation of Polymers

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

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

4. Relative Weightage: CWS:15 PRS:25 MTE:20 ETE:40 PRE:0

5. Credits: 4 6. Semester: Spring 7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To provide knowledge of procedures of molecular modeling and simulations and their applications for polymers

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to Molecular Simulations: Concept of molecular simulations and their applications; Polymer Chain Conformations; The Gaussian Chain, Chain Conformation under an External Field; Excluded Volume Effect and Theta Condition	3
2	Theory of polymeric behavior : Bead-spring model for a polymer; Rouse theory; Hydrodynamic interactions and the Zimm model; Concentrated polymer solutions and melts; Polymer Entanglement and Tube/Reptation theory.	5
3	Molecular Simulation Techniques – RIS-Monte Carlo (RIS-MC); Rotational Metropolis-Monte Carlo (RMMC); Molecular Dynamics (MD); On Lattice and Off-Lattice Monte Carlo Simulations; Monte Carlo Simulations in Various Ensembles; Molecular Dynamics in various Ensembles.	8
4	Mesoscale Modeling: General Concept of Coarse-graining and procedure with examples and advantages; Dissipative Particle Dynamics and other Coarse-grained techniques used.	5
5	Estimation of Dynamic properties through molecular simulations– Concepts of primitive path and Tube Model; Simulation protocols for determination of dynamic properties such as Entanglement Length, Tube Diameter, Contour Length, etc.; Models for Chain Entanglement; Primitive Path Analysis through contour Length/energy	7

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	minimization procedures.	
6	Modeling and Simulations for understanding Elasticity and Photoelasticity (birefringence-strain) relationships of Polymer networks: Relationships between stress-strain and birefringence-strain with examples from PET Film networks, SBS/SIS thermoplastic elastomeric networks and Poly-isoprene elastomeric networks.	8
7	Scope and applications of available molecular simulation software packages- Employing software packages such as DLPOLY, LAMMPS, Material studio, Z-code, to solve polymer design problems, examples - Entanglement length variation with chain length, Determining characteristic static ($\langle R^2 \rangle / M$, etc) and dynamic properties (tube diameter (a_{pp}), entanglement/contour length, etc) of some commodity polymers such as PE, PET.	6
	Total	42

List of practicals:

- Estimation of Tg of polymer through molecular simulations
- Estimation of stress strain properties through molecular simulations
- Estimation of contact angle of liquid drop on polymer surface
- Determination of static properties of polymers ($\langle R^2 \rangle$, $\langle R_g^2 \rangle$) or by RIS-MC codes
- Determination of tube diameter and entanglement length
- Estimation of shear strength of an adhesive and composite
- Estimation of chain properties in melt using molecular dynamics software
- Determination of static properties of polymers ($\langle R^2 \rangle$, $\langle R_g^2 \rangle$) or by RMMC software

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1	"Understanding Molecular Simulation: From Algorithms to Applications", Daan Frenkel and Berend Smit, Academic Press: San Diego.	1996
2	"Principles of Polymer Chemistry", P. J. Flory, Cornell University Press, Ithaca, NY.	1953
3.	"Statistical Mechanics of Chain Molecules", P. J. Flory, Interscience, New York,	1989
4.	"Conformational Theory of Large Molecules: The Rotational Isomeric State Model in Macromolecular Systems", W. L. Mattice, and U. W. Suter, Interscience, New York.	1994
5.	"The Theory of Polymer Dynamics", M. Doi & S.F. Edwards., Oxford Science Publications, Clarendon Press, Oxford	1986
6	"The Physics of Rubber Elasticity", L. R. G. Treloar, Clarendon Press, Oxford, 3/e, 1975.	1975

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: PEN-304 Course Title: Polymer Composites
2. Contact Hours: L: 2 T: 0 P: 2
3. Examination Duration (Hrs.): Theory:2 Practical :0
4. Relative Weightage: CWS:15 PRS:25 MTE:20 ETE:40 PRE:0
5. Credits: 3 6. Semester: Spring 7. Subject Area: PCC
8. Pre-requisite: Nil
9. Objective: To impart knowledge of structure, properties and applications of polymeric composites.
10. Details of the Course:

S. No.	Contents	Contact Hours
1	Introduction: Need to reinforce polymers, particulate, short and continuous fiber reinforced composites based on thermoplastic and thermoset matrices.	2
2.	Particulate Filled Polymeric Composites: Mineral, natural, organic metallic particulate reinforcements; processing of particulate polymeric composites; particulate/polymer adhesion and its effects on structure and morphology of particulate polymeric composites; mechanics and mechanical properties, and thermal properties of particulate polymeric composites; applications of particulate polymeric composites	6
3	Short Fiber Reinforced Polymeric Composites: Synthetic, inorganic, and natural short reinforcing fibers, extrusion, compounding, processing, and injection moulding of short fiber/polymer composite products; structure and properties of short fiber/polymer composites; semi-empirical equations and mechanics of short fiber/polymer composites; mechanical and thermal properties of short fiber/polymer composites; applications of short fiber/polymer composites in automobiles, building materials, and other engineering sectors.	7
4.	Continuous Fiber Reinforced Thermoset Composites: Epoxy, polyesters and vinyl esters as matrix polymers, and glass, aramid and carbon fibres as reinforcing fibers for continuous fibre / polymer composites; processing by wet pay up; contact molding and pressure bag molding, resin transfer molding and compression molding; properties, applications in aerospace, automobiles and engineering sectors	9
5	Other Composites: Introduction to continuous fibre / thermoplastic composites; matrix resins and fibres for continuous fibre /	4

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thermoplastic composites; processing limitations for continuous fibre / thermoplastic composites; introduction to polymeric nano composites	
Total	28

List of Practical

1. Extrusion & Compounding of a short-fiber / thermoplastic polymer composite by Mini Mixer / Extruder
2. Injection Moulding of Extruded short-fiber / thermoplastic polymer composite
3. Study of effect of fibre content on tensile properties of short-fiber / thermoplastic polymer composite.
4. Study of effect of fibre content on flexural properties of short-fiber / thermoplastic polymer composite.
5. Study of effect of fibre content on thermal properties of short-fiber / thermoplastic polymer composite.
6. Processing of Continuous Fibre / Thermoset Polymer Composite by Compression Moulding
7. Effect of Fibre Content on Mechanical properties of Continuous Fibre / Thermoset Polymer Composite

12. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Agarwal L. and Bourttman D.J., "Analysis and Performance of Fiber Composites", Wiley.	2000
2.	Chung C., "Introduction to Composites", Technomic, Lancaster, PA.	1998
3.	White J. and De S., "Short Fiber Composites", Technomic, Lancaster.	1996
4.	Summerscales J. and Short D., "Fiber Reinforced Polymers", Technomic.	1988

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE

Department of Chemical Engineering

1. Subject Code: CHN-310

Course Title: Process Utilities, Economics and Plant Design

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: 4

6. Semester: Spring

7. Subject Area: PCC

8. Pre-requisite: Nil

9. Objective: To provide knowledge of various process utilities and to equip the students with plant economics and design aspects.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Heat Transfer Media: Utilities in process industries, primary and secondary and their importance; Classification, characteristic properties, selection criteria of heat transfer media and their industrial applications.	8
2.	Steam Generation and Utilization: Steam generation, supercritical boilers, steam handling, steam traps-classification, characteristics and selection, condensate utilization and flashing.	3
3.	Water and Air: Raw water and its characteristics, treatment and conditioning of water for use in process industries, recycling and reuse of water; Use of air in process industries for drying and instrumentation and design of air receivers.	7
4.	Piping Network: Design of pipelines and piping networks for water, steam, condensate and air.	3
5.	Time Value of Money: Interest; Compounding and discounting factors; Loan Payments; Cash flow pattern: Discrete and continuous.	3
6.	Depreciation Methods and Profitability: Methods of depreciation; Profitability methods with and without time value of money; Effect of inflation on profitability analysis; Evaluation for replacements.	6
7.	Analysis of Cost Estimates: Corporate cash flow, equipment cost curves and indices, types of capital cost estimates, methods for estimating capital investment, estimation of revenue and total product cost, gross profit and net profit.	5
8.	Plant Location and Layout: Factors for selection of plant location, site selection and preparation, plant layout and installation.	2
9.	Scale-Up: Pilot plants and models, principle of similarity,	5

	dimensional analysis, differential equations; Regime concept: static and dynamic; Similarity criteria and Scale-equations for important equipment.	
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Goodall P. M., "The Efficient Use of Steam", Editor: Westbury House.	1980
2.	Lorch, "Handbook of Water Purification", Editor: McGraw Hill Book Company.	1981
3.	Peters M. S., Timmerhaus K. D. and West R. E., "Plant Design And Economics For Chemical Engineers", 5 th Ed., McGraw Hill, International Ed..	2002
4.	Couper J., "Process Engineering Economics", CRC Publisher.	2003

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: **CHN-322** Course Title: **Optimization of Chemical Engineering Processes**

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: **PEC**

8. Pre-requisite: Nil

9. Objective: To provide basic knowledge of optimization methods used in Chemical Engineering.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Optimization and calculus based classical optimization techniques.	5
2.	One Dimensional Minimization Methods: Elimination methods- equally spaced points method, Fibonacci method and golden section method; Interpolation methods- quadratic interpolation and cubic interpolation, Newton and quasi-Newton methods.	6
3.	Linear Programming: Graphical representation, simplex and revised simplex methods, duality and transportation problems.	7
4.	Multivariable Non-Linear Programming: Unconstrained- univariate method, Powell's method, simplex method, rotating coordinate method, steepest descent method, Fletcher Reeves method, Newton's methods Marquardt's method and variable metric (DFP and BFGS) methods; Constrained- complex method, feasible directions method, GRG method, penalty function methods and augmented Lagrange multiplier method.	9
5.	Dynamic Programming: Multistage processes- acyclic and cyclic, sub-optimization, principle of optimality and applications.	4

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6.	Geometric Programming (GP): Differential calculus and Arithmetic- Geometric inequality approach to unconstrained GP; Constrained GP minimization; GP with mixed inequality constraints and Complementary GP.	6
7.	Emerging Optimization Techniques: Genetic algorithm, simulated annealing, particle swarm and ant colony optimization.	5
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Rao S. S., "Engineering optimization: Theory and Practice", 4 th Ed., Wiley	2009
2.	Edgar T. F., Himmelblau D. M. and Lasdon L. S., "Optimization of Chemical Processes", 2nd Ed., McGraw Hill.	2001
3.	Ravindran A., Ragsdell K. M. and Reklaitis G. V., "Methods and Application" 2 nd Ed., Wiley	2006
4.	Venkataraman P., "Applied Optimization with MATLAB Programming", 2 nd Ed., Wiley	2009
5.	Beveridge G.S.G. and Schechter R.S., "Optimization: Theory and Practice", McGraw Hill	1970

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemical Engineering

1. Subject Code: CHN-323 Course Title: Computer Applications in Chemical Engineering

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

3. Examination Duration (Hrs.): Theory Practical

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

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

8. Pre-requisite: Nil

9. Objective: To provide knowledge of advanced numerical methods and their applications to chemical engineering problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Review of solution methods of non linear single variable equations, polynomials (determination of quadratic factors), linear set of simultaneous equations, ill conditioned matrix, and set of nonlinear equations using Newton's and globally convergent methods	8
2.	Solution of homogeneous set of linear equations using eigen values and eigen vectors with application to chemical engineering problems.	3
3.	Review of numerical differentiation and numerical integration methods, quadratures and their applications to numerical integration.	4
4.	Review of single step and multiple step methods to solve initial value ordinary differential equations problems, estimation of error and its propogation in single step and multiple step methods, step size selection and adaptable step size Runge-Kutta methods, stiff ODE's and Gear's class of methods.	8
5.	Boundary value problems (BVP) - shooting methods for linear system, finite difference methods, regular perturbation method, method of weighted residuals and orthogonal collection methods to solve first and higher order BVP in ODE's application to chemical engineering systems, concept of finite element.	10
6.	Review of finite difference techniques to solve partial difference equations (PDE's), similarity transformation, method of weighted residuals, orthogonal collocation to solve PDEs with their application to chemical engineering systems.	9
Total		42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Finlayson B. A., "Introduction to Chemical Engineering Computing", 7 th Ed., Wiley Interscience publication.	2006
2.	Gerald C. F. and Wheatly P. O., "Applied Numerical Analysis", 7 th Ed., Addison Wesley.	2003
3.	Rice R.G. and Do D. D., "Applied Mathematics for Chemical Engineers", Wiley.	1995
4.	Beers K. J., "Numerical Methods for Chemical Engineering: Applications in Matlab", Cambridge University Press.	2006
5.	Constantinides A. and Mostoufi N., "Numerical Methods for Chemical Engineers with MATLAB Applications", Prentice Hall.	1999
6.	Cutlip M. B. and Shacham M., "Problem Solving in Chemical and Biochemical Engineering with POLYMATH, EXCELL and MATLAB", 2 nd Ed., Prentice Hall.	2008

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CHN-324 Course Title: **Computational Fluid Dynamics**

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: **Spring** 7. Subject Area: **PEC**

8. Pre-requisite: Nil

9. Objectives: To provide an understanding of physical models to study hydrodynamics in engineering systems.

10. Details of Course:

S.No	Contents	Contact Hours
1.	Basic Concepts of Fluid Flow: Philosophy of computational fluid dynamics (CFD), review of equations governing fluid flow and heat transfer, simplified flow models such as incompressible, inviscid, potential and creeping flow, flow classification.	5
2.	Grid Generation: Structured and unstructured grids, choice of suitable grid, grid transformation of equations, some modern developments in grid generation in solving the engineering problems.	3
3.	Finite Difference Method (FDM): Discretization of ODE and PDE, approximation for first, second and mixed derivatives, implementation of boundary conditions, discretization errors, applications to the engineering problems.	15
4.	Finite Volume Method: Discretization methods, approximations of surface integrals and volume integrals, interpolation and differential practices, implementation of boundary conditions, application to the engineering problems.	9
5.	Case studies: Case studies using FDM and FVM: Flow and heat transfer in pipes and channels, square cavity flows, reacting flow, reactive flow, multiphase flow, Heat Transfer in Rotary Kiln Reactors, Fluid mixing, etc. Essence of Finite element method (FEM).	10
Total		42

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11.Suggested Books:

S.No.	Authors / Name of Books / Publisher	Year of Publication
1.	Fletcher C.A.J. "Computational Techniques for Fluid Dynamics, Vol. 1: Fundamental and General Techniques", Springer-Verlag.	1998
2.	Fletcher C.A.J. "Computational Techniques for Fluid Dynamics, Vol. 2: Specific Techniques for Different Flow Categories", Springer-Verlag.	1998
3.	Anderson. J.D., "Computational Fluid Dynamics", McGraw Hill.	1995
4.	Ghoshdastidar P.S., "Computer Simulation of Flow and Heat Transfer", Tata McGraw Hill.	1998
5.	Patankar S.V., "Numerical Heat Transfer and Fluid Flow", Taylor and Francis.	2004

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE:

Department of Chemical Engineering

1. Subject Code: CHN-325

Course Title: Process Integration

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:

6. Semester: Spring

7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To introduce the concept of pinch technology in integration of unit operations in process industries.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Process Integration and its Building Blocks: Definition of Process Integration (PI), School of thoughts, Areas of application and Techniques available for PI, Onion diagram.	6
2.	Pinch Technology – An Overview: Introduction, Basic concept, How it is different than energy auditing, Role of thermodynamic laws, Problem addressed by Pinch technology.	7
3.	Key Steps of Pinch Technology: Data extraction, Targeting, Designing, Optimization-Supertargeting.	5
4.	Basic Elements of Pinch Technology: Grid diagram, Composite curve, Problem table algorithm, Grand composite curve.	5
5.	Targeting of Heat Exchanger Network (HEN): Energy targeting, Area targeting, Number of units targeting, Shell targeting, cost targeting.	5
6.	Designing of HEN: Pinch design methods, Heuristic rules, Stream splitting, Design of maximum energy recovery (MER), Design of multiple utilities and pinches, Design for threshold problem, Loops and Paths.	6
7.	Heat Integration of Equipments: Heat engine, Heat pump, Distillation column, Reactor, Evaporator, Drier, Refrigeration systems.	4
8.	Heat and Power Integration: Co-generation, Steam turbine, Gas turbine.	3
	Total	42



11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Kemp I. C., "Pinch Analysis and Process Integration: A user Guide on Process Integration for the Efficient Use of Energy", 2 nd Ed., Butterworth-Heinemann.	2007
2.	Smith R., "Chemical Process Design and Integration", 2 nd Ed., Wiley.	2005
3.	Shenoy U. V., "Heat Exchanger Network Synthesis", Gulf Publishing Company.	1995
4.	El Halwagi M. M., "Process Integration", 7 th Ed., Academic Press.	2006

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT: Department of Polymer and Process Engineering

1. Subject Code: PEN-325 Course Title: Transport Phenomena in polymeric Solutions

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

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: PEC

8. Pre-requisite: Nil

9. Objective: To provide knowledge of Cell balances in steady/unsteady state transport processes involving momentum, energy, mass.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Review of mathematics of vectors and tensors; Use of various co-ordinate systems; Kronicker delta; Integral theorem; Differential operators; Invariants; Ordinary/partial differential equations and common solution techniques.	04
2.	Fluid Mechanics (Isothermal Systems): Shell balances and velocity distributions in laminar flow through tube, annular space and tube-flow of adjacent immiscible liquids; Interfacial boundary conditions; Flow through a slit.	04
3.	Equation of Change for Isothermal Systems: Equation of continuity; Equation of motion; Equation of mechanical energy; Equation of angular momentum; Vorticity; Stress and rate of strain tensor; Newtonian case (Navier Stokes and Euler equations); Example of flow problems: creeping flow, Hagen-Poiseuille flow and Couette flow; Cone and plate viscometer and parallel plate torsion; Viscoelastic fluids.	06
4.	Polymeric Liquids: Analysis of behaviour of polymeric liquids; Rheometry; Non-Newtonian viscosity and the generalized Newtonian models; Elasticity and linear viscoelastic models such as Maxwell, Kelvin, Jeffreys and Burger model and their combinations; Corotational derivatives and non-linear viscoelastic models; Molecular theories of polymeric liquids.	04

5.	Energy Transport and Heat Transfer: Energy generalized balance and heat equation; Conductivity, heat capacities, temperature and pressure dependence of conductivity; Theory of thermal conductivities.	06
6.	Equations of Change for Non-isothermal Systems: Special forms of heat equation (for internal energy and for temperature); Boussinesq equation for forced and free convection; Use of equations of change to solve steady state problems involving polymeric fluid fluxes; Boundary layer theory for non-isothermal flow; Laminar flow heating-Von Karman momentum and energy balances.	06
7.	Mass Transport: Mass transfer/molecular transport by convection; Molar fluxes; Fick's law; Maxwell-Stephan's law; Diffusion in binary liquids and gases at low density; Permeability, solubility, diffusivity of gas and solute through polymers; Shell balance and boundary conditions.	06
8.	Equation of Change: Equation of continuity for multicomponent systems; Dimensional analysis of equations of change for non-reacting binary mixtures, species continuity, constant mass density, constant molar density; Sorption of gases and vapors in polymers: rubbery polymers, glassy polymers, semi-crystalline polymers.	06
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Bird R.B., Stewart W.E. and Lightfoot E. N., "Transport Phenomena", McGrawhill Second Ed.	2002
2.	Mashelkar R.A., Majumdar A.S., Kamal M.R., "Transport Phenomena in Polymer Solution", Ellis Horwood Publisher	1989
3.	Deen W.M., "Analysis of Transport Phenomena", Oxford University Press. ISBN 978-0-19-508494-8.	1998
4.	Whitaker S., "Fundamental Principles of Heat Transfer", New York, Pergamon Press	1997

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-401**

Course Title: **Bio- Polymers Engineering**

2. Contact Hours: **L: 3**

T: 1

P: 0

3. Examination Duration (Hrs.):

Theory: 3

Practical :0

4. Relative Weightage: **CWS:25**

PRS: 0

MTE:25

ETE:50

PRE: 0

5. Credits: **4**

6. Semester: **Both**

7. Subject Area: **PEC**

8. Pre-requisite: **Nil**

9. Objective: To impart knowledge about biopolymers and their applications, engineering and processing.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Definition, examples, applications and classification of biopolymers based on different sources; General characteristics of biopolymers; Advantages and disadvantages of biopolymers.	5
2.	Synthesis and Characterization of Bio-polymers: Structure and properties of proteins, polysaccharides, DNA, RNA, glycoproteins, proteoglycans, glycosaminoglycans.	8
3.	Biodegradation of Biopolymers: Mechanism of biodegradation; Biodegradation kinetics.	4
4.	Engineering of Biopolymers: Principles of engineering the properties of biopolymer molecules; Chemical modification; Biopolymer based composites and blends.	8
5.	Biopolymer Processing: Process technology for the production of biopolymeric nanoparticles, nanofibers, nanofilms, microfilms, 3D architecture of any shape.	8
6.	Application of Biopolymers: Application of biopolymers in tissue engineering, medical surgery, drug delivery, wound healing, packaging, automobile industry, electronics industry, household items etc.	9
	TOTAL	42

11. Suggested Books:

S. No.	Name of Books / Authors /Publisher	Year of Publication / Reprint
1.	Dumitriu S., "Polymeric Biomaterials", Marcel Dekker.	2002
2.	Hyon S. H., "Polymeric Biomaterials", Plenum Press.	1984
3.	Mark H. F., (Ed.) "Encyclopaedia of Polymer Science and Engineering", John Wiley & Sons.	1989
4.	Shuiz S. and Bhirmer K., "Principles of Protein Structure", Academic Press.	2003
5.	Guilak F., Butler D.L., Goldstein S.A. and S.A. Mooney, "Functional Tissue Engineering", Springer-Verlag New York, 1 st Edition.	2003
6.	Migonney V., "Biomaterials", Wiley-ISTE, 1 st Edition.	2014

Ph

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-402 Course Title: High Performance and Special Polymers

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

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

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

5. Credits: 4

6. Semester: Spring

7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To impart knowledge of structure, properties, processing and manufacturing of the polymeric materials at high end applications.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Engineering Polymers: Polymerization and Industrial processing, Unit operations, Catalysts, Flow Chart of Industrial Production and Structure, Properties, Applications of following Commodity/Engineering plastics – Polyolefins, Vinyl Polymers and Styrene Polymers like Polyethylene, Polypropylene, Polyisobutylene, Poly(1-Butylene), Poly (vinyl chloride), Polystyrene, Styrene co-polymers, ABS, SAN, Polyacrylics, and others.	8
2	Macromolecular Structure of High Performance Polymers: Semi rigid, quasi-rigid and rigid rod macromolecules; Macromolecular chain rigidity and rotational hindrance; Effect of chain rigidity on thermal and mechanical properties of high performance polymers.	5
3	High Performance Thermoplastics: Structure, properties, and engineering and high-tech applications of following high performance polymers: polyamides, polyesters, polycarbonate, polyethers, poly-ether-ether-ketone, polyphenylenesulphide, polysulphones, polyphenylene-oxides	6
4	Thermally Stable Polymers: Structure, properties, and engineering and high-tech applications of following high performance polymers: polyesterimides, polyetherimides, polybismelimides, poly-amide-imide, pyromellitic di anhydride oxy dianiline.	6
5	Thermotropic Liquid Crystalline Polymers: Thermotropic liquid crystalline polymers; Structure and parameters imparting thermotropic nature; Main chain and side chain thermotropic polymers; Fibers from thermotropic polymers; Structure-property co-relations; Advanced, engineering and high tech applications.	6
6	Lyotropic Liquid Crystalline Polymers: Structural parameters imparting lyotropic liquid crystalline nature; Aramid and other lyotropic polymers; Fibers from lyotropic polymers; Dry-jet wet-	6

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	spin processing; Structure-property co-relations; Advanced, engineering and high tech applications.	
7	High Performance Polymers for Engineering Applications: High performance polymers for following applications: automobile, aerospace, transportation and other engineering and high tech applications.	5
		Total 42

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Brydson J. A., "Plastic Materials", Newnes Butterworth	1989
2.	Campbell I.M., "Introduction to Synthetic Polymers", Oxford University Press	2000
3.	Erhstein G., "Polymeric Materials", HanserGardner.	2001
4.	Baer E., Moet A. "High performance polymers", Hansen Publisher.	1991
5.	Fin J.K., "High performance polymers", Elsevier, 2nd Edition.	2014

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

- NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering
1. Subject Code: PEN-403 Course Title: Electronic and Conducting Polymers
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: PEC
8. Pre-requisite: Nil
9. Objective: The course will impart knowledge of electronic and conducting polymers
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Conducting polymers, structurally different conducting polymers and their general applications	2
2.	Conducting Polymers : Structure, mechanism of Conduction, preparation of conducting polymers e.g. polyacetylene, polydiacetylene, polyphenylene, polypyrrole, polythiophene, polyaniline, poly(phenylenesulphide) and poly (1,6-heptadiyne); Properties and applications	9
3.	Photoconducting Polymers: Molecularly designed synthesis and characterization of light sensitive and photo conducting polymers and their application. Photoresist Polymers: Positive and negative polymer resists for lithographic process, semiconductor fabrication by LB films and spin coatings techniques	8
4.	Polymers for Optoelectronics : Synthesis of <i>Guest-Host</i> type and side chain liquid crystalline polymers and NLO chromophore-functionalized polymers, LASER light sensitive polymers exhibiting second harmonic and third harmonic generation ; Poling of <i>Guest Host</i> polymers; Genral optical characterization and their application	8
5.	Piezoelectric, Pyroelectric and Ferroelectric Polymers: Synthesis, characterization and typical application of these	6

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	polymers	
6.	Applications: Polymers in telecommunications, microelectronics, insulations, submarine cable insulation, polymers in optical fiber cables	9
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books /Publishers	Year of Publication
1.	Goosey M.T., "Plastic for Electronics", Elsevier, Applied Science Publishers	1985
2.	Licari J.J., "Hand book for Polymer Coatings for Electronics Chemistry, Technology and Applications", Noyes Publications	1985
3.	Mark H.F., "Encyclopedia of Polymer Science and Engineering," John Wiley and Sons	1989
4.	Nalwa H.S., Miyata S., "Nonlinear Optics of Organic Molecules and Polymers, CRC Press, Inc.	1997
5.	Skotheim T.A., Reynolds J.R. "Conjugated Polymers; Processing and Applications", CRC Press	2006

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN- 404**

Course Title: **Polymeric Film Technology**

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: **PEC**

8. Pre-requisite: **Nil**

9. Objective: The course will impart knowledge of polymeric films and packaging materials and their processing.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Polymers for Films and Sheets: Structure, properties and morphology of film and sheet forming polymers.	4
2.	Blown Film: Principle, technology and operation of equipment for processing of blown film, structure and properties of blown films.	8
3.	Melt Processed Film: Materials, processes, equipment and machinery for melt processing of film, effect of processing parameters on structure and properties of melt processed film applications.	8
4.	Multi Layered Films: Materials and equipment for multi layered films, structure, properties and applications of films multi layered films; Tetra-packs.	8
5.	Packaging Materials: Types of packaging, film, sheet, and boxes, laminated packaging, packaging for electronic goods, commodity materials, medicines and food products.	6
6	Processing: Equipment and machinery for processing of packaging materials, principle, technology and operation of equipment, economics of packaging; Die design for film making.	6
	Total	42

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11. Suggested Books

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Bryston J. H., "Plastic Films", Longman.	2003
2.	Osswald J., "Polymer Processing Fundamentals", Hanser Gardner.	2004
3.	Brooks D. and Giles G., (Eds), "PET Packaging Technology", Sheffield Academic Press.	2002
4.	Lagarón J., "Multifunctional and Nanoreinforced Polymers for Food Packaging", Woodhead Publishing.	211
5.	Hashim A.A., "Polymer Thin Films", InTech.	2010

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: **PEN-405** Course Title: **Polymeric Membrane Technology**

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

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

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

5. Credits: 4 6. Semester: Autumn 7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To provide knowledge about polymeric membranes and its application in separation processes.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Separation concepts: diffusion across a membrane, terminologies in membrane separation processes, driving forces, type of membranes.	2
2.	Transport Mechanism through Membrane: Concentration and process gradients, solution-diffusion model, concentration polarization, gel layer concentration.	4
3.	Membrane Materials: Polyethylene, polytetrafluoroethylene, polypropylene, cellulose acetate, cellulose nitrite, polyacrylonitrile, polyimide, polyamide, polysulfone, polyethersulfone, blockcopolymeric materials; Bi-polar membrane materials; Inorganic membranes.	6
4.	Polymeric Membrane Preparation, Testing and Applications: Sintering, stretching, track-etching, template leaching, phase inversion techniques (diffusion-induced phase separation & thermally-induced phase separation), phase inversion membrane and interfacial polymerization; Membrane testing and morphology; Applications: Haemodialysis, beverage, food industry, water treatment and fuel cell.	6
5.	Microfiltration and Ultrafiltration: Membrane properties, concentration polarization and fouling, fouling during protein separation, crossflow and dead-end microfiltration/ultrafiltration, micellar enhanced ultrafiltration, selected application and economics.	5
6.	Nanofiltration and Reverse Osmosis: Membrane properties, osmotic pressure model, membrane fouling, design consideration, pretreatment, applications in desalination and wastewater treatment, economic	6

	consideration.	
7.	Pervaporation: Membrane properties, process diagram, mechanism, selectivity and flux, model consideration, application (alcohol concentration, VOC and other pollutant separation).	4
8.	Membrane Reactor: Membrane separation with chemical reaction; Membrane bioreactor, catalytic membranes, equilibrium limited reaction, membrane reactor for hazardous pollutant degradation, functionalized membrane.	5
9.	Membrane Application for Water/Wastewater Treatment and System Design: Hydride processes and novel application, selected environmental applications involving for water reuse and material recovery, membrane flux, fouling and separation optimization.	4
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Mulder M., "Basic Principles of Membrane Technology", Kluwer Academic Publisher.	1996
2.	Baker R.W., "Membrane Technology & Application", McGraw Hill.	2000
3.	Zeman L. J. and Zydney A. L., "Microfiltration and Ultrafiltration: Principle & Application", Marcel Dekker Inc.	1996
4.	Nath K., "Membrane Separation Processes", Prentice Hall of India.	2008
5.	Scott K., "Handbook of Industrial Membrane", Elsevier.	1995
6.	Schaefer A., "Nanofiltration, Principle & Application", Elsevier.	2004
7.	Drioli E. Criscuoli A. and Curcio, E., "Membrane Contactors: Fundamentals, Applications and Potentialities", Elsevier.	2005

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-406 Course Title: Advanced Polymer Composites

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: PEC

8. Pre-requisite: Nil

9. Objective: The course will impart knowledge of advanced composites

10. Details of Course:

S. No.	Contents	Contact Hours
1	Introduction: Concept of reinforcement in polymeric composites, introduction and overview of particulate, short and continuous fiber reinforced composites, and nano particle and nanofibre composites; aspect ratio and reinforcing efficiency of reinforcement	2
2.	Advanced Particulate Polymeric Composites: Principles of selecting a particle as reinforcement, incorporation, packing and geometry of reinforcement particles; Wollastonite, feldspar and nepheline syenite, red mud, beryllium oxide, zinc oxide, titanium oxide as particulate reinforcements; Extrusion and compounding of particulate composite by single and twin screw extruder; and processing by injection molding; semi-empirical equations for Young's modulus of particulate composites.	8
3.	Advanced Short Fiber Reinforced Polymeric Composites: Glass, aramid, and natural fibers as reinforcement; principles of selection and efficiency of short fiber as reinforcement; orientation of short fibers in a composite; isotropy and anisotropy of composites; short fiber / thermoset composites; natural fiber / polymer composites, their fiber/matrix interface and methods for improvement of fibre/matrix interfacial adhesion in them	8

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4.	Advanced Continuous Fiber Reinforced Thermoset Polymeric Composites: Phenolic and polyimide as thermosetting matrix resins; silica, high silica and boron as reinforcing continuous fibers; fiber orientation in composites; unidirectional, quasi-isotropic and isotropic composites; fiber-matrix interphase and interfacial adhesion; interface improvement and use of interfacial agents, fiber surface treatment, matrix modification, and compatibilizers for improvement; Composite fabrication techniques, processes and equipment; pultrusion and other advanced processing techniques; Statistical mechanics and semi empirical equations for tensile modulus; advanced applications.	8
5.	Continuous Fiber Reinforced Thermoplastic Polymeric Composites: Polyether-ether-ketone, polyetherimide, polyethersulfone, and other high performance thermoplastics as matrix resins, fiber/matrix adhesion, interphase, and interface improvement; fabrication techniques; equipment, processes and processing of long and continuous thermoplastic composites; limitations of processing techniques; Applications.	7
6.	Nano Composites: Fillers: Plate, equi-axed, inorganic fillers, carbon and other nano tubes. Matrices: Engineering, high tech and liquid crystal polymer matrices. Processing: Direct and solution mixing, in-situ polymerization.	7
7.	Applications: Fire resistant, high temperature, automobile, and aerospace applications.	2
Total		42

11. Suggested Books

S. No.	Name of Books / Authors / Publisher	Year of Publication
1.	Ajayan P. M., Schadler L. S., Braun P. V., "Nanocomposite Science & Technology", Wiley-VCH.	2003
2.	De S. and White J., "Short Fiber Composites", Technomic.	2006
3.	Summerscales J. and Short D., "Fiber Reinforced Polymers", Technomic.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-407 Course Title: Advanced Extrusion and Compounding

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: PEC

8. Pre-requisite: Nil

9. Objective: To provide advanced knowledge of polymer extrusion and compounding

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Products manufactured using extruders; Fundamental principles; Different types of extruders; Extruder hardware, instrumentation and control.	03
2.	Types of Extruders: Single screw extruder: Basic operations, vented extruders, rubber extruders; Multi-screw extruders: Twin screw, multi-screw with more than two screws, gear pump extruder; Disk extruders; Ram extruders.	04
3.	Extruder Hardware and Instrumentation: Extruder drive; Thrust bearing assembly; Barrel and feed throat; Feed hopper; Extruder screw; Die assembly; Screens and screen changers; Heating and cooling systems: Electric heating, fluid heating, extruder cooling, screw heating and cooling; Instrumentation requirements; Pressure measurements; Temperature measurements; Rotational speed; Temperature controls.	08
4.	Twin Screw Extruders: Twin versus single screw extruders; Intermeshing co-rotating extruders; Intermeshing counter-rotating screw extruders; Coaxial twin screw extruders; Devolatilization in twin screw extruders; Commercial twin screw extruders.	06
5.	Extruder Screw and Die Design: Mechanical considerations; Optimization of output; Optimizing for power consumption; Single flighted extruder screws, devolatilizing extruder screws; Multi-Flighted extruder screws, Mixing screws, Rebuilding worn screws and barrels; Die Design: Basic consideration; Film and sheet dies; Blown	08

	film dies; Profile extrusion dies; Coextrusion; Calibrators.	
6.	Polymer Properties and Design considerations: Bulk polymer properties: Bulk density, coefficient of friction and particle size and shape; Thermal and melt flow properties: Thermal conductivity, specific volume and morphology, specific heat and heat of fusion, specific enthalpy, thermal diffusivity, melting point, induction time, viscoelastic behavior. Design considerations for extruding: Olefins, PVC, PS, engineering thermoplastics, blending and additive, compounding.	08
7.	Troubleshooting: Requirements for efficient troubleshooting; Data and tools for troubleshooting; Systematic troubleshooting: Upset versus development problems, machine related problems, polymer degradation, extrusion instabilities, air entrapment, gel problems and die flow problems.	05
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Chris R., "Polymer Extrusion", Hanser Publications, 5th Edition, Hanser.	2014
2.	Tadmor Z. and Gogos C.G., "Principles of Polymer Processing", Wiley.	2000
3.	Lafleur P.G., Verfnes. B., "Polymer Extrusion", Wiley.	2014
4.	Hensen F., Berghaus. U., "Plastic Extrusion Technology", Hanser Publications, 2 nd Edition.	2000

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-408** Course Title: **Paint and Coating Engineering**

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: Nil

9. Objective: To impart knowledge about paint, paint formulation and manufacture, surface coating methods and its applications.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Definition and properties; Importance of paints; Classification of paints.	2
2.	Basic Paint Ingredients: Binders: classification and properties; Synthetic and natural binders: synthetic and natural resins, acrylics, vinyl acrylics, polyurethane, polyester, melamine resins, epoxy, oils; Solvent: types and properties; Fillers; Paints additives.	5
3.	Formulation and Manufacturing of Paints: Principles of paint formulation; Phenomenon of wetting, grinding and dispersion; Steps in paint manufacturing; Equipment for paint manufacturing: Ball mills, peddle mills, high speed disk disperser, double blade mixture; Problems in paint manufacturing and their solutions; Paint preservation methodology.	7
4.	Paint Applications, Drying, Curing, and Defects: Pretreatment and surface preparation; Application methods; Common defects and its prevention.	5
5.	Paint Testing and Environmental Protection: Important paint properties; Scrape adhesion test; Pull-off test; Cross cut test; Wedge-cut method for determination of film thickness (scribe and drill method); Pollution from solvent, pigment and binders;	5

	Safety measures in paint industry and pollution control.	
6.	Surface Coating: Significance of coating and surface engineered materials, and application; Surface dependent	3
7.	Surface Treatment and Surface Coating Methods: Surface treatment and surface energy testing on post-treatment step; Coating methods; Gravure coating, knife over roll coating, hot melt coating, reverse roll pan, Myer bar, slot orifice, immersion/dip coating, chemical and physical vapor deposition; Electrode and electrode-less deposition, and thermal spray process.	7
8.	Process Parameters and Engineered Surface Coating: Influence of process parameters on surface yield and surface properties of coating; Physical and mechanical characteristics of the coating; Industrial coatings: Multi-layered coating, super hydrophilic and hydrophobic coating; Lyophilic coatings.	4
9	Performance Testing of Coated Product: Accelerated weathering test, salt spray and immersion resistance; Abrasion, adhesion, contact angle, hardness test; TiN coated tool, performance evaluation of CVD diamond coated tool.	4
	TOTAL	42

11. Suggested Books:

S. No.	Name of Books / Authors /Publisher	Year of Publication / Reprint
1.	Morgans W.M., "Outlines of Paint Technology", 3 rd Ed., CBS Publishers.	1990
2.	Schweitzer P.A., "Paint and Coatings: Application & Corrosion Resistance", 1 st Ed., CRC Press.	2005
3.	Grainger S. and Blunt J., "Engineering Coating: Design and Application" 2 nd Ed., Elsevier.	1998
4.	Tracton A.A., "Coating Technology Hand Book", 3 rd Ed., CRC Press.	2005
5.	Koleske J.V., "Paint and Coating Testing Manual", 15 th Ed., ASTM International.	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-409** Course Title: **Polymeric Fiber Technology**

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: **PEC**

8. Pre-requisite: **Nil**

9. Objective: The course is intended to provide understanding about technology of polymeric fibers.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Structure, properties and morphology of fiber forming natural and synthetic polymers.	4
2.	Processing: Melt and solution spinning operation, general principles of fluid flow, spinning and extrusions, dry and wet spinning of fibers, spinneret size, rate of extrusion, effect of spinning on filament structure and properties; Die design.	8
3.	Post-processing: Post spinning, finishing, drawing and seat setting operations, effect on orientation and crystallization, heat setting and texturing, principles of setting of fibers and fabrics.	6
4.	Characterization: Testing of fibers: Density, birefringence, tensile, moisture regain, dyeing mechanism, color fastness.	10
5.	Yarn synthesis: Production of staple yarns of natural and synthetic fibers.	4
6.	Production and Applications: Manufacturing methods and applications of fibers based on: Polyethylene, polyamide, polypropylene, polyacrilonitrile, polyester, polylactic acid.	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books /Publishers	Year of Publication
1.	Gupta V.B. and Kothari V.K. , "Manufactures Fiber Technology", Chapman and Hall.	2003
2.	Mark H.F., Atlas S.M. and Cernia E., "Man Made Fibres Science and Technology", Wiley Interscience.	1968
3.	Moncrieff R.W., " Man Made Fibres" , Haywood Books.	1975
4.	Vaidya A. A. "Production of Synthetic Fibers", Prentice Hall.	2001
5.	Deopura B. L., Alagirusamy R., Gupta B., Joshi M., "Fibrous Materials: Polyesters and Polyamides", Woodhead Publishing Ltd and CRC Press.	2008

42

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-410** Course Title: **Adhesives and Sealants Technology**

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: **PEC**

8. Pre-requisite: **Nil**

9. Objective: To provide knowledge of various polymeric adhesives and sealants.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to Adhesives and Sealants: History of adhesive industry; Types of polymeric adhesives; Theory and mechanism of adhesion; Advantages and disadvantages of adhesive bonding over conventional joining techniques; Adhesive coating equipment's; Introduction to sealants, caulks and mastics; Advantages and disadvantages of sealant bonding over conventional joining techniques.	7
2.	Adhesive Performance and Characterization: Description of performance properties of adhesives and their determination: Peel strength, shear strength, tack, creep and visco-elastic properties; Characterization of degree of branching, crystallinity, side-chain substitution, cross-linking, molecular weight, backing material; Identification of elastomer, tackifier, plasticizer, antioxidant and fillers.	8
3.	Adhesive Types: Properties, formulation principle, production techniques, additives and applications of adhesives: Pressure sensitive adhesives, structural adhesives, one part and multi-part adhesives, hot-melt adhesives, natural rubber adhesives, butyl and polyisobutylene adhesives, vinyl-ether adhesives, urea-formaldehyde adhesives, malamine-formaldehyde and resorcinol based adhesives.	8
4.	Additives for Adhesives and Surface Preparation: Tackifiers, cross-linkers, antioxidants, plasticizers, colorants, fillers and scents used to enhance mechanical performance, ageing characteristics, ease of use; Surface treatment procedures of	6

	substrates to improve adhesive bonding: Mechanical preparation, priming, corona treatment and chemical etching.	
5.	Specialty Adhesives: Anaerobic adhesives, bio-adhesives, reactive adhesives and adhesives that get activated using light/UV and heat; Adhesives examples for various industries viz. electronics, wood industry, healthcare, construction, packaging, textiles, automotive, consumer, abrasives and friction material shoes, electrical, paper and aerospace.	5
6.	Sealant Performance, Characterization and Applications: Sealant types: Reactive sealants, hardening from melts, sealants based on water or solvent loss; Production processes and equipment's; Properties and formulation of sealants relevant to different application; Curing process of sealants; Characterization of sealants; Additives and its effects on sealant performance; Performance testing; Surface preparation; Specialty sealants; Sealant application in various industries; Major trends in technology and markets.	8
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Satas D., "Handbook of Pressure Sensitive Adhesive Technology" Second Edition.	2014
2.	Taylor and Francis, "Handbook of Adhesive Technology", Second Edition, LLC.	2003
3.	Benedek I., "Pressure Sensitive Adhesive and Applications".	2004
4.	Petrie E.M., "Handbook of Adhesives and Sealants", Second edition, The McGraw-Hill Companies, Inc.	2007
5.	Flick E.W., "Handbook of Adhesives Raw Material".	1989

AL

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-411 Course Title: Rubber Product Technology

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

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

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

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

8. Pre-requisite: Nil

9. Objective: To impart knowledge of processing and applications of different rubbers.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Introduction: Machinery used for rubber mixing-two roll mills, internal mixers and continuous mixers; Master batch preparation, blending and mixing on mills, internal mixers and continuous mixers.	5
2	Machinery Used for Moulding: Compression, transfer and injection moulding of rubbers; Flashless moulding, finishing of moulded articles, calculation of mould shrinkage, molding defects and its remedies; Machinery used for extrusion; Ram and screw extruders, extrusion technology, crosshead extruders and strainers.	7
3	Rubber compounding: Principles of rubber compounding; Compounding to meet processing and vulcanisate properties; Reinforcement of elastomers by fillers; Factors influencing reinforcement and mechanism of reinforcement; Compounding and manufacture of cycle tyres and tubes, solid tyres, mechanical seals, sports goods, surgical products and miscellaneous moulded, extruded and calendered rubber products.	8
4	Engineering Aspect of Tyre Manufacturing Technology: Different types of tyres: basic features and performance comparison; Components of tyres, tyre-geometry and functions; Manufacturing techniques of tyres: two wheeler, car tyres, truck tyres, OTR farm tyres and air craft tyres; Method of building bias belted, radial	9

	and tubeless tyres, green tyre treatments; Tyre curing methods; Quality control tests.	
5.	Engineering Aspect of Rubber Product Manufacturing other than Tyre: Manufacturing techniques of conveyer belt technology, sealing ring technology, V-belt, footwear technology, hose technology, rubber coated roll, cable technology, vibration isolation and mounts.	9
6.	Recent Trends in Rubber Manufacturing Technology: Some recent trend of rubber processing technology; electron beam curing of rubber products; Computer aided rubber product design; Coated fabric technology.	4
	Total	42

11. Suggested Books

S.No.	Name of Authors /Books/Publishers	Year of Publication
1.	Bhowmick A.K., "Rubber Product Manufacturing Technology" CRC Press.	1994
2.	Johnson P., "Rubber Processing: An Introduction", Hanser-Gardner.	2001
3.	Morton M., "Rubber Technology", Van Norstrand-Reinhold.	1987
4.	Bhowmick A.K., "Current topic in Elastomer Research" CRC Press,	2008
5.	Ciesielski A., "An Introduction to Rubber Technology" Rapra Technology Limited, UK	1999
6.	Blow C.M., "Rubber Technology & Manufacture" Butterworths, London	1982

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: **PEN-412** Course Title: **Polymer Colloids**
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: PEC
8. Pre-requisite: Nil
9. Objective: To provide knowledge of polymer colloids
10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Introduction to colloids (from blood to milk, pumice to gelatine); Polymer colloids and its applications; Colloidal structure due to addition of pigments, fillers and electrolytes; Colloidal structure in aqueous and non-aqueous medium.	04
2.	Polymer Emulsions: Emulsion polymerization; Interfacial phenomena; Thermodynamic consideration and colloidal stability; Surfactants; Physical properties; Rheological properties; Film formation; Wetting; Surface modifications; Paint technology; Concentrated dispersions.	10
2.	Colloidal Interaction and Stability: Forces in colloidal system; Stability of colloidal particles and latex products; Order-disorder behavior of polymer colloids; Interface science; Janus particles.	08
3.	Characterization of Colloids: Particle size, microscopy, zonal methods, scattering methods, analysis of scattered radiation, neutron reflection, dynamic light scattering, rheological evaluation.	10
4.	Advances in Polymer Colloids: Advances in polymer latex technology, colloidal crystals-3D ordered arrays, soft particle glasses, polymeric self-assembly, nanotechnology with soft materials; colloidal biomolecules, biomaterials and biomedical applications, polymer nanocomposites, food colloids.	10
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Fitch R., "Polymer Colloids: A Comprehensive Introduction", Academic Press Inc., 1 st Edition.	1997
2.	Chern C.S., "Principles and Applications of Emulsion Polymerization", Wiley.	2008
3.	Goodwin J.W., "Colloids and Interfaces with Surfactants and Polymers-An Introduction", Wiley.	2000
4.	Hamley I.W., "Introduction to Soft Matter", Wiley.	2007

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-413 Course Title: Polymer Nanocomposites

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

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

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

5. Credit: 4 6.Semester: Spring/Autumn 7 Subject Area: PEC

8. Prerequisite: Nil

9. Objective: To impart knowledge of preparation, processing and applications of polymer nanocomposites.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Nanocomposites and Nanofillers: Overview of polymer nanocomposites; Classification of nanofillers: Nanoclay, nanosilica, nanoparticles, carbon based nanofillers; Synthesis and properties of fillers.	4
2.	Synthesis of Nanocomposites: Direct mixing, solution mixing, in-situ polymerization, ex-situ processing; Ceramic/polymer composites; Metal/polymer nanocomposites; Modification of interfaces; Modification of nanofillers.	6
3.	Thermal, Electrical and Optical Properties: Thermal stability and flammability; Dynamic mechanical thermal properties; Glass transition; Electrical properties: resistivity, permittivity, breakdown strength; Optical properties: refractive index, transparency.	8
4.	Mechanical Properties: Stress-strain properties - tensile, modulus, elongation at break; Flexural properties; Load-carrying capability; Toughness; Impact resistance; Relaxation behavior; Wear resistance.	7
5.	Morphological Properties: Characterization of nanocomposites by XRD, TEM, AFM and FESEM.	8
6.	Barrier Properties: Permeation and diffusion models relevant to polymer nanocomposites: diffusivity, sorption.	4
7.	Applications: Applications of polymer nanocomposites in space, automobiles, defence, electronics, packaging, bio-medical engineering, filtration, coatings and cosmetic.	5
Total		42

11. Suggested Books:

S.No.	Name of Book / Authors	Year of Publication
1.	Mai Y.W. and Yu Z.Z., "Polymer Nanocomposites", Woodhead Publishing Limited and CRC Press LLC, USA.	2006
2.	Ajayan P.M., Schadler, L.S., Braun, P.V., "Nanocomposite Science and Technology" Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.	2003
3.	Nicolais L. and Carotenuto G., "Metal-Polymer Nanocomposites", Wiley Inter Science.	2005
4.	Sergeev G.B., "Nanochemistry" Elsevier	2006
5.	Ke Y.C. and Stroeve P., "Polymer-Layered Silicate and Silica Nanocomposites" Elsevier.	2005

AE

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN- 414 Course Title: Advanced Process Control

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

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

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

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

8. Pre-requisite: Nil

9. Objective: To provide knowledge about advanced process control systems and their analysis.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Overview of dynamics of chemical processes, and control systems of simple and complex nature; Control system analysis; Importance of advanced computer control in chemical process industry with examples; Overview of dynamic process control and related transfer functions.	5
2.	Advanced Control Strategies: Analysis of cascade control; Split-range control; Selective control; Override control and auctioneering control; Smith-predictor control; Multi-loop control such as combination of feedforward, feedback and inferential control; Batch process control- sequential and logic control; Real time optimization and DCS-loop analysis.	7
3.	Advanced Tuning Methodologies for Traditional and Non-traditional Control: Advanced control system design with hybrid control: PI-PD, PI-PID and I-PID; Tuning based on direct synthesis(DS), IMC, Lambda, Hagglund and Astrom, Tyreus-Luyben and integral square error techniques; Limitations of PID control; Set-point tracking; Limiting and anti-reset windup.	4
4.	Computer Control Strategies: Internal model control (IMC); Predictive control; Adaptive control; Adaptive-predictive control; Adaptive-inferential control; Supervisory control; Principles of process identification.	7
5.	Multivariable Control System: Control of system with $M \times N$ variables; Relative static and dynamic gain array; Hankel interaction index array (HIIA); Decoupling condition number; Niederlinski	7

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	index; Resiliency; Morari resiliency index (MRI); Inverse Nyquist array; Robustness and sensitivity analysis; Doyle-Stein criterion; Uncertainty analysis; Skogestad-Morari method; Singular value decomposition; Tyreus-load-rejection criterion (TLC); BLT tuning; Multivariable DMC; Multivariable IMC; Observability and controllability analysis.	
6.	Digital Process Control System: Control with hardware and software involving system dynamics with Z and modified Z transform-DDC; Open loop and closed loop response; Bilinear transformation and stability analysis; Nyquist criteria; Sample data control of a first order system with dead time; Design of sample data controllers.	8
7.	Non-linear control: Lyapunov analysis; Describing function technique; Use of ANN, Fuzzy logic, PSO, ABC for advanced control; Plant-wise control system design.	4
	Total	42

11. Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Bequette B.W., "Process Control – Modeling, Design and Simulation", Prentice Hall of India.	2003
2.	Coughanour D.R., 2 nd Ed., "Process System Analysis and Control", McGraw Hill Publishing Inc.	1991
3.	Seborg D.E., Edgar T.F. and Mellichamp D.A., "Process Dynamics Control", 2 nd Ed., John Wiley & Sons.	2008
4.	Stephanopoulos G., "Chemical Process Control- An Introduction to Theory and Practice", Prentice Hall of India.	2008
5.	Richardson J.F. and Peacock D.G., "Coulson & Richardson's Chemical Engineering", Vol. 3, 3 rd Ed., Butterworth -Heinemann	2006
6.	Luyben W., "Process Modeling, Simulation and Control for Chemical Engineers", 2 nd Ed., McGraw-Hill Publishing Inc.	1990

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject code: PEN-415 Course title: Polymer and Tissue Technology

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

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

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

5. Credits: 4 6. Semester: Autumn 7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To impart knowledge of tissue engineering and biomaterials.

10. Details of course:

S. No.	Contents	Contact Hours
1	Introduction: Definition, principles and practices of tissue engineering; Tissue engineering triad;	2
2	Cells, Scaffolds and Growth Factors: Structure of cell; Cellular functions; Cell culture techniques; Different types of cells and their applications; Types and properties of scaffolds; Scaffold modifications; Growth factors: pH, temperature, chemical, electrochemical and mechanical stimuli; <i>In-vitro</i> and <i>in-vivo</i> environmental stimuli.	7
3	Polymers and Biomaterials for Tissue Engineering: Definition and classification of biomaterials and polymers; Natural and synthetic polymer system; Smart polymers; Polymer blends and composites; Bioceramics; Metal based scaffold-materials; Nanomaterials; Physical, mechanical, and chemical properties of biomaterials; Biocompatibility and biodegradation; Tailoring of polymers and biomaterial properties.	8
4	Scaffold Fabrication Techniques: Solvent casting; Porogen leaching; Gas foaming; Self assembly; Electrospinning; Phase-separation; Rapid prototyping/hybrid printer; Fiber mesh and fiber bonding; Melt molding; Freeze drying; Decellularization; Controlling pore size and porosity of the scaffold.	7
5	Scaffold Characterisation and Cell Behaviour on Scaffold: Determination of porosity, pore size, hydrophilicity, mechanical strength, roughness, toxicity, biocompatibility and biodegradability of the scaffold; Determination of shape, size, growth, proliferation and differentiation of cells.	8
6	Bioreactors for Tissue Engineering: Ideal bioreactor and its major characteristics; Fabrication of bioreactor; Scale-up possibilities for	4

	tissue engineered constructs.	
7	Regulatory and Clinical Issues: Pre-clinical evaluation of tissue engineered constructs; Trends in food and drug administration; Ethical issues; Dealing with ethical issues.	3
8	FutureAdvancements: Overcoming present drawbacks; Dealing with ethical issues.	3
	TOTAL	42

11.Suggested Books:

S. No.	Name of Books / Authors	Year of Publication
1.	Lanza R.P., Langer R. andVacanti J., "Principles of Tissue Engineering", Academic Press, 4 th Edition.	2014
2.	GuilakF., Butler D.L., Goldstein S.A.and Mooney S.A.,"Functional Tissue Engineering", Springer-Verlag, New York, 1 st Ed.	2003
3.	Migonney V., "Biomaterials", Wiley-ISTE, 1 st Ed.	2014
4.	Shi D., "Biomaterials and Tissue Engineering" Springer-Verlag, New York, 1 st Ed.	2004
5.	HelsenJ. A. andMissirlisY., "Biomaterials", Springer-Verlag, New York, 1 st Ed.	2010

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: **PEN-417**

Course Title: **Polymer Degradation and Stability**

2. Contact Hours: **L: 3**

T: 1

P: 0

3. Examination Duration (Hrs.):

Theory:3

Practical :0

4. Relative Weightage: **CWS:25**

PRS:0 MTE:25

ETE:50 PRE:0

5. Credits: **4**

6. Semester: **Spring**

7. Subject Area: **PEC**

8. Pre-requisite: **Nil**

9. Objective: To impart knowledge on various factors influencing stability and degradation of polymers

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Polymer degradation by various means: Heat, oxygen, light/UV, ozone, chemical, mechanical and biological; Role of chemical structure towards degradation; Advantages and disadvantages of polymer degradation; Case studies from various industries; Polymer stabilization.	4
2.	Thermo-Oxidative Degradation: Mechanisms of thermal degradation: Radical and non-radical de-polymerization, cyclization with elimination; Mechanisms of oxidative and thermo-oxidative degradation: Auto oxidation, oxidative chain reaction, chemical changes in polymers during oxidative degradation; Effect of chemical structure on oxidation rate. Degradation during manufacturing and service; Degradation effects on product performance with case studies.	6
3.	Photo-degradation: Mechanism of photo-oxidative degradation and photo-degradation of important polymers: polyolefins, acrylates and its copolymers, methyl vinyl ketone, polystyrene, polymers with heteroatoms in main chain and condensation polymers.	6
4.	Antioxidants and Stabilizers: Mechanism of antioxidant action; Chain breaking antioxidants; Preventive antioxidants; Synergism and antagonism; Chain breaking acceptor antioxidants; Metal deactivators; UV screens and filters; Stabilization of polymers during manufacture and in service; Melt stabilization; Thermal oxidative stabilization; Polymer bound antioxidants; UV stabilizers.	6
5.	Degradation in Special Environments: Polymers under stress; Degradation in harsh environments: Nitrogen dioxide, sulfur dioxide, ablation, mechanical and ultrasonic degradation; Quantitative aspects of ultrasonic degradation and changes in molecular weight; Degradation by high energy radiation and radiation pre-oxidation; hydrolytic degradation.	6

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6.	Degradation of Polymeric Biomaterials: Introduction to degradation of biomaterials; Controlling degradation rate and drug release in biomaterials; Degradation through oxidation, hydrolysis, enzymolysis, photolysis, stimuli-sensitive; Immune response to degradation.	6
7.	Polymer Degradation Kinetics: Random chain scission, mid chain scission, end chain scission; Kinetics based on mode of chain scission; Kinetics of solid phase thermal degradation (pyrolysis): order of reaction, rate constant, effect of temperature, reactive gas, radical donor, catalyst on rate constant, energy of activation; Kinetics of solution degradation of polymer: rate constants, role of radical donor; Lewis acid, catalyst on rate constant; Stoichiometric carnal, molecular weight distribution, population balance of polymer chains, integro-differential equation and it's analytical solution; Optimum temperature in degradation with initiator.	5
8.	Biodegradable Polymers and Polymer Recycling: Biodegradation of polymers in soil and water; Case studies of biodegradable polymers; Recent trends in biodegradability. Limitations to polymer recycling; Case studies: Polyolefins, PET, PVC, PS, nylon, PU, polymer composites, tyres.	3
Total		42

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1.	Hamid S. H., "Handbook of Polymer Degradation", 2 nd Ed., CRC Press, Taylor and Francis Group	2000
2.	Billingham N. C., "Degradation and Stabilization of Polymers", Wiley Online Library	2013
3.	Jellenick H.H.G., "Polymer Degradation and Stability", 1 st Edition, Elsevier Amsterdam, the Netherlands	1983
4.	Ranby. B. and Rabek. J. F., "Photo-degradation, Photo oxidation and photo-stabilisation of polymers", Wiley and Sons.	1975
5.	Denisov E. T. and Denisova. T. G., "Handbook of Antioxidants, Second edition, CRC Press, Taylor and Francis Group	2000

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Department of Polymer and Process Engineering**

1. Subject Code: **PEN-418** Course Title: **Polymers Recycling and Environment**

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

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

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

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

8. Pre-requisite: Nil

9. Objective :To impart knowledge of adverse effects of polymers on the environment and recycling of waste polymers.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction to Polymer Recycling: Disposed plastics, pollution, environmental issues related to plastic industry, plastic waste recycle.	4
2.	Plastic Waste: Sources of plastic waste: municipal, industrial, agricultural and medical; Plastic waste accumulation; Separation and segregation of plastics waste: Polyethylene, polypropylene, polyvinylchloride, polystyrene, polyester, polyurethane, thermosets and thermoplastics.	7
3.	Environmental Effects on Waste Polymers: Stability and degradation of polymers in environment; Photo and bio degradation of plastics waste, effect of plastic degradation on environment; Weather parameters influencing lifetime of waste plastics; Polymer waste in sea and marine environment, and on hills and mountains.	6
4.	Polymer Degradation Mechanism: Solid phase degradation of polymers through catalytic, UV, oxidative, hydrolytic, thermal and pyrolytic processes; Polymer degradation in solution; Mechanism and kinetics of polymer degradation.	5
5.	Waste Plastics Recycling: Collection of plastics waste for recycling; Reuse of plastics; Processes for recycling of thermoplastics and thermosets; Recycling of plastic waste based on an individual plastic; Recycling of mixed thermoplastics and thermosets; Recycling of mixtures of both thermoplastics and thermosets.	7
6.	Thermal Treatment of Plastics Waste: Methods and processes; Thermal degradation, incineration and energy recovery from waste plastics: Polyethylene, polypropylene, polyvinylchloride, polystyrene, polyester;	8

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	Energy requirements for plastic waste destruction.	
7.	Sustainability: Life cycle of plastics; Sustainability, economy, legislation and regulations for waste polymers, future of plastics.	5
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books /Publishers	Year of Publication
1.	Andrady A.L., "Plastics and The Environment", Wiley Interscience.	2003
2.	Bisio A.L. and XanthosM., (Eds.), "How to Manage Plastics Waste: Technology and Market Opportunities", Carl Hanser Verlag.	1994
3.	Brandrup J. "Recycling and Recovery of Plastics", HanserGardner.	1996
4.	ScheirsJ. "Polymer Recycling, Science, Technology and Applications", John Wiley & Sons.	1998



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-419 Course Title: Polymer for Packaging Technology

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

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

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

5. Credits: 4 6. Semester: Autumn 7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To provide knowledge about polymers used in packaging industry.

10. Details of Course:

Sl. No	Contents	Contact Hours
1.	Introduction: Packaging technology raw materials: Types of forms, products, applications and consumption pattern, evaluation of films; Comparison of polymer packaging with paper, metal and glass materials.	2
2.	Packaging Materials and Properties: Major polymers used for packaging applications: Polyethylene, EVA, ionomers, HDPE, LLDPE, PP, PVC, PVDC, PS, PVOH, EVOH, nylon, polyester, polycarbonate, fluoropolymers, acrylonitrile copolymers, thermoplastic elastomer, cellophane and cellulose plastics, polymer blends; Adhesives for packaging; Properties for packaging: MVTR, OTR, mechanical, thermal, optical, chemical.	8
3.	Packaging Converting Processes: Blown film extrusion, Cast film extrusion, films co-extrusion; Coating and lamination; Manufacturing of flexible packaging; Thermoforming; Injection molding; Blow moulding: extrusion and injection blow moulding; Calendering; Foam manufacturing; Sealing methods.	8
4.	Biobased Packaging: Edible and biobased food packaging materials; Edible, polysaccharide, lipid and protein based coating; First, second and third biobased packaging materials; Permeability of thermoplastic polymers; Multilayer films; Processing; Degradation; Deteriorative reaction in foods; Enzyme reactions; Chemical reactions; Physical and biological change.	8
5.	Food Packaging: Aseptic packaging of foods; Sterilization of packaging materials; Packaging of ready-to-eat and microwavable foods; Active and intelligent packaging; Modified atmospheric packaging; Packaging of horticultural products, dairy products, cereals, snack foods and confectionary, beverages; Shelf life of foods and factors controlling shelf	8

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	life; Safety and legislative aspects of packaging.	
6.	Package Printing Technologies: Print production workflow: Typography, graphic design, artwork, prepress, printing, post press/finishing; Materials: Substrates, ink; Drying methods; Recent trends; Printing methods: Lithography, Flexography, Gravure.	8
	Total	42

11. Suggested Books:

S. No	Name of Authors/ Books/ Publisher	Year of Publication
1.	Susan E.M., Selke J., Culter D. and Ruben J. "Plastics Packaging: Properties, Processing, Applications and Regulations", Hanser.	2004
2.	Pringer O.G. and Baner A.L. "Plastic Packaging Materials for Food: Barrier Function, Mass Transport, Quality Assurance and Legislation", John Wiley and Sons.	2008
3.	Sina E., "Plastic Films in Food Packaging: Materials, Technology and Applications", Elsevier.	2012
4.	Robertson G.L., "Food Packaging Principles and Practice", Second Edition, CRC Press.	2006
5.	Nayak S.K., "Fundamental of Plastic Testing", Springer.	2010
6.	Kipphan H., "Handbook of Print Media", Springer.	2004
7.	Johansson K., Lundberg P. and Ruberg R., "A Guide to Graphic Print Production", Wiley.	2002

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-420

Course Title: Polymers for Smart & Memristive Materials

2. Contact Hours: L: 3

T: 1

P: 0

3. Examination Duration (Hrs.):

Theory:3

Practical :0

4. Relative Weightage: CWS:25

PRS:0

MTE:25

ETE:50 PRE:0

5. Credits: 4

6. Semester: Autumn

7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To provide knowledge of synthesis, device fabrication and application of smart materials

10. Details of Course:

Sl. No	Contents	Contact Hours
1.	Introduction: Definition of memristive and smart materials and their classification; Class of polymers having said properties.	2
2.	Memristive Materials: Electrical memory switching polymers; Volatile memory and non-volatile memory: definition and classification, I-V characteristics; Transistor; Reversibility and memory sustaining capability.	6
3.	Synthesis and Characterization of Smart and Memristive Materials: Synthetic procedure for different polymers, characterization, advantages and disadvantages; Device fabrication techniques: Detailed characterization by AFM, SEM techniques.	8
4.	Memristive Devices with Different Polymeric Materials: Organic, inorganic, metal doped organic and organic-metallic hybrid devices; Switching and carrier transport mechanism; Shape memory polymers: Definition, classification and applications.	8
5.	Smart Materials: Definition, classification, advantages and disadvantages of electrochromic materials; Applications in e-paper, smart glass window, display; Definition, classification and applications of halochromic, pH sensitive, self-healing, piezoelectric and photochromic materials.	8
6.	Device Fabrication Techniques and Characterization: Memristive device: Sandwich and lateral device, advantages and disadvantages; Electrochromic materials: Use of supporting electrolyte in device fabrication and its importance, different types of supporting electrolytes, detailed device fabrication for other smart devices.	6
7.	Real Life Applications: Applications in memory chip, glass window,	4

	display system and others; Advantages and limitations of such devices.	
	Total	42

11. Suggested Books:

Sl. No	Name of Authors/ Books/ Publisher	Year of publication
1.	Tu C.-H., "Electrical Switching and Memory Behaviors in Organic-based Devices", ProQuest.	2008
2.	Burghartz J.N., "Guide to State-of-the-art Electronic Devices", John Wiley & Sons.	2013
3.	Dai L., "Intelligent Macromolecules for Smart Devices: From Materials Synthesis to Device Applications", Springer.	2004

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: Department of Polymer and Process Engineering

1. Subject Code: PEN-421

Course Title: Applications of Polymer in Drug Delivery

2. Contact Hours: L: 3

T: 1

P: 0

3. Examination Duration (Hrs.):

Theory:3

Practical :0

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

5. Credits: 4

6. Semester: Autumn

7. Subject Area: PEC

8. Pre-requisite: Nil

9. Objective: To impart knowledge on various polymers used in drug delivery applications

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Polymers used in drug delivery, synthetic and natural polymers: cellulose, poly-ethylene glycol, poly-n-vinyl pyrrolidone, PCL, PLA, PLGA, HMPA.	04
2.	Conventional techniques of drug delivery: Compression, spray, dip-coating and encapsulation, diffusion controlled systems, solvent activated system, bio-degradable system.	04
3.	Responsive polymers for drug delivery: Responsive systems based on temperature, pH and redox potential, polymer therapeutics, polymer-drug conjugates, protein-polymer conjugates	04
4.	Polyelectrolytes: polyelectrolytes, characterization of polyelectrolytes application of polyelectrolyte complexes. Soluble drug carriers, polymeric micelles, liposomes, microgel, nanogel, nanoparticles, dendrimers, examples	06
5.	Current thrust in drug delivery: Endosomolytic polymers and macromolecules, role of poly (ethylene glycol), peptide and protein drugs, microencapsulation of polymeric drug e.g. RNA, protein; drug – polymer interactions.	08
6.	Polymeric biomaterial and its stability: Polymer stability with pH, temperature, oxido-reductive, and phagocyte effect; Adsorption of polymers from solution; Macromolecular adsorption over polymer interface; Protein adsorption; Colloid stability, Control of protein adsorption	08
7.	Novel Drug Delivery Systems: Mucosal, transdermal drug delivery system (TDDS), bio-degradable polymeric stent, parenteral implants, ophthalmic insets, micro encapsulation. intrauterine delivery system	08

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	(IUDs); Targeted drug delivery systems.	
		Total 42

11. Suggested Books

S. No.	Name of Authors / Books / Publisher	Year of Publication
1	Lachman L. and Lieberman H.A., "The Theory and Practice of Industrial Pharmacy", CBS publishers, India.	2005
2.	Avis K. E. and Lieberman H.A., "Pharmaceutical dosage forms, Parenteral medications", 2 nd ed, Vol I, II and III, Marcel Decker	1993
3.	Tyle P., "Drug Delivery System", 1 st Ed, Marcel Decker	1988
4.	Jain N. K., "Advances in controlled and novel drug delivery", 1 st Ed., CBS Publication	2001
5.	Robinson J.R. and Lee V.L. "Controlled Drug Delivery: Fundamental and Applications", Marcel Dekker, USA.	2003
6.	Radomsky M., Liu L. and Iwamoto Z., "Sustained Release Injectable Products, Interpharm Englewood, Colorado.	2000

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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT/CENTRE:

Department of Chemistry

1. Subject code: CYN-422

Course Title: Polymer Physics

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: Spring

7. Subject Area: PEC

8. Pre-requisite: Basic Physical Chemistry Course, calculus and physics.

9. Objective: To familiarize students with the basic concepts of polymer physics.

10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Statistical Thermodynamics: Microstates, Ensembles-microcanonical, canonical, grand-canonical, partition functions, distributions, averages, thermodynamic connection, probability distribution of fluctuations.	6
2.	Chain Statics: Characteristic dimensions of 'random coil' polymers, models for calculating the average end-to-end distance for an ensemble of statistical chains, distribution of end-to-end vectors, Worm-like chain, measurement of radius of gyration from scattering, free energy of ideal chain, scaling arguments for stretching and confinement, pair correlation for ideal chain, structure factor.	12
3.	Real chains: Excluded volume, self-avoiding walks, deforming real and ideal chains, scaling model for real chains, Flory theory, solvent quality, theta-temperature. Thermodynamics and statistical mechanics of polymer networks.	8
4.	Polymer solutions: Thermodynamics of mixing, Flory-Huggins theory, osmotic pressure, concentration regimes in polymer solutions, correlation length, correlation function, screening of excluded volume forces, size of a polymer in semi-dilute solutions, polymer-polymer blends and phase diagrams.	9
5.	Polymer melts: chains in melts, screening in dense polymer melts, and correlation hole.	3
6.	Polymer dynamics: Rouse model, Zimm model, Reptation	4
	Total	42

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11. Suggested Books:

S. No.	Name of Authors/Book/ Publisher etc.	Year of Publication/ Reprint
1.	Rubinstein M. and Colby R. C., "Polymer Physics", 1 st Ed., Oxford University Press.	2003
2.	de Gennes P.G., "Scaling Concepts in Polymer Physics", 1 st Ed., Cornell University Press.	1979
3.	Doi M. and Edwards S.F., "The Theory of Polymer Dynamics", Clarendon Press.	1988
4.	Flory P. J., "Principles of Polymer Chemistry", 1 st Ed., Cornell University Press.	1953
5.	Strobl G. R., "The Physics of Polymers: Concepts for Understanding Their Structures and Behavior", 3 rd Ed., Springer-Verlag Berlin Heidelberg.	2007
6.	Gedde U., "Polymer Physics", Reprint, Springer Netherlands.	2001

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RESEARCH AWARDS

KHOSLA NATIONAL AWARD OF Rs. 1,25,000/-, a GOLD MEDAL & a CITATION.

Dr. Janardan Nanda

INSA Honorary Scientist

Department of Electrical Engg. IIT Delhi Hauz Khas, Delhi-110016

VNMM AWARD OF Rs. 1,00,000/- , a MEDAL & a CITATION.

Dr. S. Sridhar

Principal Scientist & Project Leader, Membrane Separations Group, Chemical Engineering Division ,

Indian Institute of Chemical Technology,
Hyderabad-500 007

A.S. ARYA YOUNG EARTHQUAKE ENGINEER AWARD OF Rs. 50,000/- , a MEDAL & a CITATION.

Dr. Subhadeep Banerjee

Assistant Professor,

Department of Civil Engineering,
Indian Institute of Technology Madras





BACHELOR OF TECHNOLOGY/ BACHELOR OF ARCHITECTURE

1) Sanket Vaibhav Mehta, B.Tech. (Computer Science & Engg.)

- **President's Gold Medal** for obtaining highest C.G.P.A. amongst the B.Tech./B.Arch./IDD/Int. M.Sc./Int. M.Tech. Passing out students entered through JEE having good character.
- **Dr. A.N. Khosla Medal** for obtaining highest C.G.P.A. in all B.Tech. Courses.
- **Smt. Shashi Krishna Medal** for obtaining highest C.G.P.A. all B.Tech./B.Arch. courses.

2) Abhinav Rajvanshi, B.Tech. (Mechanical Engg.)

- **Director's Gold Medal** for the best all-rounder other than sports amongst the B.Tech./B.Arch./IDD/Int. M.Sc./Int. M.Tech. Passing out students entered through JEE having good character and having CGPA ≥ 9.0 .
- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B.Tech. (Mechanical Engg.)
- **Dr. A.S. Arya Cash Prize** of Rs. 4000/- for the second best student (boy) in B.Tech./B.Arch.

3) Rahul Adhikari, B.Tech. (Civil Engg.)

- **The President of India, Dr. Shankar Dayal Sharma Gold Medal** For excellent performance in academics, extra-curricular activities including social service and having good character amongst all passing out UG and PG students.
- **Sri M.A. Rao Cash Prize** of Rs. 1000/- for having all round best performance in studies and sports in B.Tech. Courses
- **"Dr. K.V. Mittal Memorial"** Cash Prize of Rs. 5000/- for the boy student in Lawn Tennis Champion
- **Sarojni Naidu Cup** for work and play.

4) Soumya Gupta, B.Tech. (Biotechnology)

- **Dr. Jai Krishna Gold Medal** For the best student in B.Tech./B.Arch. Courses for outstanding performance in Academics and in Sports..
- **Durga Award** of Rs. 5000/- to a girl student for outstanding proficiency including character, conduct and excellence in academics performance, extra-curricular activities and social services.
- **"Om Bala Thapar"** Cash Prize of Rs. 12000/- for the best all round girl student in the B.Tech. Degree Programme.

5) Chandana R. (Bachelor of Architecture)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Bachelor of Architecture.
- Everest Award of Excellence of Rs. 10,000/- for obtaining highest CGPA in Bachelor of Architecture.
- "Architect Yash Pal Gupta Award of Excellence" of Rs. 10,000/- for obtaining highest CGPA in Bachelor of Architecture.

6) Anupriya Tripathi, B. Tech. (Biotechnology)

- Smt. Kaushalaya Arya Cash Prize of Rs. 4000/- for the next best girl student in B.Tech/B.Arch.
- Prof. Ranvir Singh Shastri" Cash Prize of Rs. 6000/- to a girl student of obtaining Second highest C.G.P.A. in B.Tech. (Biotechnology).
- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Biotechnology)

7) Gaurav Kumar, B.Tech. (Chemical Engg.)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Chemical Engg.)
- Prem Prakash Gupta Medal for obtaining highest C.G.P.A. in B. Tech. (Chemical Engineering).
- Prem Prakash Gupta Cash Prize of Rs. 5000/- for obtaining highest C.G.P.A. in B.Tech.(Chemical Engg.)

8) Akash Agarwal, B.Tech. (Civil Engg.)

- Madhusudan Dayal Mithal Medal for obtaining highest C.G.P.A. in B.Tech.(Civil Engg.)
- Rai Bahadur Sohan Lal Bhatia Medal for obtaining highest C.G.P.A. in B.Tech.(Civil Engg.)
- Brig. Harish Chandra Cash Prize of Rs. 1000/- for best Design (Project) in B. Tech. (Civil Engg.)
- Tara Chand Kanti Devi Cash Prizes of Rs. 2500/- for doing best design project in B. Tech. (Civil Engg.)
- "Prabhakar Swarup Civil Engineering Award" of Rs. 10000/- for obtaining highest C.G.P.A. in B.Tech (Civil Engg.)
- "Shri Shiv Nandan Swaroop and Avadh Narayan Bhatnagar" Cash Prize of Rs. 10000/- for being Batch topper of B.Tech. (Civil Engg.)
- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Civil Engg.).
- **Institute Medal** For Best Project in Engineering & Architecture amongst the students B.Tech.(Civil Engg.)

9) Rajan Mantri, B. Tech. (Electrical Engg.)

- Late Smt. Kailash Devi Goyal W/o Sri Kanhaiyalal Goyal of Firoza Memorial Cash Prize of Rs. 5000/- for obtaining highest C.G.P.A. in B.Tech. (Elect.)
- **Institute Silver Medal** For obtaining the highest C.G.P.A. amongst the students of B. Tech. (Electrical Engg.)

10) Deep Jain, B. Tech (Electronics & Communication Engg.)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Electronics & Communication Engg.)

11) Arvind Das Gupta, B. Tech. (Metallurgical & Materials Engg.)

- **Institute Medals** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Metallurgical & Materials Engg.)
- Mrs. Leila Saxena Memorial Cash Award of Rs. 5000/- For obtaining highest C.G.P.A. in B.Tech. (Metallurgical & Materials Engineering).
- G.P. Bagchi Metallurgical & Materials Engineering Cash Prize of Rs. 5000/- for obtaining highest C.G.P.A. in B.Tech. (Metallurgical & Materials Engg.)

12) Dhruv Narayan, B. Tech. (Production & Industrial Engg.)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Production & Industrial Engg.)

13) Vrinda Garg, B. Tech. (Pulp & Paper Engg.)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of B. Tech. (Pulp & Paper Engg.).
- Federation of Paper Traders Association of India Medal for obtaining highest C.G.P.A. in B.Tech. (Pulp & Paper Engg.).

14) Ishani Gupta, IDD (B. Tech (Chemical Engg.) & M.Tech. (HE))

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of IDD (B. Tech (Chemical Engg.) & M.Tech. (HE))

15) Garvit Rajesh Choudhary, IDD (B. Tech. (Computer Science & Engg.) & M.Tech. (IT))

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of IDD (B. Tech. (Computer Science & Engg.) & M.Tech. (IT))

16) Subham Kumar Singh, IDD (B. Tech. (Electrical Engg.) & M.Tech. (PE))



1) Aniruddh Jain, B. Architecture

- **Institute Medals** for Best Project amongst the students of Bachelor of Architecture.

2) Geetika Nehra, B.Tech. (Biotechnology)

- "Kedar Nath Agarwala, I.S.E. Memorial" trophy and Cash Award of Rs. 5000/- for Academics Excellence and outstanding Community services.
- **Institute Medal** for Best Project amongst the students of B. Tech (Biotechnology.)

3) Pooja Kumari, B. Tech. (Chemical Engg.)

- "Astha Mukul Dixit Prize" of Rs. 5,100/- for the best Engineering Project in B.Tech. (Chemical Engg.)
- **Institute Medal** for Best Project amongst the students of B. Tech (Chemical Engg.)

4) Vikrant Yadav, B. Tech. (Computer Sciences & Engg.)

- **Institute Medal** for Best Project amongst the students of B. Tech (Computer Science & Engg.)

5) Harshal Priyadarshi, B. Tech. (Electrical Engg.)

- **Institute Medal** for Best Project amongst the students of B. Tech (Electrical Engg.)

6) Harshit Sihare, B. Tech (Electronics & Communication Engg.)

- **Institute Medal** for Best Project amongst the students of B. Tech (Electronics & Communication Engg.)

7) Amir Raza, B. Tech. (Mechanical Engg.)

- **Institute Medal** for Best Project amongst the students of B. Tech (Mechanical Engg.)



- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of IDD (B. Tech. (Electrical Engg.) & M.Tech. (PE))

17) Pradyumna Paliwal, IDD (B. Tech. (E & CE) & M.Tech. (WC))

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of IDD (B. Tech. (E & CE) & M.Tech. (WC)).

18) Rajesh Ranjan, IDD (B. Tech. Process Engg.) & MBA

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of IDD (B. Tech. Process Engg.) & MBA

19) Rehan Ali Pradhan, Int. M. Tech. (Polymer Science & Technology)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M. Tech. (Polymer Science & Technology).

20) Aayush Garg, Int. M. Tech. (Geophysical Technology)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M. Tech. (Geophysical Technology)

21) Sarita Nandwani, Int. M. Tech. (Geological Technology)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M. Tech. (Geological Technology)

22) Prateek Mehta, Int. M.Sc. (Applied Mathematics)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M.Sc. (Applied Mathematics)

23) Ashmeet Singh, Int. M.Sc. (Physics)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M.Sc. (Physics).

24) Kanchan Aggarwal, Int. M.Sc. (Chemistry)

- **Institute Medal** for obtaining the highest C.G.P.A. amongst the students of Int. M.Sc. (Chemistry).



8) Akshay V. Singhal, B. Tech. (Metallurgical & Materials Engg.)

- Institute Medal for Best Project amongst the students of B. Tech (Metallurgical & Materials Engg.).

9) Vaibhav Goel, B. Tech. (Production & Industrial Engg.)

- Institute Medal for Best Project amongst the students of B. Tech (Production & Industrial Engg.)

10) Mayank Gupta, B. Tech. (Pulp & Paper Technology)

- Institute Medal for Best Project amongst the students of B. Tech (Pulp & Paper Technology)

11) Shubham Tayal, B.Tech. (Civil Engg.)

- Sri M.A. Rao Cash Prize of Rs. 1000/- for standing second in order of merit in B.Tech. (Civil Engg.)
- "Vinay Krishna Cash Prize of Rs. 5,000/-" for obtaining second highest CGPA in B.Tech., Civil Engg.

12) Mannat Gupta, B.Tech. (Civil Engg.)

- Sri M.A. Rao Cash Prize of Rs.1000/- for the best girl student obtaining highest C.G.P.A. amongst girl students in B.Tech (Civil Engg.).
- "Prof. (Mrs.) Renu Bhargava Cash Award for Excellence in Environmental Engineering" of Rs. 11,000/- to a girl student obtaining highest Marks/Grade in compulsory Environmental Engineering subjects in B.Tech.(Civil Engg.) and securing overall CGPA 8.0 or above.

13) Rupal Saraswat, B.Tech. (Electrical Engg.)

- Dr. G. Pande Medal for the girl standing first amongst the girl student in all B.Tech./B.Arch. courses.
- Laxmi Devi and Shri Banadri Das Cash prize of Rs. 5000/- for the best and outstanding girl student with excellence in academics amongst all girl sStudents in B.Tech. /B.Arch. courses.
- "Col. Bajpai" Cash Prize of Rs.5000/- for the girl student obtaining highest C.G.P.A.. Amongst girl students in undergraduate Programme
- "Smt. Rama Devi Krishna Bhatnagar" Cash Prize of Rs. 10000/- for the girl student amongst girl students in all Branches undergraduate Programme.
- "Air Cmdr Shyam Chand Mehra Scholarship" of Rs. 10,000/- to a girl student for obtaining highest C.G.P.A. in B.Tech. Electrical Engg.

M.Tech./M.Arch./M.U.R.P. M.Phil./M.Tech(ES)/M.Sc.

14) Gaurav Singh, M.Tech., Civil (Transportation Engg.)

- Tara Chand Kanti Devi Cash Prizes of Rs. 3000/- to the best student of M.Tech. (Civil)
- Sunita Bahadur Memorial Gold Medal Award" for obtaining highest C.G.P.A. in M.Tech (Transportation Engineering) of Civil Engineering Department.

15) Aashiq Hussain Ganaie, M.Tech. Civil (Geotech.)

- Tara Chand Kanti Devi Cash Prizes of Rs. 2000/- to the best student of M.Tech.(Geotech)

16) Saride Anvesh, M.Tech. Earthquake (Structural Dynamics)

- The Indian Service of Engineers Cash Prize of Rs. 2000/- for standing first in class in "Structural Dynamics"

17) Kaushik Mallik, M.Tech. Electrical (System & Control)

- Late Smt. Uma Goyal, W/O Sri Uday Shankar Goyal Memorial Cash Prize of Rs. 2500/- for obtaining highest C.G.P.A. in M.Tech.(Electrical)

18) Devyani Varshney, M.Tech. Chemical (Computer Aided Process Plant Design)

- Dr. Jai Krishna Medal for obtaining highest C.G.P.A. in all M.Tech. Courses.
- Laxmi Devi and Shri Banadri Das Cash Prizes of Rs. 5000/-for the best student with excellence in academics amongst all the student in M.Tech. Engg. /M.Arch. Courses.

19)Madimatla Satyanarayana Murthy, M.Tech. E&C (Microelectronics & VLSI)

- Late Sri Kanahiya Lal Goyal F/O Sri Uday Shanker Goyal Cash Prize of Rs. 2500/- for obtaining highest C.G.P.A. in M.Tech. (E&C)

20) Nalluri Sri Mahathi, M.Tech. Computer Science & Engg.

- Goyal Cash Prize of Rs. 1500/- for obtaining highest C.G.P.A. in M.Tech. (Computer Science & Engg.).

21) Ravi Shakya, M.Tech. (Hydrology) (Hydrology –Surface water)

- Puran Mal Gupta Medal for obtaining highest C.G.P.A. in courses M.Tech.(Hydrology)
- Kathpalia Award of Rs. 5000/- for the best dissertation in M.Tech. (Environment Engg.) Hydrology) in the area of Environment Aspects.

22) Deepa S. Koomullil, M.Tech. WRDg



- Dr. A.N. Khosla Medal for obtaining highest C.G.P.A. in M.Tech. WRD
- Dr. P.S. Nigam- Nirjala Cash Prize of Rs.1000/- for the best project in M.Tech. WRD

23) Rasmita Kumari Sahu, M.Tech. (WRD)

- Kathpalia Award of Rs. 5000/- for the best dissertation in M.Tech. (Environment Engg.) (WRD) in the area of Environment Aspects.

24) Nikunj Tomar, M.Tech. AHEC (Alternate Hydro Energy Systems)

- Hydro Awards of Rs. 10000/- for a candidate obtaining highest C.G.P.A. in M.Tech. (AHEC)
- "Electro Steel Award" of Rs. 10,000/- for best dissertation in M.Tech.(Alternate Hydro Energy Systems).

25) Nidhi, M.Sc. Chemistry

- Dr. A. N. Khosla Medal for obtaining highest C.G.P.A. in M.Sc. Chemistry.
- Smt. Sushilavati Khosla Medal to the girl student for obtaining highest C.G.P.A. in M.Sc. Chemistry.
- G. Pande Medal to the girl student for obtaining highest C.G.P.A. in M.Sc. Chemistry
- Dr. Hari G. Garg Cash Prize of Rs. 5000/- for obtaining highest C.G.P.A. in M.Sc. Chemistry.

26) Suresh Singh, M.Tech. Civil (Geomatics)

- Amba Prasad – Kalawati Memorial Cash Prize of Rs.5000/- for obtaining highest C.G.P.A. in M.Tech. (Geomatics).

27) Anurag Kalbhor, M.Tech. (Infrastructure Systems)

- "Shri Ravi Mohan Mangal" Cash Prize of Rs. 25,000/- for obtaining highest C.G.P.A. in M.Tech. (Infrastructure Systems) of center for Transportation Systems (CTRANS)

