भारतीय प्रौद्योगिकी संस्थान रूड़की
रूड़की - 247667 (भारत)
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE-247667 (INDIA)


सीनेट की नवासीवीं बैठक हेतु कार्यसूची AGENDA FOR THE 89 ${ }^{\text {th }}$ MEETING OF THE SENATE

बैठक सं०
MEETING NO.

स्थान
VENUE
दिनांक
DATE
समय
TIME

नवासीवीं
$89^{\text {th }}$
सीनेट हॉल, भा०प्रौ०सं०रूड़की
Senate Hall, IIT Roorkee
09 दिसम्बर 2021
$09{ }^{\text {th }}$ December 2021
04.00 बजे अपरान्ह
04.00 P.M.

# भारतीय प्रौद्योगिकी संस्थान रूड़की <br> INDIAN INSTITUTE OF TECHNOLOGY ROORKEE <br> रूड़की 247667 <br> ROORKEE - 247667 



कार्यसूची/AGENDA

| मुद्दा सं०/ <br> Item No. | विवरण / Particulars | $\begin{aligned} & \text { पृष्ठ / } \\ & \text { Page(s) } \end{aligned}$ |
| :---: | :---: | :---: |
| 89.1 | सीनेट की दिनांक 03.09.2021 को आयोजित हुई 88वीं बैठक के कार्यवृत्त की पुष्टि करना। <br> To confirm the minutes of the $88^{\text {th }}$ meeting of the Senate held on 03.09.2021. | 1 |
| 89.2 | सीनेट की दिनांक 03.09.2021 को आयोजित हुई 88वीं बैठक में लिए गए निर्णयों के कियान्वयन हेतु की गई कार्यवाही को रिपोर्ट करना। <br> To report on the actions taken to implement the decisions of the Senate taken in its $88^{\text {th }}$ meeting held on 03.09.2021. | 2-4 |
| 89.3 | कक्षाओं को ऑफलाइन मोड में आयोजित करने के प्रस्ताव पर विचार करना। To consider the proposal of conducting the classes in offline mode. | 5 |
| 89.4 | बीएस—एमएस कार्यक्रमों की सामान्य संरचना और द्वितीय वर्ष के बाद के पाठयक्रम के लिए पर निम्नानुसार विचार करनाः <br> 1. बी.एस—एमएस कार्यक्रमों के लिए सामान्य संरचना <br> 2. (i) बीएस-एमएस (गणित और कंप्यूटिंग) <br> (ii) बीएस-एमएस (रासायनिक विज्ञान) <br> To consider the common structure for the BS-MS programmes and II year onwards curriculum as given below: <br> 1. Common structure for BS-MS Programmes <br> 2. (i) BS-MS (Mathematics and Computing) <br> (ii) BS-MS (Chemical Sciences) | 6-26 |


| 89.5 | जल और नवीकरणीय ऊर्जा विभाग के मौजूदा एम.टेक प्रौगाम का नाम 'वैकल्पिक जल ऊर्जा प्रणाली' से 'नवीकरणीय और जल ऊर्जा' बदलने और इसकी संरचना को संशोधित करने के प्रस्ताव पर विचार करना। <br> To consider the proposal of Department of Hydro and Renewable Energy to rename the existing M.Tech. program on 'Alternate Hydro Energy System' as "Renewable and Hydro Energy" and to revise its structure. | 27-30 |
| :---: | :---: | :---: |
| 89.6 | यूजी नियमो के समान सहयोगी संस्थानों से मास्टर छात्रों के लिए क्रेडिट ट्रांसफर के प्रस्ताव पर विचार करना। <br> To consider the proposal of credit transfer for Master students from partner institutes similar to UG regulation. | 31-32 |
| 89.7 | एम-डेस (औद्योगिक डिजाइन) और एमआईएम (नवाचार प्रबंधन में परास्नातक) कार्यक्रम की संरचनाओं को संशोधित करने के डिजाइन विभाग के प्रस्ताव पर विचार करना। <br> To consider the proposal of Department of Design to revise the structures of M. Des. (Industrial Design) and MIM (Masters in Innovation Management) programs. | 33-43 |
| 89.8 | पी.एच.डी कार्यक्रम में चयन के समय प्रवेश में द्वितीय सूची सृजित करने के प्रस्ताव पर विचार करना। <br> To consider the proposal to create second list in the admission to Ph. D. programme at the time of selection. | 44 |
| 89.9 | जल संसाधन विकास एवम् प्रबंधन विभाग में पीएचडी कार्यक्रम में प्रवेश हेतु न्यूनतम शैक्षिक योग्यता (एमईक्यू) पर विचार करना। <br> To consider the Minimum Educational Qualification (MEQ) for admission in Ph. D. programme in Water Resources Development and Management Department. | 45 |
| 89.10 | अध्यक्ष, सीनेट द्वारा दी गई मंजूरी को रिपोर्ट करना। <br> To report the approvals accorded by the Chairman, Senate | 46-51 |
| अन्य मुददे अध्यक्ष की अनुमति से / Under any other item with the permission of the Chair. |  |  |

## Item No. 89.1: To confirm the minutes of the 88 $^{\text {th }}$ Senate meeting held on 03.09.2021.

The minutes of the $88^{\text {th }}$ Senate meeting held on 03.09.2021 were circulated to the members vide e-mail dated 12.10.2021. No comments have been received.

The Senate may consider and confirm the said minutes.

Item No. 89.2: To report on the actions taken to implement the decisions of the Senate taken in its $88^{\text {th }}$ meeting held on 03.09.2021.


| 88.5 | To consider the awards, Medals and Cash Prizes for Convocation 2021. | Chairman, SCSP presented the recommendations on the Awards, Medals and Cash Prizes for Convocation 2021. The Senate approved the awards, medals and prizes. | Awarded |
| :---: | :---: | :---: | :---: |
| 88.7 | To consider the  <br> proposals of the  <br> Department of  <br> Mathematics,   <br> Department of  <br> Physics and  <br> Department of  <br> Chemistry for  <br> restructuring and  <br> renaming their $5-$  <br> year Integrated  <br> Master of Science  <br> programme (IMS)  <br> into 5-year (4+1) BS- <br> MS Dual Degree <br> programme with exit  <br> option after four <br> years with BS <br> Degree:   | The Senate considered and approved the proposals for restructuring and renaming of the IMS Programs into BS-MS Dual Degree programs with exit option after four years with a BS degree. <br> Further, the Senate approved the first year course structures of these three programs. | Notified |
| 88.8 | To considerrenaming of the MSEconomics programof Department ofHumanities andSocial Sciences as <br> "BS-MS <br> (Economics)", a 5- <br> year MS programme.. | The Senate considered and approved the proposal to name the program as BS-MS dual degree program with exit option after four years with a BS degree. | Notified |
| 88.9 | To consider the  <br> following proposals of  <br> Department of <br> Electronics $\&$ <br> Communication  <br> Engg. regarding  <br> M.Tech. (VLSI):  <br> (a) Course  <br> structure of the  <br> program "M.Tech.  <br> (VLSI)"  | The Senate considered and approved the proposals along with the course structure. | Notified |


|  | (b)The <br> permissible <br> range of <br> credits in a <br> semester to be <br> $04-16$ credits. |  |  |
| :---: | :---: | :---: | :---: |
| 88.10 | To consider the <br> proposal of <br> Department of <br> Biosciences and <br> Bioengineering w.r.t. <br> admission to DBT <br> supported M.Sc. (BT) <br> programme for <br> lession $2021-22$.  | The Senate considered and approved the following: <br> 1. The merit list will be prepared in the ratio of $1: 5$ according to the seat matrix, in order of merit of GAT-B Score/Rank. <br> 2. Transfer of registered students to other institutions will be allowed within the scheduled date for such transfer. Any vacancy, if it exists and/or gets created due to a possible transfer, shall be filled only from our own wait-list according to merit. Transfer request of candidates, admitted through GAT-B or other entrance examination, from other institutions to IIT Roorkee MSc (BT) programme will not be considered for admission. <br> 3. The admission schedule for the MSc (BT) program will be prepared keeping in view the schedule announced by DBT. | Notified |
| 88.11 | To consider the proposal for the establishment of a Mehta Family School of Data Science \& Artificial Intelligence. | The Senate recommended to the Board the proposal to convert the Centre for AI and DS into Mehta Family School of Data Science and Artificial Intelligence once the MoU between the Mehta Family Foundation and IIT Roorkee is signed. | Recommenda tions were placed before the $63{ }^{\text {rd }}$ meeting of the Board. The Board approved the proposal. The same was notified. |
| 88.6 wa | s only the reporting item. |  |  |

## Item No. 89.3 To consider the proposal of conducting the classes in offline (physical class-room) mode.

Following the onset of the COVID-19 pandemic in the first part of the year 2020, the Institute has been continuing its academic activities online till date. Teaching and research in the online mode have been challenging and there are requests from students, their parents/guardians and the faculty members for starting the academic activities again in offline mode w.e.f. the Spring semester, 2021-2022.

In view of improvements in the pandemic situation, our Institute has called back the students in batches, except the first year UG \& Masters students, to the campus following a set of relevant guidelines and advising them to follow COVID appropriate protocols. Presently, there are approximately 3500 students in the campus. Most of the faculty members and the staff are also in the campus. The central and the state Governments have significantly relaxed the COVID-19 related protocols.

In view of the above, the following are proposed:
(a) All academic activities, except the classes of the UG first year, will continue in the offline mode as in the prepandemic sessions w.e.f. the January 01, 2022 (Spring semester, 2021 - 2022).
(b) All academic activities of the UG first year will continue in the offline mode as in the pre-pandemic sessions w.e.f. January 31, 2022.

The above is submitted for the consideration and approval of the Senate.

Item No. 89.4 To consider the common structure for the BS-MS programmes and II year onwards curriculum as given below:

1. (i) BS-MS (Mathematics and Computing) (Appendix-A)
(ii) BS-MS (Chemical Sciences) (Appendix-B)
2. Common structure for BS-MS Programmes (Appendix-C)
3. BS-MS (Physics) (Appendix-D)

The BS-MS (Mathematics and Computing), offered by the Department of Mathematics, BS-MS (Chemical Sciences), offered by the Department of Chemistry, and BS—MS (Physics), offered by the Department of Physics, programmes were approved by the Senate in its $88^{\text {th }}$ meeting held on 03.09.2021. The Senate also approved the curricula of the I year of the programmes.

The IAPC in its $113^{\text {th }}$ meeting considered the proposed structures from II year to V Year for the BS-MS programmes offered by the Department of Mathematics, Chemistry and Physics. The IAPC also formulated a common structure for all BS-MS programmes.

The IAPC recommended the curricula of both the programmes with modifications.

The recommended curricula for BS-MS (Mathematics and Computing), BS-MS (Chemical Sciences), BS-MS (Physics) and a common structure/framework for BS-MS programmes are placed as (Appendics-A, B, C and D) respectively.

The above is submitted for the consideration and approval of the Senate.

Appendix - A

Credit distribution in proposed BS- MS (Mathematics and Computing) Program

| CURRICULAR COMPONENTS | CREDITS | REMARK |
| :---: | :---: | :---: |
| (a) Institute Core Courses |  |  |
| $\begin{array}{ll}\text { (i) } & \text { Humanities and Social Sciences (HSSC) } \\ \text { (ii) } & \text { Basic Sciences (BSC) } \\ \text { (iii) } & \text { Engineering Sciences (ESC) } \\ \text { (iv) } & \text { General Sciences (GSC) }\end{array}$ | $\begin{aligned} & 04 \\ & 16\left(4^{* *}+12^{*}\right) \\ & 08^{* *} \\ & 03 \end{aligned}$ | *From Mathematics Department <br> ** From other departments |
| Total $=$ | 31 |  |
| (b) Programme Core Courses (PCC) |  |  |
| (i) Class Contact Core Courses <br> (ii) Introduction to (discipline)Eng./Science <br> (iii) Technical Communication <br> (iv) Project/Thesis <br> (v) Seminar <br> (vi) Educational Tour | $\begin{aligned} & \hline 92 \\ & 02 \\ & 02 \\ & 16(4+12) \text { * } \end{aligned}$ | * 4 Credits for Stage 1 and 12 Credits for Stage 2 |
| Total $=$ | 112 |  |
| (c) Humanities, Social Science and Management Elective Courses (HSSMEC) |  |  |
| (i) Humanities \& Social Science <br> (ii) Management Studies | $\begin{aligned} & \hline 03 \\ & 03 \end{aligned}$ |  |
| Total $=$ | 06 |  |
| (d) Open Elective Course (OEC) | 03-06 |  |
| (e) Program Elective Courses (PEC) | 32 |  |
| (f) Co-curricular Activities (CCA) |  |  |
| (i) Discipline (To be awarded after Final Year) <br> (ii) NCC/NSO/NSS (First Year)* | 02 |  |
| Total $=$ | 02 |  |
| Grand Total (a+b+c+d+e+f) = | 186-189 | 158-161 Credits for BS degree <br> 176-181 Credits for BS degree with MSC) <br> 204-209 Credits for BS-MS degree with MSC |

*The students opting for these proficiencies at first year level may be given certificate with the remark excellent/very good/ good/satisfactory/ unsatisfactory.
DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTEOF TECHNOLOGY ROORKEE
Proposed Structure (To be implemented from the session 2021-2022)

## BS-MS (Mathematics and Computing) MATHEMATICS

Teaching Scheme

| Year | Credits in Autumn Semester | Credits in Spring Semester | Credits (year-wise) |
| :---: | :---: | :---: | :---: |
| 1 | 21 | 20 | 41 |
| 2 | 20 | 21 | 41 |
| 3 | $19-22$ | $16-19$ | $38-41$ |
| 4 | 16 | 20 | 36 |
| 5 | 16 | 12 | 28 |
| Extra-Curricular |  |  |  |
| Grand Total | $\mathbf{9 2 - 9 5}$ | $\mathbf{8 9 - 9 2}$ | $\mathbf{1 8 6 - 1 8 9}$ for BS-MS degree <br> $\mathbf{1 5 8 - 1 6 1}$ for BS degree |
| Grand Total with <br> Minor Specialization <br> Courses | $\mathbf{5}$ more course with additional credits 18-20 | $\mathbf{2 0 4 - 2 0 9}$ for BS-MS degree |  |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Structure (To be implemented from the session 2021-2022)

## BS-MS (Mathematics and Computing) MATHEMATICS 312 MA I

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam Duration (Hrs.) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ¢ | Subject Code | Course Title |  | ¢ | L | T | P |  |  | $\sum_{3}^{\infty}$ | - | $\stackrel{\text { E }}{\text { V }}$ | 亗 | $\underset{\text { 山 }}{\text { ¢ }}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MAN-001 | Mathematics-1 | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | PHN-001 | Mechanics | BSC | 4 | 3 | 0 | 2 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | CEN-105 | Introduction to Environmental Studies | GSC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | HSN-001 | Communication Skills | HSSC | 2 | 1 | 0 | 2 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | HSN-002 | Introduction to Psychology | HSSC | 2 | 1 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MA-101 | Introduction to Mathematical Sciences | PCC | 2 | 2 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 7. | MA-103 | Introduction to Computer Programming | PCC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
|  |  |  | Total | 21 | 17 | 2 | 6 |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MAN-004 | Numerical Methods | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MAN-006 | Probability and Statistics | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-102 | Elementary Real Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-104 | Number Theory | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | CSN-102 | Data Structures | ESC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Total |  |  |  | 20 | 15 | 5 | 0 |  |  |  |  |  |  |  |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Program Code : 312 BS-MS (Mathematics and Computing) MATHEMATICS

| Teaching Scheme |  |  |  |  | Contact Hours/Wee k |  |  | Exam Duration (Hrs.) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ¢ | Subject Code | Course Title |  | ¢ | L | T | P | 증 ¢ ¢ |  | $\sum_{0}^{0}$ | - | $\stackrel{\text { w }}{\Sigma}$ | 先 | $\underset{\text { 山 }}{\substack{\text { ¢ }}}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-201 | Basic Abstract Algebra | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-203 | Design and Analysis of Algorithms | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-205 | Discrete Mathematics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-207 | Linear Algebra | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MA-209 | Ordinary and Partial Differential Equations | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  |  |  | Total | 20 | 15 | 4/5 | 0 |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-202 | Complex Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-204 | Statistical Machine Learning | PCC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 3. | MA-206 | Stochastic Calculus | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-208 | Technical Communication | PCC | 2 |  |  |  |  |  | 100 |  |  |  |  |
| 5. | MA-210 | Transform Techniques | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | HSS-ELE | HSS Elective Course | HSSMEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  |  |  | Total | 21 | 17 | 4 | 0 |  |  |  |  |  |  |  |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Structure (To be implemented from the session 2021-2022)
Program Code : 312 BS-MS (Mathematics and Computing)
MA MATHEMATICS
.. .. .
Department
Teaching Scheme

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam Duration (Hrs.) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\mathbf{2}} \\ & \dot{\infty} \end{aligned}$ | Subject Code | Course Title |  |  | L | T | P |  | W | $\sum_{0}^{\infty}$ | $\begin{aligned} & \mathscr{C} \\ & \frac{\alpha}{a} \end{aligned}$ |  | $\stackrel{\text { ■ }}{ \pm}$ | $\underset{\sim}{\text { 山 }}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | CSN-351 | Database Management System | ESC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-301 | Fluid Dynamics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-303 | Numerical Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-305 | Operations Research | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MS-ELE | Management Elective Course | HSSMEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | *OEC-1 | Institute Open Elective | OEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  |  |  | Total | 19-22 | 15 | 4 | 0 |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-302 | Mathematical Modeling and Simulation | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-304 | Theory of Computation | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-ELE | Program Elective - 1 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-ELE | Program Elective - 2 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | *OEC-2 | Institute Open Elective | OEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MSC-1 | Minor Specialization Course-1 | MSC | 3/4 | 3 | 0/1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Total |  |  |  | 16-23 | 18 | 4/5 | 0 |  |  |  |  |  |  |  |


Autumn Semester
*Students can take one or both courses under OEC category.
DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Structure (To be implemented from the session 2021-2022)

| 312 | BS-MS (Mathematics and Computing) |
| :--- | :--- |
| MA | MATHEMATICS |
| IV |  | .. .. .. Program Code



|  |  | Teaching Scheme |
| :---: | :---: | :---: |
| $\dot{\mathbf{2}}$ | Subject <br> Code | Course Title |
| $\dot{\omega}$ | Con |  |

$$
\begin{array}{l|l|l}
\hline \text { 1. } & \text { MAN-404 } & \text { Functional Analysis } \\
\hline
\end{array}
$$

| 1. | MA-401 | Abstract Algebra |
| :---: | :--- | :--- |
| 2. | MA-409 | Real Analysis |
| 3. | MA-411 | Theory of Ordinary <br> Equations |
| 4. | MA-ELE | Program Elective-3 |
| 5. | MSC-2 | Minor Specialization |
| 6. | MSC-3 | Minor Specialization |

Spring Semester

| $\begin{gathered} \text { N} \\ \text { N} \\ \text { Non } \end{gathered}$ | $\begin{gathered} \text { n } \\ \text { N} \\ \text { Non } \end{gathered}$ | $\begin{aligned} & \text { N} \\ & \text { N } \\ & \text { Ǹ } \end{aligned}$ | $\begin{gathered} \text { n} \\ \substack{2 \\ \text { N}} \end{gathered}$ | $\begin{gathered} \text { n} \\ \substack{2 \\ \underset{N}{2}} \end{gathered}$ | $\begin{aligned} & \text { n} \\ & \text { N} \\ & \underset{N}{2} \end{aligned}$ | $\begin{gathered} \stackrel{N}{N} \\ \text { N} \\ \text { N} \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 0 \\ & \text { op } \\ & \text { ó } \end{aligned}$ | $\begin{aligned} & \text { op } \\ & \text { b } \\ & \text { of } \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \text { O} \end{aligned}$ | $\begin{aligned} & \text { ô } \\ & \text { B } \\ & \text { of } \end{aligned}$ | $\begin{aligned} & \text { ô } \\ & \text { b } \\ & \text { of } \end{aligned}$ | $\begin{aligned} & \text { ô } \\ & \text { Q } \\ & \text { O} \end{aligned}$ | $\begin{aligned} & \text { ô } \\ & \text { Q } \\ & \text { O} \end{aligned}$ |
| $\begin{aligned} & \text { O} \\ & \text { ò } \end{aligned}$ | $\begin{aligned} & \text { O} \\ & \text { Ǹ } \\ & \hline \end{aligned}$ | $\begin{gathered} \text { O} \\ \text { N} \\ \text { N} \end{gathered}$ | $\begin{aligned} & \text { O} \\ & \text { N} \\ & \hline \end{aligned}$ | $\begin{gathered} \stackrel{O}{2} \\ \stackrel{\rightharpoonup}{N} \end{gathered}$ | $\begin{gathered} \text { O} \\ \text { N} \\ \hline \end{gathered}$ | $\begin{gathered} \text { O} \\ \text { N} \\ \hline \end{gathered}$ |
| ' | ' | ' | ' | , | ' | ' |
| $\begin{gathered} \infty \\ \underset{N}{\mathrm{~N}} \\ \hline \end{gathered}$ | $\begin{gathered} \text { N } \\ \text { N} \\ \hline \end{gathered}$ | $\begin{gathered} \text { N } \\ \text { N} \\ \vdots \end{gathered}$ | $\begin{gathered} \text { n } \\ \underset{\sim}{2} \\ \hline \end{gathered}$ | $\begin{gathered} \stackrel{\sim}{n} \\ \underset{\sim}{c} \end{gathered}$ | $\begin{gathered} \text { N } \\ \underset{\sim}{c} \\ \vdots \end{gathered}$ | $\begin{gathered} \text { N } \\ \text { N} \\ \vdots \end{gathered}$ |
| 0 | - | - | - | - | - | $\bigcirc$ |
| m | m | $\cdots$ | m | m | m | m |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Structure（To be implemented from the session 2021－2022） $\begin{array}{ll}312 & \text { BS－MS（Mathematics and Computing）} \\ \text { MA } & \text { MATHEMATICS } \\ \text { V } & \end{array}$ ．．．．．． Program Code Department Year

| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | Exam Duration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ¢ | Subject Code | Course Title |  | 号 | L | T | P |  |  | $\sum_{0}^{\infty}$ | $\stackrel{\sim}{\sim}$ | $\stackrel{\text { U }}{\Sigma}$ | 嵒 | $\stackrel{\text { 山 }}{\underline{\sim}}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MAN－500A | Thesis Stage－1 | PCC | 4 | 0 | 0 | 0 | 0 | 0 | － | － | 30 | 70 | － |
| 2. | MA－ELE | Program Elective－ 6 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | MA－ELE | Program Elective－ 7 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | MA－ELE | Program Elective－ 8 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| Total |  |  |  | 16 | 9 | 3 | 0 |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MAN－500B | Thesis Stage－2 | PCC | 12 | 0 | 0 | 0 | 0 | 0 | － | － | 30 | 70 | － |
| Total |  |  |  | 12 | 0 | 0 | 0 |  |  |  |  |  |  |  |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Structure (To be implemented from the session 2021-2022)

## List of the Program Elective Courses <br> BS-MS in Mathematics and Computing MATHEMATICS

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | ExamDuration(Hrs.) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\boldsymbol{Z}} \\ & \dot{\infty} \end{aligned}$ | Subject Code | Course Title |  |  | L | T | P |  |  | $\sum_{0}^{\infty}$ | $\begin{aligned} & \infty \\ & \text { ભ } \end{aligned}$ | $\stackrel{\text { w }}{\Sigma}$ | 㡙 | $\stackrel{\text { 山 }}{\stackrel{\sim}{\alpha}}$ |
| Program Elective Courses (Elective-1 and Elective-2) to be chosen in Third Year |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-411 | Analytic Number Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-412 | Combinatorial Mathematics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-413 | Credit Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-414 | Differential Geometry | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MA-415 | Financial Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MA-416 | Graph Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 7. | MA-417 | Mathematical Image Processing | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 8. | MA-418 | Numerical Optimization | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Program Elective Courses (Elective-3 to Elective-8) to be chosen in IV Year and V Year |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-400 | Project | PEC | 8 | 0 | 0 | 0 | 0 | 0 | - | - | 30 | 70 | - |
| 2. | MA-511 | Abstract Harmonic Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-512 | Advanced Complex Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-513 | Advanced Matrix Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MA-514 | Advanced Numerical Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MA-515 | Advanced Operations Research | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 7. | MA-516 | Advanced Partial Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 8. | MA-517 | Algebraic Number Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 9. | MA-518 | Algebraic Topology | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 10. | MA-519 | Approximation Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |

## Proposed Structure (To be implemented from the session 2021-2022)

| 11. | MA-520 | Coding Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 12. | MA-521 | Commutative Algebra | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 13. | MA-522 | Computational Fluid Dynamics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 14. | MA-523 | Control Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 15. | MA-524 | Dynamical Systems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 16. | MA-525 | Financial Mathematics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 17. | MA-526 | Finite Element Methods | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 18. | MA-527 | Fuzzy Sets and Fuzzy Systems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 19. | MA-528 | Hyperbolic Conservation Laws | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 20. | MA-529 | Integral Equations and Calculus of Variations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 21. | MA-530 | Machine Learning in Finance | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 22. | MA-531 | Mathematical Biology | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 23. | MA-532 | Mathematical Cryptography | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 24. | MA-533 | Measure Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 25. | MA-534 | Multivariate Techniques | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 26. | MA-535 | Numerical Linear Algebra | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 27. | MA-536 | Operator Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 28. | MA-537 | Optimal Control Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 29. | MA-538 | Orthogonal Polynomials and Special Functions | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 30. | MA-539 | Portfolio Optimization | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 31. | MA-540 | Regularization Theory for Inverse Problems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 32. | MA-541 | Representation Theory of Finite Groups | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 33. | MA-542 | Semigroup Theory and Applications | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 34. | MA-543 | Sobolev Spaces and Applications | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 35. | MA-544 | Statistical Inference | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 36. | MA-545 | Stochastic Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 37. | MA-546 | Stochastic Partial Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |
| 38. | MA-547 | Wavelet Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 |

Appendix - B
Proposal for BS-MS in Chemical Sciences
(4+1 Year Dual Degree Programme)
Program Overview
Chemistry Department proposes to replace the existing 5-year integrated M.Sc. in Chemistry by $(4+1)$ year BS-MS Dual Degree in Chemical
Sciences with an exit option to earn BS degree after successful completion of 4 years.
Program Salient Features
Exit option: The students willing to exit the program with BS degree can apply before the end of $7^{\text {th }}$ semester.
For BS Degree: All the essential fundamentals will be covered including sufficient practical exposure up to $8^{\text {th }}$ semester. Students will gain
fundamental knowledge on all the specializations (analytical, physical, inorganic, organic, materials, computational \& theoretical chemistry)
and a research project. The students qualifying with BS degree will have career prospects in chemical industry and for higher studies.
For MS Degree: $5^{\text {th }}$ Year will be extensively research-oriented with dissertation work and advanced elective courses. Students continuing
and completing 5 years of study will obtain dual degree (BS-MS in Chemical Sciences). Students will gain advanced knowledge and research
exposure. The qualifying students will have prospects for higher studies and eligibility for scientists posts in scientific and industrial
laboratories.

## DEPARTMENT OF CHEMISTRY

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| Program Code: | XX | BS-MS (Chemical Sciences) |
| :--- | :--- | :--- |
| Department: | CY | Chemistry |

Teaching Scheme

| Year | Credits in Autumn Semester | Credits in Spring Semester | Credits (Year-wise) |  |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 21 | 23 | 44 |  |
| 2 | 23 | 24 | 47 |  |
| 3 | 21 | 19 | 40 |  |
| 4 | 16 | 17 | 33 |  |
| 5 | 15 | 12 | 27 |  |
| Co-curricular Activities | 96 | 95 | $\mathbf{1 9 3}$ for BS-MS Degree |  |
| Grand Total | 166 for BS Degree |  |  |  |
| Total with Minor <br> Specialization Courses | $\mathbf{2 1 1 - 2 1 3}$ for BS-MS Degree <br> $\mathbf{1 8 4 - 1 8 6}$ for BS Degree |  |  |  |

Credit Distribution for BS-MS Programme in Chemical Sciences

| Curricular Components | Credit Distribution for for BS-MS (Chemical Sciences) |
| :---: | :---: |
| (a) Institute Core Courses |  |
| Humanities and Social Sciences (HSSC) | 04 |
| Basic Sciences (BSC) | 20 |
| Engineering Sciences (ESC) | 12 |
| General Sciences (GSC) | 03 |
| Total | 39 |
| (b) Program Elective Courses (PCC) |  |
| Class Contact Core Courses | 95 |
| Introduction to discipline | 02 |
| Technical Communication | 02 |
| Project/Dissertation | 16 |
| Seminar | 02 |
| Educational Tour | S/U\# |
| Total | 117 |
| (c) Humanities, Social Science and Management Elective Courses (HSSMEC) |  |
| Humanities \& Social Science | 03 |
| Management Studies | 03 |
| Total | 06 |
| (d) Open Elective Courses (OEC) Total | 03 |
| (e) Program Elective Courses (PEC) Total | 26 |
| (f) Co-curricular Activities |  |
| Discipline (to be awarded after final year) | 02 |
| NCC/NSO/NSS (First year)* | - |
| Grand Total | 193 |

[^0]* The students opting for these proficiencies at first year level may be given certificate with the remark excellent/very good/good/satisfactory/ unsatisfactory.


## DEPARTMENT OF CHEMISTRY

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Program Code: XX BS-MS (Chemical Sciences)
Department:
Year:

## CY Chemistry

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam. <br> Duration |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Sub Code | Courses Title | Sub. <br> Area | Credits | L | T | P | 家 | 或 | CWS | PRS | MTE | ETE | PRE |
| Semester-I (Autumn) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-001 | Mathematics-I | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | CY-101 | Introduction to Chemical Science | PCC | 2 | 2 | 0 | 0 | 0 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-103 | Computer Programming | ESC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | 0 |
| 4. | PH-007 | Modern Physics | BSC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | 0 |
| 5. | HSN-002 | Introduction to Psychology | HSSC | 2 | 1 | 1 | 0 | 2 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | CEN-105 | Introduction to Environmental Studies | GSC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | HSN-001 | Communication Skills | HSSC | 2 | 1 | 0 | 2 | 2 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 21 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semester-II (Spring) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-004 | Numerical Methods | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | PH-008 | Electromagnetic theory | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-102 | Physical Chemistry-I | PCC | 4 | 3 | 0 | 2 | 3 | 2 | 10-25 | 25 | 15-25 | 30-40 | 0 |
| 4. | CY-104 | Organic and Inorganic Chemistry | PCC | 4 | 3 | 0 | 2 | 3 | 2 | 10-25 | 25 | 15-25 | 30-40 | 0 |
| 5. | CY-106 | Basic Analytical Chemistry | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | CHN-102 | Energy Engineering | ESC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 23 |  |  |  |  |  |  |  |  |  |  |

Program Code:
Department:
Year:

XX BS-MS (Chemical Sciences) CY Chemistry
II

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam. <br> Duration |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Sub Code | Courses Title | Sub. <br> Area | Credits | L | T | P |  | 或 | CWS | PRS | MTE | ETE | PRE |
| Semester-III (Autumn) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | BT-201 | Genetics and Developmental Biology | ESC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | 0 |
| 2. | CY-201 | Chemical Thermodynamics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-203 | Main Group and Cluster Chemistry | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 4. | CY-205 | Organic Chemistry-I | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | MA-209 | Ordinary and Partial Differential Equations | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | HSS-ELE | HSS Elective Course | HSSMEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 23 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semester-IV (Spring) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | CY-202 | Coordination Chemistry and Organometallics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | CY-204 | Organic Chemistry-II | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-206 | Chemical Kinetics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 4. | CY-208 | Polymer Chemistry | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | CY-212 | Laboratory-I | PCC | 6 | 0 | 0 | 12 | 0 | 4 | 0 | 25-35 | 20-30 | 0 | 40-50 |
| 6. | CY-ELE1 | Program Elective-1 | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 24 |  |  |  |  |  |  |  |  |  |  |

Program Code:
XX
CY
III
Department:
Year:

BS-MS (Chemical Sciences) Chemistry


Program Code:
Department:
Year:

XX BS-MS (Chemical Sciences)

## CY Chemistry

IV

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam. Duration |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Sub Code | Courses Title | Sub. <br> Area | Credits | L | T | P | 迺 | 或 | CWS | PRS | MTE | ETE | PRE |
| Semester-VII (Autumn) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | CY-521 | Advanced Analytical Methods | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | CY-523 | Organic Chemistry-V | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-525 | Advanced Molecular Spectroscopy | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 4. | CY-531 | Physical Chemistry Laboratory | PCC | 4 | 0 | 0 | 8 | 0 | 4 | 0 | 25-35 | 20-30 | 0 | 40-50 |
| 5 | CY-ELE3 | Program Elective-3 | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | MSC-2 | Minor Specialization Course-II | MSC | 3/4 | 3 | 0/1 | 0 | 0 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | MSC-3 | Minor Specialization Course-III | MSC | 3/4 | 3 | 0/1 | 0 | 0 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 16-24 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semester-VIII (Spring) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | CY-522 | Materials Chemistry | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | CY-524 | Frontier Inorganic Chemistry | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-526 | Organic Chemistry-VI | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | CY-ELE4 | Program Elective-4 Project* $^{*}$ | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | CY-ELE5 | Program Elective-5 CY-500 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | MSC-4 | Minor Specialization Course-IV | MSC | 3/4 | 3 | 0/1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | MSC-5 | Minor Specialization Course-V | MSC | 3/4 | 3 | 0/1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
|  |  | Total |  | 17-25 |  |  |  |  |  |  |  |  |  |  |

Note: Students wishing to have BS Degree in Chemical Sciences they must inform to Dean (Academic Affairs) about their option before completing $7^{\text {th }}$ semester and they may exit the program at the end of $4^{\text {th }}$ year.
*Compulsory for BS Degree students

Program Code:
Department:
Year:

XX BS-MS (Chemical Sciences)
CY Chemistry


List of Program Elective Courses

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam. <br> Duration |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Sub Code | Courses Title | Sub. <br> Area | Credits | L | T | P | 家 | 或 | CWS | PRS | MTE | ETE | PRE |
| 1. | CY-210 | Bioinorganic and Biomimetic Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | CY-309 | Chemistry of Industrial Processes | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | CY-512 | Nuclear and Radiochemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 4. | CY-514 | Heterocyclic Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | CY-518 | Structure, Bonding and Properties of Solids | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | CY-606 | Total Synthesis | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | CY-607 | Electroanalytical Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 8. | CY-608 | Chemical Biology | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 9. | CY-609 | Inorganic Biochemistry and Reaction Mechanism | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 10. | CY-610 | Molecular Modeling and Simulations | PEC | 3 | 2 | 0 | 2/2 | 2 | 0 | 15-30 | 20 | 15-25 | 30-40 | 0 |
| 11. | CY-612 | Carbon Nanomaterials and their Applications | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 12. | CY-613 | Frontiers in Inorganic Biochemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 13. | CY-614 | Asymmetric Synthesis | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 14. | CY-615 | Crystal and Molecular Structure | PEC | 3 | 2 | 0 | 2/2 | 2 | 0 | 15-30 | 20 | 15-25 | 30-40 | 0 |
| 15. | CY-617 | Supramolecular Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 16. | CY-619 | Modern Organic Synthetic Methods | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 17. | CY-621 | Organic Structure Determination | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 18. | CY-623 | Organic Semiconductors | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 19. | CY-625 | Proteins and Polypeptides | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 20. | CY-627 | Advanced Surface and Colloidal Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 21. | CY-633 | Nanoscale Materials: Properties and Applications | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |


| 22. | CY-635 | Advanced Magnetic Resonance <br> Spectroscopy | PEC | 3 | 3 | 0 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 23. | CY-638 | Reactivity, Structure Determination, <br> Devices and Electronic Structure of <br> Solids | PEC | 3 | 2 | 0 | 2 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| 24. | CY-703 | Advanced Material Characterization <br> Techniques | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| 25. | CY-902 | Advanced Inorganic Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| 26. | CY-903 | Advanced Organic Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| 27. | CY-904 | Advanced Physical Chemistry | PEC | 3 | 3 | 0 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |
| 28. | CY-905 | Spectroscopic Methods of <br> Structural Elucidation | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | 0 | $20-30$ | $40-50$ | 0 |

## Appendix - C <br> Item No. Senate / 89.4

Credits for BS-MS Programs

| CURRICULAR COMPONENTS | Credits |
| :---: | :---: |
| (a) Institute Core Courses |  |
| (i) Humanities and Social Sciences (HSSC) | 04 |
| (ii) Basic Sciences (BSC) | 16-20 |
| (iii) Engineering Science (ESC) | 08-16 |
| (iv) General Sciences (GSC) | 03 |
| Total | 31-43 |
| (b) Program Core Courses (PCC) |  |
| i. Class Contact Core courses <br> ii. Introduction to (Discipline) Engineering/Sciences <br> iii. Technical Communication <br> iv. Project/Thesis <br> v. Seminar <br> vi. Educational Industrial Tour | $\begin{gathered} \hline 92-102 \\ 02 \\ 02 \\ 12-16 \\ 0-2 \\ S / U \end{gathered}$ |
| Total | 108-124 |
| (c) Humanities, Social Sciences and Management Elective Courses (HSSMEC) |  |
| i. Humanities and Social Sciences <br> ii. Management Studies | $\begin{aligned} & \hline 03 \\ & 03 \end{aligned}$ |
| Total | 06 |
| (d) Open Elective Course (OEC) | 03-06 |
| (e) Programme Elective Courses (PEC) | 24-32 |
| (f) Minor Specialisation Courses (MSC)/Departmental Honour Courses (DHC) | 18-20 |
| (g) Co-curricular Activities (CCA) |  |
| i. Discipline (To be awarded after Final Year) <br> ii. NCC/NSO/NSS (First Year)* | 02 |
| Total | 02 |
| Grand Total <br> (For those who exit after BS program) | 156-166 |
| Grand Total <br> (For those who opt for degree with minor specialisation or honours with <br> BS program) | 174-186 |
| Grand Total <br> (For those who opt BS-MS program) | 186-196 |
| Grand Total <br> (For those who opt for degree with minor specialisation or honours with <br> BS-MS program) | 204-216 |

* The students opting for these proficiencies at first year level may be given certificate with the remark excellent/very good/ good/satisfactory/ unsatisfactory.


## Appendix - D <br> Item No. Senate / 89.4

Credits for BS-MS (Physics) Program

| CURRICULAR COMPONENTS | Credits |
| :---: | :---: |
| (a) Institute Core Courses |  |
| (i) Humanities and Social Sciences (HSSC) | 04 |
| (ii) Basic Sciences (BSC) | 16 |
| (iii) Engineering Science (ESC) | 08 |
| (iv) General Sciences (GSC) | 03 |
| Total | 31 |
| (b) Program Core Courses (PCC) |  |
| i. Class Contact Core courses | 94 |
| ii. Introduction to (Discipline) Engineering/Sciences | 02 |
| iii. Technical Communication | 02 |
| iv. Project/Thesis | 16 |
| v. Seminar | 2 |
| vi. Educational Industrial Tour | - |
| Total | 116 |
| (c) Humanities, Social Sciences and Management Elective Courses (HSSMEC) |  |
| i. Humanities and Social Sciences | 03 |
| ii. Management Studies | 03 |
| Total | 06 |
| (d) Open Elective Course (OEC) | 03 |
| (e) Programme Elective Courses (PEC) | 30-33 |
| (f) Minor Specialisation Courses (MSC)/Departmental Honour Courses (DHC) | 18-20 |
| (g) Co-curricular Activities (CCA) |  |
| i. Discipline (To be awarded after Final Year) | 02 |
| ii. NCC/NSO/NSS (First Year)* | - |
| Total | 02 |
| (For those who exit after BS program) | 161-164 |
| Grand Total <br> (For those who opt for degree with minor specialisation or honours with BS program) | 179-184 |
| Grand Total (For those who opt BS-MS program) | 188-191 |
| Grand Total <br> (For those who opt for degree with minor specialisation or honours with <br> BS-MS program) | 206-211 |

* The students opting for these proficiencies at first year level may be given certificate with the remark excellent/very good/ good/satisfactory/ unsatisfactory.
DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Program Code: XX BS-MS in Physics

Department:
Year:

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam Duration (Hrs.) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| io | Subject Code | Course Title |  | \% | L | T | P | 2 | 或 | § | ¢ | $\stackrel{\text { U }}{\Sigma}$ | 亗 | $\underset{\text { щ }}{\text { ¢ }}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-001 | Mathematics - 1 | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | 0 |
| 2. | PH-103 | Computer Programming | ESC | 4 | 3 | 0 | 2 | 3 | 0 | 15-25 | 25 | 20-30 | 40-50 |  |
| 3. | CYN-001 | Physical Chemistry | BSC | 4 | 3 | 0 | 0 | 0 | 0 | 20-35 | - | 20-30 | 40-50 | 0 |
| 4. | HSS-10X | Communication Skills | HSSC | 2 | 1 | 1 | 0 | 2 | 0 | 25-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | HSS-10Y | Introduction to Psychology | HSSC | 2 | 2 | 0 | 0 | 0 | 0 | 25-35 | 0 | 20-30 | 40-50 | 0 |
| 6. | PH-101 | Introduction to Physical Science | PCC | 2 | 2 | 0 | 0 |  | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 7. | CEN-105 | Introduction to Environmental Studies | GSC | 3 | 3 | 0 | 0 | 3 |  |  |  |  |  |  |
|  |  | TOTAL |  | 21 | 17 | 2 | 2 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-002 | Mathematical Methods | BSC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 2. | PH-xxx | Physics 1 (Mechanics and Relativity) | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 3. | PH-xxx | Physics 2 (Electro Magnetic Theory) | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 4. | PHN-xxx | Basic Analog Electronics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | 0 | 20-30 | 40-50 | 0 |
| 5. | PH-xxx | Physics Lab 1 (Basic experiments) | PCC | 3 | 0 | 0 | 6 | 0 | 4 | 0 | 50 | 0 | 0 | 50 |
| 6. | CY-104 | General Organic and Inorganic Chemistry | BSC | 4 | 3 | 0 | 2 | 3 | 2 | 15-25 | 25 | 20-30 | 40-50 | 0 |
|  |  | TOTAL |  | 22 | 15 | 3 | 8 |  |  |  |  |  |  |  |

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

## Program Code：XX BS－MS in Physics Physics 픔＝ Department： Year：

| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | Exam Duration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\dot{i}$ | Subject Code | Course Title |  |  | L | T | P | 칭 ¢ $\stackrel{1}{1}$ |  | $\sum_{0}^{n}$ | $\underset{\sim}{\check{\alpha}}$ | $\stackrel{山}{\Sigma}$ | 亗 | 岗 |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MIN－108 | Mechanical Engineering Drawing | ESC | 4 | 2 | 0 | 4 | 0 | 4 | 0 | 50 | 0 | 0 | 50 |
| 2. | PH－xxx | Quantum Physics | PCC | 3 | 2 | 1 | 0 | 2 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 3. | PH－xxx | Thermal Physics and Statistical Mechanics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 4. | PH－xxx | Digital Electronics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 5. | PH－xxx | Physics Lab 2 （Thermal \＆Electronics） | PCC | 3 | 0 | 0 | 6 | 0 | 4 | 0 | 50 | 0 | 0 | 50 |
| 6. | HSS－ELE | HSS Elective Course | $\begin{aligned} & \hline \text { HSS } \\ & \text { MEC } \end{aligned}$ | 3 | 2 | 1 | 0 | 0 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
|  |  | TOTAL |  | 20 | 12 | 3 | 10 |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | PH－xxx | Elements of condensed matter Physics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 2. | PH－xxx | Mathematical Physics I | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 3. | PH－xxx | Applied Optics | PCC | 4 | 3 | 1 | 0 |  | 2 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 4. | PH－xxx | Nuclear Physics and its applications | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 5. | PH－xxx | Spectroscopy \＆Laser Physics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | 0 | 20－30 | 40－50 | 0 |
| 6. | PH－xxx | Physics Lab 3 （Optics＋Atomic Physics） | PCC | 3 | 0 | 0 | 6 | 0 | 6 | 0 | 50 | 0 | 0 | 50 |
| 7. | PH－xxx | Technical Communication | PCC | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 |
|  |  | TOTAL |  | 21 | 16 | 2 | 6 |  |  |  |  |  |  |  |

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

## Program Code：XX BS－MS in Physics Physics 폼 Department：

| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | ExamDuration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{2} \\ & i \end{aligned}$ | Subject Code | Course Title |  | 늫 0 0 | L | T | P |  | 或 | $\sum_{0}^{n}$ | $\underset{\sim}{\underline{n}}$ | $\underset{\Sigma}{\stackrel{\mu}{\nu}}$ | 亗 | 岚 |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | PH－xxx | Quantum Mechanics－ 1 | PCC | 4 | 3 | 1 | － | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 2. | PH－xxx | Mathematical Physics 2 | PCC | 4 | 3 | 1 | － | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 3. | PH－xxx | Classical Electrodynamics | PCC | 4 | 3 | 1 | － | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 4. | PH－xxx | Classical Mechanics | PCC | 4 | 3 | 1 | － | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 5. | PH－xxx | Physics Lab 4 | PCC | 3 | 0 | 0 | 6 | － | 3 | － | 50 | － | － | 50 |
| 6. | OEC | OEC | OEC | 3 | 3 | 0 | 0 | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
|  |  | Total |  | 22 |  |  |  |  |  |  |  |  |  |  |
| Spring Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | PH－xxx | Condensed Matter Physics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | PH－xxx | Statistical Mechanics | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | PH－xxx | Quantum Mechanics－II | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | PH－xxx | Atomic and Molecular Physics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. | PH－xxx | Nuclear and Particle Physics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | 0 |
| 6. | PH－xxx | Physics Lab 5 | PCC | 3 | 0 | 0 | 6 | 0 | 3 |  | 50 |  |  | 50 |
| 7. | HSSMEC | Management Elective | HSSMEC | 3 | 3 | 0 | 0 | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 8. | MSC－1 | Minor Specialization Course－I | MSC | 3／4 | 3 | 0／1 | 0 | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
|  |  | Total |  | $\begin{gathered} 24 / \\ 28 \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Program Code：XX BS－MS in Physics Physics エ ロ $\geq$ Department： Year：

| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | Exam Duration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| io | Subject Code | Course Title |  | － | L | T | P | ？ |  | $\sum_{3}^{n}$ | $\stackrel{\curvearrowleft}{a}$ | $\stackrel{\text { w }}{\Sigma}$ | 亗 | $\stackrel{\text { 世 }}{\text { ¢ }}$ |
| Autumn Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | PH－xxx | Semiconductor Devices and Applications | PCC | 4 | 3 | 1 | － | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | PH－xxx | Plasma and space physics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | PH－xxx | Programme Elective－I | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | 0 |
| 4. | PH－xxx | Programme Elective－II | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. | PH－xxx | Project＊stage－ 1 （optional） | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 6. | MSC－2 | Minor Specialization Course－II | MSC | 3／4 | 3 | 0／1 | 0 | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
| 7. | MSC－3 | Minor Specialization Course－III | MSC | 3／4 | 3 | 0／1 | 0 | 3 | － | 20－35 | － | 20－30 | 40－50 | － |
|  |  | Total |  | $\begin{array}{r} 14 / \\ 22 \end{array}$ |  |  |  |  |  |  |  |  |  |  |

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Program Code: XX BS-MS in Physics Department: PH Physics Year:


Item No. 89.5 To consider the proposal of Department of Hydro and Renewable Energy to rename the existing M.Tech. program on 'Alternate Hydro Energy System' as "Renewable and Hydro Energy" and to revise its structure.

The erstwhile Alternate Hydro Energy Centre (AHEC) has been converted to a Department named Hydro and Renewable Energy vide 57 th meeting of BoG (Item No. 57.5), dated Mar 06, 2019. The department has been offering the Masters Program on "Alternate Hydro Energy System". However, in view of the change in the status and the name of the academic entity as well as to update the program deliverables, the Department proposed to change the (a) Name of the Masters Programme, (b) Structure of the Programme.

The IAPC, in its $113^{\text {th }}$ meeting held on 24.11.2021, considered the proposal and recommended to rename the Programme as "M. Tech. (Renewable and Hydro Energy)". The IAPC also recommended the structure with modifications.

The modified course structure is placed at (Appendix-A).
The above is submitted for the consideration and approval of the Senate.

## DEPARTMENT OF HYDRO AND RENEWABLE ENERGY INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Program Code：
Department：
12 M．Tech．（Renewable and Hydro Energy）
HRE Department of Hydro and Renewable Energy
Year：

| Teaching Scheme |  |  |  |  | $\begin{gathered} \text { Contact } \\ \text { Hours/Week } \end{gathered}$ |  |  | ExamDuration |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\mathbf{Z}} \\ & \dot{\Delta} \end{aligned}$ | Subject Code | Course Title |  | \％ | L | T | P | 定 | 或 | $\frac{\pi}{0}$ |  | N | 可 | 戓 |
| Semester－I（Autumn） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AHN－510 | Hydropower Planning and Management （New） | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | AHN－513 | Renewable Energy Resources Development Technology（Existing） | PCC | 4 | 3 | 1 | 2／2 | 3 | 0 | 15－30 | 20 | 15－25 | 30－40 | － |
| 3. |  | Program Elective－I | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 4. |  | Program Elective－II | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 5. |  | Program Elective－III | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
|  |  | Total |  | 20 |  |  |  |  |  |  |  |  |  |  |
| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AHN－583 | Grid Integration of Renewable Energy（New） | PCC | 4 | 3 | 1 | 2／2 | 3 | 0 | 15－30 | 20 | 15－25 | 30－40 | － |
| 2. | AHN－584 | Finance，Policy and Regulations for Renewable Energy（New） | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | AHN－700 | Seminar | SEM | 2 | － | － | － | － | － | － | － | － | 100 | － |
| 4. |  | Program Elective－IV | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 5. |  | Program Elective－V | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
|  |  | Total |  | 18 |  |  |  |  |  |  |  |  |  |  |

## DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Program Code：
Department：
Year：

12 M．Tech．（Renewable and Hydro Energy）
HRE Department of Hydro and Renewable Energy II

| Teaching Scheme |  |  |  |  | $\begin{gathered} \text { Contact } \\ \text { Hours/Week } \end{gathered}$ |  |  | $\underset{\text { Duration }}{\text { Exam }}$ |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\dot{\dot{z}} \dot{\dot{\sim}}$ | Subject Code | Course Title |  | 気 | L | T | P | 蕃 | 坒 | 会 | $\frac{n}{x}$ | $\sum_{2}^{N}$ | $x_{1}$ | 先 |

Semester－I（Autumn）

| 1. | AHN－701A | Thesis Stage－I <br> （to be continued next semester） | DIS | 12 | - | - | - | - | - | - | - | - | 100 | - |
| :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\mathbf{1 2}$ |  |  |  |  |  |  |  |  |  |  |

Note：Students can take 1 or 2 audit courses as advised by the supervisor，if required．

| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1. | AHN－701B | Thesis Stage－II （continued from III semester） | DIS | 18 | － | － | － | － | － | － | － | － | 100 | － |
|  |  | Total |  | 18 |  |  |  |  |  |  |  |  |  |  |


| Summary |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Semester | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ |  |
| Semester－wise Total Credits | 20 | 18 | 12 | 18 |  |
| Total Credits | $\mathbf{6 8}$ |  |  |  |  |

Program Elective Courses M.Tech. (Renewable and Hydro Energy)

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam <br> Duration |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\mathbf{Z}} \\ & \dot{\sim} \end{aligned}$ | Subject Code | Course Title |  | $\begin{aligned} & \text { Un } \\ & \text { E. } \end{aligned}$ | L | T | $\mathbf{P}$ |  |  | $\frac{\infty}{3}$ | $\frac{n}{\alpha}$ | N | 界 | 年 |
| 1. | AHN-514 | Hydro Electric Equipment (Existing PCC) | PEC | 4 | 3 | 1 | 2/2 | 3 | - | 15-30 | 20 | 15-25 | 30-40 | - |
| 2. | AHN-515 | Design of Hydropower Structures (New) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 3. | AHN-516 | Hydro mechanical Equipment (Existing PCC) | PEC | 4 | 3 | 1 | 2/2 | 3 | - | 15-30 | 20 | 15-25 | 30-40 | - |
| 4. | AHN-517A | Modelling, Simulation \& Computer Applications (Existing) | PEC | 4 | 3 | 1 | 2/2 | 3 | - | 15-30 | 20 | 15-25 | 30-40 | - |
| 5. | AHN-518 | Environmental Planning and Management (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 6. | AHN-522 | Wind Energy Application Technology (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
|  | AHN-526 | Instrumentation for Hydro Power Plants (Existing) | PEC | 4 | 3 | 1 | 2/2 | 3 | - | 15-30 | 20 | 15-25 | 30-40 | - |
|  | AHN-528 | Rural Electrical Energy System Planning and Design (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 9. | AHN-532 | Remote Sensing and GIS for Renewable Energy Planning (New) | PEC | 4 | 3 | 0 | 2 | 3 | - | 10-25 | 25 | 15-25 | 30-40 | - |
| 10. | AHN-534 | Construction Planning and Management (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 11. | AHN-536 | Biomass Production and Utilisation (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 12. | AHN-540 | Solar Photo-Voltaic Design and Application (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 13. | AHN-542 | Energy Conservation and Management (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 14. | AHN-580 | Climate Change and water Resources (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 15. | AHN-581 | Energy-water-food nexus (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 16. | AHN-582 | Electric Vehicular Technology (Existing) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 17. | AHN-585 | Energy Storage Systems (New) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |
| 18. | AHN-586 | Hydrogen Economy (New) | PEC | 4 | 3 | 1 | 0 | 3 | - | 20-35 | - | 20-30 | 40-50 | - |

## Item No. 89.6 To consider the proposal of credit transfer for Master students from partner institutes similar to UG regulation.

The Institute, under the Clause 35 of UG Regulations, allows transfer of credits earned by the students from reputed institutions known for high academic standards in India and abroad, which have an MOU with the Institute concerning this aspect.

Dean, International Relations submitted a proposal to create a similar provision for PG students. It is argued that such provision shall help improving collaborative work between the partner Institutes.

The IAPC, in its $111^{\text {th }}$ meeting held on 22.09.2021, considered the proposal and recommended Credit Transfer for Masters students with minor modification (Appendix-A).

The above is submitted for the consideration and approval of the Senate.

## Appendix - A

## Transfer of Course Credits from other institutes for award of degree for Master Students

(1) Transfer of credits earned by the students from reputed institutions known for high academic standards in India and abroad, which have an MOU with the Institute concerning this aspect, be permitted.
(2) The students of IIT Roorkee, who have been nominated/ recommended by the Chairman, DAPC/ CAPC, and approved by Dean, Academic Affairs for pursuing study in such other institutions, will only be eligible for such transfer of credits.
(3) The subject wise study programme for each student and equivalence for transfer of credits based on the syllabi of the course of the host Institution to the Institute will be recommended by the Chairman, DAPC on case to case basis, and be approved by the Dean, Academic Affairs.
(4) The credits earned in other institute will be transferred for award of degree.
(5) The maximum permissible limit for transfer of credits will be 24.
(6) The subjects and grades earned will be indicated in the consolidate grade sheet/transcripts with the remark that the grades have been awarded by the host institution.
(7) Credits earned and grades will not be considered towards of SGPA/ CGPA.
(8) Grades earned in host institutions will not be considered for any award/prize at the Institute.

## Item No. 89.7 To consider the proposal of Department of Design to revise the structures of M. Des. (Industrial Design) and MIM (Masters in Innovation Management) programs.

The program structures for M. Des. (Industrial Design) and MIM were approved by the Senate in its $86^{\text {th }}$ meeting held on 09.02.2021. Subsequently, the department developed the detailed syllabi of the programmes. A few minor changes were observed while accommodating the newly developed syllabi in the structures according to the course components.

The IAPC, in its $113^{\text {th }}$ meeting held on 24.11.2021, considered and recommended the modified structures of the said programs.

The revised structures are placed as (Appendix-A).

The above is submitted for the consideration and approval of the Senate.

## M. Des. (Industrial Design)

## Teaching Scheme

I Year: Autumn Semester


[^1]IYear: Spring Semester

|  | Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | S. No. | Course Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
|  | 1 | IDN-502 | Design Methodology | PCC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
|  | 2 | IDN-504 | Form Design | PCC | 3 | 1 | 0 | 4 | 0 | 4 | 20-35 | 20-30 | - | - | 40-50 |
|  | 3 | IDN-506 | Design for Sustainability | PCC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  | 4 | IDN-508 | Creation Project | PCC | 5 | - | - | 10 | - | - | - | 100 | - | - | - |
|  | 5 | IDN-510 | Design Seminar | PCC | 2 | - | - | 4 | - | - | - | 100 | - | - | - |
|  | 6 |  | Program Elective II | PEC | 3/4 | - | - | - | - | - | - | - | - | - | - |
|  | 7 |  | Program Elective III | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| ట゙ |  |  |  | Sub Total | 22/23 |  |  |  |  |  |  |  |  |  |  |

## IIYear: Autumn Semester

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Course Code | Course Title | Subject Area | Credit | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IDN-702 | Internship <br> (Industrial Training/ Project/ <br> Interaction) | SEM | 4 | - | - | - | - | - | - | - | - | 100ss | - |
| 2 |  | Program Elective IV | PEC | 3/4 | - | - | - | - | - | - | - | - | - | - |
| 3 |  | Program Elective $\mathrm{V}^{*}$ | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| 4 | IDN-701A | Design Project (Phase-I) | DIS | 5 | - | - | - | - | - | - | - | - | 100 | - |
|  |  |  | Sub Total | 15/16 |  |  |  |  |  |  |  |  |  |  |

$\$ \$$ Evaluation scheme: (Industry: 40 + Institute: 60) Internship will be completed during summer break.
*May be completed through online mode (for example, NPTEL).

## II Year: Spring Semester

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage \% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Course Code | Course Title | Subject Area | Credit | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IDN-701 B | Design Project (Phase - II) | DIS | 12 | - | - | - | - | - | - | - | - | 100 | - |
|  | Sub Total |  |  | 12 |  |  |  |  |  |  |  |  |  |  |
|  | Total |  |  | 70/73 |  |  |  |  |  |  |  |  |  |  |

Basket of Elective Courses for M. Des. (Industrial Design)
Basket 1 Engineering Group

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Course <br> Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
|  | First Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-521 | Sensors, Actuators and IOT | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 2 | IDN-522 | Computer Aided Design | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 3 | IDN-523 | Rapid Prototyping | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 4 | IDN-546 | Product Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5 | EEN-524 | Intelligent Sensors and Instrumentation | PEC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
|  | Second Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | ECN-578 | Digital Systems Design | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IDN-525 | CAE in Product Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | IDN-526 | Reverse Engineering | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
|  | Third Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-527 | Artificial Intelligence and Data Science | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IDN-547 | Manufacturing Guidelines for Product Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | AID-505 | Machine Learning | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |

## Basket 2 Management Group

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { S. } \\ \text { No. } \end{gathered}$ | Course Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
|  | First Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-528 | Product Planning and Marketing | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  | Second Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IMN-505 | Business Valuation | PEC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IDN-530 | Business and Service Innovation | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | IMN-506 | Intellectual Property Management | PEC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4 | IMN-510 | Product Innovation Management | PEC | 2 | 2 | 0 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  | Third Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-531 | Legal Standards/IPR | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IDN-532 | Systems Thinking | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |

## Basket 3 Design Group

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { S. } \\ \text { No. } \end{gathered}$ | Course Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
|  | First Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-533 | User Experience Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  | Second Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-534 | Interaction Design | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 2 | IDN-536 | Service Design | PEC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | IDN-537 | Research into Design | PEC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4 | IDN-538 | Bio Inspired Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5 | IDN-548 | Inter-Disciplinary Design | PEC | 3 | 2 | 0 | 2/2 | 2 | 0 | 15-30 | 20 | 15-25 | 30-40 | - |
| 6 | IDN-549 | Design for Social Inclusion | PEC | 3 | 2 | 0 | 2/2 | 2 | 0 | 15-30 | 20 | 15-25 | 30-40 | - |
|  | Third Semester |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | IDN-535 | Mobility Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IDN-539 | Computer Game Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | IDN-540 | Design for Society | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4 | IDN-541 | Graphic Design | PEC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 5 | IDN-542 | Product Detailing | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6 | IDN-543 | Contemporary Visual Design | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 7 | IDN-544 | Representation Techniques for Animation | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 8 | IDN-545 | Visual Narrative | PEC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |

## Basket 4 On-line mode: NPTEL

A list of approved NPTEL courses by DAPC will be provided to students
Course duration: 20hrs
The courses will be PEC without laboratory work

## MIM (Masters in Innovation Management)

## Teaching Scheme

## IYear: Autumn Semester

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { S. } \\ \text { No. } \end{gathered}$ | Course <br> Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IDN-503 | Design Thinking | PCC | 3 | 1 | 0 | 4 | 2 | 0 | 10-25 | 25 | 15-25 | - | 30-40 |
| 2 | IMN-503 | Effective Communication | PCC | 2 | 1 | 1 | 0 | 0 | 2 | 20-35 | 20-30 | - | - | 40-50 |
| 3 | IMN-505 | Business Valuation | PCC | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4 | IMN-507 | Innovative Entrepreneurship Strategies | PCC | 3 | 2 | 0 | 2 | 2 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 5 | IMN-509 | Legal Aspects of Business | PCC | 2 | 2 | 0 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6 | IMN-511 | Business Decision Making | PCC | 3 | 3 | 0 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 7 | IMN-513 | Contemporary Management Practices | PCC | 2 | 2 | 0 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  | Sub Total |  |  | 18 |  |  |  |  |  |  |  |  |  |  |

## I Year: Spring Semester



II Year: Autumn Semester

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { S. } \\ \text { No. } \end{gathered}$ | Course <br> Code | Course Title | Subject Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IMN-601 | Summer Training | SEM | 3 | - | - | - | - | - | - | - | - | 100 | - |
| 2 | IMN-602 | Project | RP | 2 | - | - | - | - | - | - | - | - | 100 | - |
| 3 |  | Elective I | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| 4 |  | Elective II | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| 5 |  | Elective III | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| 6 |  | Elective IV | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
| 7 |  | Elective V | PEC | 3 | - | - | - | - | - | - | - | - | - | - |
|  | Sub Total |  |  | 20 |  |  |  |  |  |  |  |  |  |  |

$\stackrel{+}{N}$
N II Year: Spring Semester

| Teaching Scheme |  |  |  |  | Contact Hrs Per Week |  |  | Exam <br> Duration |  | Relative Weightage\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { S. } \\ \text { No. } \end{gathered}$ | Course Code | Course Title | Subject <br> Area | Credits | L | T | P | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IMN-603 | Project (Continued from Sem III) | RP | 18 | - | - | - | - | - | - | - | - | 100 | - |
|  | Sub Total |  |  | 18 |  |  |  |  |  |  |  |  |  |  |
|  | Grand Total |  |  | 74 |  |  |  |  |  |  |  |  |  |  |

List of Elective Courses for MIM (Masters in Innovation Management):

| S. No. | Course <br> Code | Subject Name | Credit | L | T | $\mathbf{P}$ | Exam Dur. (Hrs) |  | Relative Weightage (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | T | P | CWS | PRS | MTE | ETE | PRE |
| 1 | IMN-521 | IP Portfolio Management | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2 | IMN-522 | Intellectual Value and Corporate Value Creation | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3 | IMN-523 | Licensing and Commercialization of IP | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4 | IMN-524 | Diffusion of Innovations in Social networks | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5 | IMN-525 | Design for Extreme Affordability | 3 | 2 | 1 | 0 | 2 | 0 | 20-35 | - | 20-30 | 40-50 | - |

* All the elective subjects for M.Des Course are also available for the students of MIM as PECs.


## Item No. 89.8 To consider the proposal to create second list in the admission to $P h$. D. programme at the time of selection.

The Institute admits students into the Ph.D. Programmes in both the semesters of an academic session through a rigorous selection process. It is observed that many candidates do not join the programmes in either semester. In such cases, some seats apparently fall vacant as there is no mechanism to offer these seats presently. It poses difficulty in some activities where involvement of research students are planned.

In view of the above, many departments proposed to create a provision for preparing a second list of selected candidates so that subsequent offers can be made in case of non-joining of offered candidates. It was discussed in the 49th IRC meeting held on 15.09.2021 vide Item No. 49.2.4. Later, based on the recommendations received from the departments/centres, it was placed in $50^{\text {th }}$ IRC meeting on 29.10.2021 under Item No. 50.2.1.

The IRC recommended preparation of a second list of selected candidates for Ph.D. admission with the following conditions:

1. Second-list of candidates will be provided category wise for each specialization, if any, by the Department/Centre to Academic Affairs Office (AAO) along with the first-list of selected candidates for Ph.D. admission.
2. Number of candidates in the second-list should not be more than $50 \%$ of the total number of selected candidates in each category.

The above is submitted for the consideration and approval of the Senate. (MEQ) for admission in Ph . D. programme in Water Resources Development and Management Department.

The Department of Water Resources Development and Management has revisited their MEQ for admission into their Ph.D. programme in order to improve the quality of the admitted students.

The IRC, in its $51^{\text {st }}$ meeting held on 10.11.2021, recommended the MEQ proposed by the Department as presented in the following Table to be implemented w.e.f. Autumn Semester 2022-23.

| Existing MEQ | Proposed MEQ |
| :---: | :---: |
| (i) B.E. /B. Tech. /M.E. /M.Tech. <br> Environment/Electrical, <br> Mechanical / Agricultural or equivalent degree. <br> (ii) M.Sc. <br> Degree <br> Agricultural/ Biological / Environmental / Natural / Social Sciences Environmental Planning or equivalent consistent with research areas of the department. | B.E. /B. Tech. /M.E./M.Tech. in Civil,Environment / Electrical,Mechanical /Agricultural/Computer Engineering orequivalent degree.M.Sc. Degree inAgricultural/ Computer <br> Science/ Environmental / <br> Natural / Environmental <br> Planning or equivalent <br> consistent with research <br> areas of the Department <br> along with mathematics <br> at bachelor's level. l |

The above is submitted for the consideration and approval of the Senate.

## Item No.89.10 To report the approvals accorded by the Chairman, Senate

## (a) Institution of new scholarships/awards/prizes.

1) AK Goel Green Energy Prize and Gold Medal: Mr. Ashwani Kumar Goel, an alumnus of 1970 batch, has created a corpus to support one (01) cash prize of Rs. 1 Lac along with a Gold Medal and citation per year. This award will be awarded to a graduating student of UG/PG (including Ph.D.) programmes for significant contribution towards green/renewable energy sector. The award will be given on the following basis:

- Innovative idea in hydro/green/renewable energy sector,
- Reduction of carbon emission,
- Possibility of scalability,
- Possibility of wider deployment in industry,
- Encouraging sustainable energy development in the long run.

Eligibility: All graduating students of UG/PG (including Ph.D.) programmes.

Selection Process: The selection process will be based on inviting the applications from the students at individual level. These applications will be shortlisted by a committee, proposed by Chairperson, SCSP and approved by Chairman, Senate. The shortlisted candidates will be asked to make a presentation in front of the committee constituted. The final recommendation of the committee will be sent to the Senate for the approval.
2) Hari Krishna Mittal Leadership Award for Enhancing Entrepreneurship Culture at IIT Roorkee: Mr. Sanjeev Mittal, an alumnus of 1984 batch of B.E. (Electronics \& Communication Engineering), Mrs. Seema Garg, an alumnus of 1988 batch of B.E. (Computer Science \& Engineering) and Mr. Rajeev Krishna, an alumnus of 1989 batch of B.E. (Electronics \& Communication Engineering), have created a corpus to support one (01) award of Rs. 30,000/- per year. This award will be given to a deserving student of UG/PG (including Ph.D.) programmes for significant contribution towards enhancing the entrepreneurship culture at IIT Roorkee.

Eligibility: All students of UG/PG (including Ph.D.) programmes.

Selection Process: The selection process will be based on inviting the applications from the students at individual level. These applications will be shortlisted by a committee, proposed by Chairperson, SCSP and approved by Chairman, Senate. The shortlisted candidates will be asked to make a presentation in front of the committee constituted. The final recommendation of the committee will be sent to the Senate for the approval.
3) S.K. Kumar Gold Medal: Mr. Abhas Kumar, an alumnus of 1984 batch of B.E. (Mechanical Engineering), has established a corpus to create one (01) Gold medal for 10 years. This medal will be awarded as the S.K. Kumar Department Gold Medal to the graduating student of M.Tech. programmes of Department of Water Resources Development and Management with the highest CGPA.
4) Ar. Rishi Tiwari Memorial Scholarship: Alumni of 2020 batch of B.Arch. programme have created a corpus to support one (01) scholarship of Rs. 10,000/- per year. This scholarship will be given to a student obtaining the highest SGPA in the Professional Training Semester of B.Arch. programme. In case of a tie, the student with the highest CGPA will get this award.
5) New MCM Scholarships:
i. Brigadier Harish Chandra Memorial MCM Scholarship: Smt. Mamta Malhotra has created a corpus to support one (01) MCM scholarship of Rs. $10,000 /-$ per year. This scholarship will be given to a deserving student of final year of B.Tech. programme of Department of Civil Engineering. The awardee will be selected as per the prevailing procedure adopted by SCSP to award MCM scholarships of the Institute. This scholarship will replace the existing "Brigadier Harish Chandra Memorial Award".
ii. Arvind Kumar Jain MCM Scholarship: Mr. Arvind Kumar Jain, an alumnus of 1971 batch of B.E.
(Electrical Engineering), has created a corpus to support one (01) MCM scholarship of Rs. 10,000/- per year. This scholarship will be given to a deserving student of B.Tech. programme of any year and any department. The awardee will be selected as per the prevailing procedure adopted by SCSP to award MCM scholarships of the Institute.
iii. Electrical Branch 1971 Batch MCM Scholarship: Mr. Arvind Kumar Jain, Mr. Chandra Mohan Trikha and Mr. P.S. Mohan, alumni of 1971 batch of B.E. (Electrical Engineering), have created a corpus to support one (01) MCM scholarship of Rs. 10,000/- per year. This scholarship will be given to a deserving student of B.Tech. programme of Department of Electrical Engineering. The awardee will be selected as per the prevailing procedure adopted by SCSP to award MCM scholarships of the Institute.
iv. Metallurgy Branch 1971 Batch MCM Scholarship: Mr. Ambrish Bhargava and Mr. Pramod Gothi, alumni of 1971 batch of B.E. (Metallurgy Engineering), have created a corpus to support one (01) MCM scholarship of Rs. 10,000/- per year. This scholarship will be given to a deserving student of B.Tech. programme of Department of Metallurgical and Materials Engineering. The awardee will be selected as per the prevailing procedure adopted by SCSP to award MCM scholarships of the Institute.
(b) Recommendations of $49^{\text {th }}, 50^{\text {th }}$ and $51^{\text {st }}$ meeting of IRC.
(1) The non-compliance of admission requirements by the provisionally admitted P.G. and Ph. D. Students 2021. (Item No.: 49.2.1, 49th IRC dt: 15.09.2021)
(2) The seat matrix for Ph. D. admission in Departments /Centres in Spring Semester 2021-2022. (Item No.: 49.2.2, 49th IRC dt: 15.09.2021)
(3) The proposed Minimum Educational Qualification (MEQ) for admission in Ph . D. programme in the following Departments/Centres:

1. Department of Biosciences and Bioengineering:

## 2. Department of Chemical Engineering:

## 3. Department of Earth Sciences:

(Item No.: 49.2.3, 49th IRC dt: 15.09.2021)
(4) The recommendation of Centre for Artificial Intelligence and Data Science (CAIDS) to start the Ph. D. programme w.e.f. Spring Semester 2021-2022. (Item No.: 49.2.5, 49 th IRC dt: 15.09 .2021 )
(5) The request of several Ph. D. students (through their SRC recommendations) for approval of their course registration after the Senate approved date i.e. 09/08/2021. (49th IRC dt: 15.09.2021 and $50^{\text {th }}$ IRC dt: 29.10.2021) Items No.: 49.2.6 and 50.2.4 respectively.
(6) The recommendations received from the various Departments/ Centres to create second list in the admission to Ph . D. programme at the time of selection. (Item No.: 50.2.1, $50^{\text {th }}$ IRC dt: 29.10.2021)
(7) The mercy appeal of Ms. Meenal Gupta (20916013), ExPh. D. student, Department of Humanities and Social Sciences for reinstatement of academic registration. (Item No.: 50.2.3, $50^{\text {th }}$ IRC dt: 29.10.2021)
(8) The modifications in the seat matrix approved in the 49th IRC meeting. (Item No.: 50.3.1, 50 th IRC dt: 29.10.2021)
(9) The conduct of Ph. D. viva-voce examination for three students, which are pending for more than a year. (Item No.: 50.3.2, $50^{\text {th }}$ IRC dt: 29.10 .2021 )
(10) The mercy appeals of P.G. and Ph. D. students, whose academic registration have been cancelled due to nonsubmission of remaining mandatory documents, required for admission in P.G. and Ph. D. programme in Autumn semester 2021-2022. (Item No.: 51.2.1, 51 st IRC dt: 10.11.2021)
(11) The IRC in its $51^{\text {st }}$ meeting held on November 10, 2021 recommended the proposal for MoU between IIT Roorkee and Chang Gung University, Taiwan for a Dual Doctoral Degree Programme.

## (c) Recommendation of IAPC

1. Requests of students regarding addition/change of course(s) after the last date: (Item No.: 110.2.1, 110 th IAPC dt: 28.08.2021)
2. Shifting of ESN-526: Field Training for M.Sc. (Applied Geology) to Spring Sem 2021-22 of Department of Earth Sciences. (Item No.: 110.2.5, $110^{\text {th }}$ IAPC dt: 28.08.2021)
3. 2nd mercy appeal of Mr. Pratik Pralhadrao Panzade (Enr. No. 20510013) M.Arch. (AR), I Yr for name restoration. (Item No.: 110.3.2, 110th IAPC dt: 28.08.2021)
4. Criteria for tie breaking while preparing merit list in M.Sc. BT admission:

1st Criterion -
a) Percentage/ CGPA obtained in the qualifying examination. A higher percentage/CGPA obtained in the qualifying examination would be given preference.
b) In case of tie with a result awaited candidate, preference would be given to the candidate with the result completed in the qualifying examination.

## 2nd Criterion -

Date of birth. Preference to a person with earlier date of birth will be given. (Item No.: 111.2.1, $111^{\text {th }}$ IAPC dt: 22.09.2021)
5. Merging of existing courses of Department of Humanities and Social Sciences on Communication Skills (HSN-001A and HSN-001B) as HSN-001:

Communication Skills for B.Tech. 1st year. (Item No.: 111.2.4, $111^{\text {th }}$ IAPC dt: 22.09.2021)
6. Shifting of ECN-597: Microelectronics Lab-2 and ECN598: Simulation Lab-2 of Deptt. of E\&CE from Spring Sem 2020-21 to Autumn Semester 2021-22. (Item No.: $111.2 .6,111^{\text {th }}$ IAPC dt: 22.09 .2021 )
7. Shifting of BMN-601: Business Simulation from Capstone of Deptt. of Management Studies from Term 5 to Term 7. (Item No.: 111.2.8 (1), $111^{\text {th }}$ IAPC dt : 22.09.2021)
8. UG seat matrix for session 2021-22. (Item No.: 111.3.1, $111^{\text {th }}$ IAPC dt: 22.09.2021)
9. Requests of students regarding name restoration. (Item No.: 112.2.1, $112^{\text {th }}$ IAPC dt: 27.10.2021)
10. Conversion of 'BT-603: Critical Analysis of Classical Papers' of Deptt. of Biosciences \& Bioengineering as a 'Seminar' course for M.Sc. BT program. (Item No.: $112.2 .3,112^{\text {th }}$ IAPC dt: 27.10.2021)
11. Mode of conducting ETE of Autumn Semester 2021-22 for all students (excluding UG I Yr). (Item No.: 112.2.4, $112^{\text {th }}$ IAPC dt: 27.10.2021)
12. Request of Md. Sameer Ansari (En. No. 20544001), M. Tech. (Industrial Metallurgy), II Year of Deptt. of Metallurgical and Materials Engineering to delete an extra PEC (MTN-517: High Temperature Materials) of Autumn Sem 2020-21. (Item No.: 112.2.5, 112 ${ }^{\text {th }}$ IAPC dt: 27.10.2021)
13. Academic calendars for UG I Yr (2021-22) \& Spring 2021-22 for all other than MBA, MSc (BT) and UG YearI. (Notification dated 30.10.2021)
14. Academic calendars for MBA Term 3, 4, 7 \& 8 and M.Sc. BT I Yr Spring Sem 2021-22. (Notification dated 26.11.2021)

The above is reported to the Senate.

# भारतीय प्रौद्योगिकी संस्थान रूड़की 

रूड़की - 247667 (भारत)
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE ROORKEE - 247667 (INDIA)


सीनेट की नवासीवीं बैठक हेतु अनुपूरक कार्य सूची SUPPLEMENTARY AGENDA FOR THE 89 ${ }^{\text {th }}$ MEETING OF THE SENATE

बैठक सं०
MEETING NO.
स्थान
VENUE :
दिनांक :
DATE :
समय :
TIME :

नवासीवीं
$89^{\text {th }}$
सीनेट हॉल, भा०प्रौ0सं०रूड़की
Senate Hall, IIT Roorkee
09 दिसम्बर 2021
09 ${ }^{\text {th }}$ December 2021
04.00 बजे अपरान्ह
04.00 P.M.

# भारतीय प्रौद्योगिकी संस्थान रूड़की <br> INDIAN INSTITUTE OF TECHNOLOGY ROORKEE रूड़की 247667 <br> ROORKEE - 247667 



## अनुपूरक कार्यसूची/SUPPLEMENTARY AGENDA

| मुद्दा सं०/ <br> Item No. | विवरण/Particulars | पृष्ठ/ |
| :--- | :--- | :--- |
| Page(s) |  |  |
| 89.11 | भारतीय प्रौद्योगिकी संस्थान रूड़की में पीएचडी कार्यक्कम में प्रवेश के लिए <br> महिला उम्मीवारों के लिए एक विशेष योजना, शकुंतला (प्रतिभा के तहत <br> ज्ञान के उम्मीदवारों के लिए योजना) फैलोशिप के प्रस्ताव पर विचार करना। <br> To consider the proposal of SAKUNTALA (Scheme for <br> Aspirants of Knowledge Under TAlent Advancement) <br> Fellowship, a special scheme for female candidates for <br> admission in Ph. D. programme at IIT Roorkee. | $52-53$ |
| 89.12 | संस्थान भर के सभी संबंधित विभागों के लिए एमएससी से पीएचडी <br> स्वीचओवर कार्यक्रम के लिए गठित समिति की संशोधित रिपोर्ट पर विचार <br> करना। <br> To consider the revised report of the committee <br> constituted for Switchover Programme from M.Sc. to <br> Ph.D. for all the concerned Departments across the <br> Institute. | 54-56 |
| 89.13 | इच्छुक परास्नातक और पीएचडी को ऑडिट पाठयक्रम के रूप में एक मुक्त <br> वैकल्पिक पाठयक्रम प्रदान करने के प्रस्ताव पर विचार करना। <br> To consider the proposal to offer an Open Elective <br> Course to interested Masters and Ph.D. students as an <br> AUDIT Course. | $57-59$ |
| 89.14 | वर्चुअल एकेडमिक सेंटर अर्थात "सेंटर फॉर फोटोनिक्स एंड क्वांटम <br> कम्युनिकेशन टिक्नोलॉजी (CPQCT) की स्थापना के प्रस्ताव पर विचार <br> करना। <br> To consider the proposal regarding establishment of a <br> virtual academic centre namely "Centre for Photonics <br> and Quantum Communication Technology" (CPQCT). | 60-66 |


| 89.15 | अनुप्रयुक्त विज्ञान (एपलाइड सांइस) एवम् अभियांन्त्रिकी विभाग के <br> निम्नलिखित प्रस्तावों पर विचार करना। <br> 1. अनुप्रयुक्त विज्ञान एवम् अभियान्त्रिकी विभाग का नाम बदलकर <br> अनुप्रयुक्त गणित और वैज्ञानिक कंप्यूटिंग विभाग करना। <br> "अनुप्रयुक्त गणित और वैज्ञानिक कप्यूटिंग" में एम.टेक. कार्यकम शुरू करने के साथ इसके पाठयक्रम संरचना और प्रवेश प्रकिया पर विचार करना। <br> To consider the following proposals of Department of Applied Science and Engineering: <br> 1. To rename the Department of Applied Science and Engineering as Department of Applied Mathematics and Scientific Computing. <br> 2. To introduce a M.Tech. Program in 'Applied Mathematics and Scientific Computing' along with its course structure and admission procedure. | 67-75 |
| :---: | :---: | :---: |
| 89.16 | सत्र 2022-23 से एसएससी गणित की संशोधित संरचना लागू किये जाने पर विचार करना। <br> To consider the revised structure of M.Sc. Mathematics to be implemented from session 2022-23. | 76-81 |
| 89.17 | डिजाइन विभाग के एमआईएम कार्यक्रम में प्रवेश के लिए पात्रता मानदंड में संशोधन पर विचार करना। <br> To consider the revision in the eligibility criteria for admission to MIM programme of the Department of Design. | 82 |
| 89.18 | जल संसाधन विकास एवं प्रबंधन विभाग द्वारा "पीने के पानी और स्वच्छता" पर एम.टेक कार्यक्रम शूरू करने के साथ इसकी प्रस्तावित संरचना और प्रवेश प्रक्रिया के प्रस्ताव पर विचार करना। <br> To consider the proposal of Department of Water Resource Development and Management to introduce M.Tech. programme on "Drinking Water and Sanitation" along with its proposed structure and admission process. | 83-90 |
| 89.19 | शैक्षणिक वर्ष 2022-2023 में यूजी कार्यकमों के लिए संशोधित सीट मैट्रिक्स पर विचार करना। <br> To consider the revised seat matrix for UG programs in the academic year 2022-2023. | 91-92 |
| 89.20 | अध्यक्ष, सीनेट द्वारा दी गई मंजूरी को रिपोर्ट करना। <br> To report the approvals accorded by the Chairman, Senate | 93 |

Item No. 89.11 To consider the proposal of SAKUNTALA (Scheme for Aspirants of Knowledge Under TAlent Advancement) Fellowship, a special scheme for female candidates for admission in Ph. D. programme at IIT Roorkee.

It has been observed that the admission of female students in the Ph . D. programme is comparatively lower than the male students. The details of gender wise break ups of the existing Ph.D. students in the institute are given below:

| Stream | Male | Female | Ratio (\%) |
| :--- | :--- | :--- | :--- |
| Engineering | 1237 | 436 | 35 |
| Non-engineering | 615 | 401 | 65 |

Male-female student ratio is often an important input for many government/non-government agencies for formulating policies. This is an important input for various institutional ranking systems as well. In this regard, a special scheme for Ph. D. admission for female candidates under full-time category is proposed. The IRC, in its $52^{\text {nd }}$ meeting held on Dec.01, 2021, recommended the proposal with the following details:

## MEQ:

Any female candidate having B.Tech./B.E./B.Arch./ B.Des. degree from National Institute of Technology (NIT) with CGPA $\geq 9.0$ in the 10 -point scale will be eligible for direct admission to Ph.D. programme in the relevant disciplines. The requirement of GATE/CEED/National Level examination will be waived-off for such candidates.

## Seats:

Seats in the above scheme will be over and above the sanctioned intake.

## Fellowship:

At par with the Institute Assistantship.

## Name:

The name of the above scheme is proposed as "SAKUNTALA (Scheme for Aspirants of Knowledge Under TALent Advancement) Fellowship" and the students enrolled under the scheme will be known as SAKUNTALA Fellows.

The IRC, in its $52^{\text {nd }}$ meeting held on November 30, recommended the following:

1. MEQ: Any female candidate having B.Tech./B.E./B.Arch./B.Des. degree from Indian Institute of Technology (IIT) / National Institute of Technology (NIT) with CGPA $\geq 9.0$ in the 10 -point scale will be eligible for admission to Ph.D. programme in the relevant disciplines. The requirement of GATE/CEED/National Level examination will be waivedoff for such candidates.
2. Selection: The concerned department/centre will assess (SOP/Interaction regarding research area) the candidature of the applicants and send the recommendations to the AAO without written test and/or interview.
3. Seats: Seats in the above scheme will be over and above the targeted/ sanctioned intake.
4. Fellowship: At par with the Institute Assistantship. In addition to this, a contingency amount of Rupees One Lakh per annum (up to five years) will be given to the Fellows.

The above is submitted for the consideration and approval of the Senate.

Item No. 89.12 To consider the revised report of the committee constituted for Switchover Programme from M.Sc. to Ph.D. for all the concerned Departments across the Institute.

Presently, IIT Roorkee has provision only for its IDD/IMT/MURP/M.Arch./ M.Tech. students to switchover to Ph.D. programme. This provision is offered to the students with CGPA 8.5 and above after completing first two semesters of Masters programme or after completing all theory courses of IDD/IMT. (Senate Item No.78.11, Clause R. 1.0 c ). However, such provision does not exist for our M.Sc. students.

It is stated that the Department of Physics recommended switchover of its five students from M.Sc. to Ph.D. programme. Following the deliberations, the Chairman-IAPC constituted a committee (IAPC Item No. 88.3.1, dated 30/31.7.2020) comprising of the following members to submit a report:

1. Prof. U.P. Singh, Chemistry - Chairman
2. Prof. S.K. Gupta, Mathematics - Member
3. Prof. P. Jeevanandam, Chemistry - Member
4. Prof. N.P. Pathak, E\&CE - Member

The Report of the Committee was considered in the IAPC meetings ( $95^{\text {th }}$ and $112^{\text {th }}$ ) held on 9.12.2020 and on 27.10.2021, respectively. The IAPC recommended that if a student opts to exit after $4^{\text {th }}$ semester, the student should complete all the requirements for M.Sc. degree (including project etc.) for award of M.Sc. Degree.

Further, the IAPC referred the proposal to IRC as most of the clauses are related to Ph.D.

The $50^{\text {th }}$ IRC, in its meeting held on 30.11.2021, considered the revised report of the Committee (Appendix A) and recommended it with the following suggestions:

1. IITR can give fellowship to the selected candidate without valid GATE/NET w.e.f. the date of switchover from M.Sc. to the Ph.D. programme.
2. If for any reason, at the end of fourth semester, and thereafter, a student does not want to continue in the switchover programme, the Institute can award him/her regular M.Sc. degree subject to he/she earns the total credit requirements for the M.Sc. degree.

The above is submitted for the consideration of the Senate.

# Appendix - A <br> Item No. Senate / 89.12 

After receiving the comments from IAPC members (Prof. Tanuja Srivastava, Mathematics, and Prof. C. N. Ramchandran, Associate Dean, Academic Affairs), a meeting related to Switchover program from M.Sc. to Ph.D. was held via Webex on August 24, 2021. The following guidelines for the switchover are suggested:

1. The students at the end of M.Sc. third semester will apply against an advertisement from the Institute for the switchover from M.Sc. to Ph.D. program.
2. The CGPA of the applicant should be 8.5 or above at the end of third semester.
3. IIT Roorkee can give fellowship to the selected candidate without valid GATE/NET w.e.f. the date of switchover from M. Sc. to the Ph. D. programme.
4. Selection of candidates for the switchover program shall be through extended DRC where all faculty members can participate. The mode of selection of the candidates may be decided by the DRC. A candidate who is applying under this program may give consent of his/her supervisor(s) at the time of selection process. A Ph.D. supervisor shall be allotted to him/her and SRC must be formed which decides about the courses that need to be completed.
5. The selected candidate should take Pre-Ph.D. courses in the fourth semester of the M.Sc. program in order to meet the credit requirements for Ph.D. program. The minimum credit requirements for the candidates admitted under this program shall be less than the normal candidates joining Ph.D. program in the Institute under regular admission process. The suggested minimum credit requirement for the candidate is 8 (in addition to the mandatory seminar ( 2 credits)). However, the SRC may recommend additional credit requirements for the student based on the research area and background of the student.
6. The minimum CGPA at the end of fourth semester shall be 8.5. If it is less than the minimum CGPA, the student has to take extra courses as suggested by the SRC to maintain the CGPA.
7. After completion of four semesters, the candidate can appear for the comprehensive exam if he/she fulfills the credit requirements and if declared successful in the comprehensive examination can present his/her research proposal for the completion of candidacy.
8. After the completion of candidacy, the candidates admitted under the switch over program will be treated on par with the candidates who were admitted under regular admission process with respect to Ph.D. regulations of the institute.
9. If for any reason, at the end of fourth semester and thereafter, a student does not want to continue in the switchover programme, the Institute can award him/her regular M.Sc. degree subject to he/she earns the total credit requirements for the M.Sc. degree.

Item No. 89.13 To consider the proposal to offer an Open Elective Course to interested Masters and Ph.D. students as an AUDIT Course.

In the last few years, students have shown interest in India's contribution to Mathematics, Science, and other relevant topics by organizing various workshops, seminars and other activities at the Institute. A number of faculty members across the departments have also expressed their enthusiasm and contributed to design a course titled 'Introduction to Sanskrit Based Knowledge Systems'. This course would provide an overview of Sanskrit based Indian knowledge systems in domains such as mathematics, science, management, humanities, and social sciences. This course is also in line with the greater objectives of New Education Policy to promote diverse subjects specially related to Indian contribution to different knowledge systems.

The IAPC, in its $113^{\text {th }}$ meeting held on 24.11.2021, approved the course for the UG students as an Open Elective Course (OEC). The course will be offered by the Department of Humanities and Social Sciences. The syllabus of the course is placed as (Appendix-A).

In addition, considering the type and contents of the course, the IAPC recommended that the course be made open to interested Masters and Ph.D. students also as an AUDIT Course.

The above is submitted for the consideration and approval of the Senate.

## Appendix - A

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Humanities and Social Sciences

1. Subject Code: IHS-325 Course Title: Introduction to Sanskrit based Knowledge Systems
2. Contact Hours:

L: 3
T: 0
P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weightage: CWS: 20-35 PRS: 0 MTE: 20-30 ETE: 40-50 PRE: 0
5. Credits: 3
6. Semester: Both
7. Subject Area: OEC
8. Pre-requisite: NA
9. Objective: The course aims to familiarize students with Sanskrit based knowledge systems and their role in advancement of science and technology.

## 10. Details of the Course

| S.No. | Contents | Contact <br> hours |
| :---: | :--- | :---: |
| 1. | Overview: Classification of Indian texts; various specializations and leading <br>  <br> conversation. | 2 |
| 2. | Basic Sciences: Introduction of astronomy in India, Overview of Surya Siddhanta, <br> Parasharatantra, Tantrasangraha and the recent developments based on Sanskrit <br> based texts; Indian Mathematics an overview, Development of calculus in India, <br> Trigonometry and spherical geometry, Magic squares; An introduction to biology, <br> anatomy, ayurveda as discovered and practiced in India from ancient to modern <br> times. | 14 |
| 3. | Architecture: Introduction of Practice of Traditional Architecture and Planning <br> (Vaastushastra), Topics covered in Vaastushastra as per ancient treatises in <br> Vaastushastra, Prescriptions for residential Vaastushastra, City planning as per <br> vaastushastra. | 6 |
| 4. | Management and Governance: Leadership and Motivation, Planning and <br> Organizing, Financial Management, Concept of Manager in Indian Knowledge <br> System. | 6 |
| 5. | Philosophy and Psychology: Rasa Siddhanta (Theory of Emotions), Natyashastra, <br> Introduction to six Indian philosophical systems (Shad Darshans), Indic perspective <br> on philosophical foundations of modern world. Pānini's contribution to linguistics. | 8 |
| 6. | Human Development: Introduction to Ashtanga Yoga for human development, <br> Fundamentals of Bhagavad Geeta teachings for proper human living. | 6 |
|  | Total | $\mathbf{4 2}$ |

11. Suggested Books:

| S.No. | Name of Authors/Book/Publisher | Year of <br> Publication /Reprint |
| :---: | :--- | :---: |
| 1. | Yoga System of Patanjali, J. H. Woods, Bharatiya Kala Prakashan | 2009 |
| 2. | Indian Philosophy - Vol I and II, S. Radhakrishnan, Oxford <br> University Press. | 2009 |
| 3. | Mayamatam - Indian Treatise on Housing, Architecture and <br> Iconography (2 volumes), Bruno Daegens, Indira Gandhi National <br> Centre for Arts. | 2007 |
| 4. | Natyasastra: Sanskrit Text With Transliteration, M. Ghosh, <br> Chaukhamba Surbharati Prakashan. | 2020 |
| 5. | Vedanta and Management: Relevance of Vedantic Concepts in <br> Modern Management Practices, N. V. Dave, Deep \& Deep. | 2002 |
| 6. | Tantrasañgraha with Detailed Mathematical Explanatory Notes, K. <br> Ramasubramanian, M. S. Sriram, Hindustan Book Agency. | 2011 |

## Item No. 89.14 To consider the proposal regarding establishment of a virtual academic centre namely "Centre for Photonics and Quantum Communication Technology" (CPQCT).

The IAPC in its $114^{\text {th }}$ meeting considered a proposal to establish a virtual academic centre namely - "Centre for Photonics and Quantum Communication Technology" (CPQCT) with joint efforts of faculty members working in the Departments of Physics and Electronics and Communication Engineering. It is stated that the Photonics and Quantum Communication Technology has been identified as one of the focused domains under the National Mission on Quantum Technologies and Applications in India. Establishment of the proposed centre will be beneficial on multiple aspects including facilitating development of new academic programs in the area and boosting interdisciplinary research using complementary expertise. Further details are provided in the (Appendix-A).

The IAPC, in its $114^{\text {th }}$ meeting held on 01.12.2021, recommended the proposal to establish a virtual academic centre.

The above is submitted for the consideration and approval of the Senate.

# Appendix-A Item No. Senate / 89.14 

## A proposal for the formation of "Centre for Photonics \& Quantum Communication Technology - CPQCT"

## Background

Photonics and Quantum Technology have emerged as very important technologies with enormous opportunities in research and development. Quantum technology encompasses quantum communication, quantum computing and quantum sensors, where photonics is a natural and major contributor. Quantum communication has come a long way from experimental demonstration of quantum cryptography for secure telecommunication over 1 km long optical fibers in 1993 in Geneva to world's first integrated quantum communication network combining 700 optical fibers and 2 ground-to-satellite links covering a total distance of 4600 km in China in 2021. In March 2021, Indian Space Research Organization (ISRO) has successfully demonstrated free-space quantum communication through an optical wireless communication link. The demonstration has included live video conferencing using quantum-key-encrypted signals. This is a major milestone achievement for unconditionally secured satellite data communication using quantum technologies. The idea of quantum computing gained impetus in 1980s. Afterwards, one of the major breakthroughs was the discovery of Shor's algortihm in 1993 where it was demonstrated that the prime factorization problem can be solved in polynomial time complexity with a quantum computer. That sparked a plethora of research in quantum algorithms. In 1999, David P. DiVincenzo proposed a criterion that a physical system need to follow in order to be a successful candidate for realizing qubits. After IBM's release of first commercial quantum computer in 2019, research on development of quantum computer has become a race among various countries and corporations. On quantum sensing front, its applications could become commercially or militarily ready within the next few years. Some of the primary applications for quantum sensing include position, navigation, and timing and possibly intelligence, surveillance, and reconnaissance.

## National Status

Owing to importance and interdisciplinary nature of these technologies, government has taken an initiative in this direction and has allocated Rs. 8000 Cr under the National Mission on Quantum Technologies and Applications, where four domains of quantum technology have been identified as (i) Quantum Communication, (ii) Quantum Simulation, (iii) Quantum Computation and (iv) Quantum sensing and metrology (https://www.psa.gov.in/technology-frontiers/quantum-technologies/346). The applications of these technologies are quite diversified which include high speed secure telecommunication using photonic and mobile networks, high speed computation, superfast simulations of very
complex systems, and sensors for civil and defense applications. As per the concept note by TIFAC on national Mission on Quantum Technology \& Applications the identified national gap areas are (i) lack of resources at undergraduate and graduate level, (ii) need for increased university level adoption, and (iii) need for building technical infrastructure to advance quantum technologies. In India there are already some dedicated centres for carrying out research, development and academics in quantum allied fields in several academic Institutes and Universities, which include RRI Bangalore, IIT Madras, IISc Bangalore, IIT Bombay, TIFR Mumbai, and IISER Pune. It is high time and immediate need for IIT Roorkee to catch up with these Institutes and start focused research and academic programs in such an important area. Creation of the proposed centre is one such step in this direction.

## Existing expertise and resources

At IIT Roorkee several faculty members having complementary expertise are contributing to the area of Photonics and Quantum Technology. There has already been a collaboration among some faculty members from different departments having complementary expertise. This collaboration has been in the form of joint doctoral guidance and collaborative externally and internally funded research projects. SMILE project on high end infrastructure for simultaneous/complementary measurements of RF and Photonic devices brought together several faculty members from Physics, Electronics \& Communication, and Computer Science \& Engineering Departments. Some of the externally funded collaborative projects are:
(a) Indo-Russian project on optical fibers for high power lasers that included Prof. Vipul Rastogi as a PI, Professor Nagendra P. Pathak and Prof. Rajesh Kumar as CoPls.
(b) Multilateral BRICS projects called ERSPIC (Energy -efficient reconfigurable silicon photonic integrated devices and circuits for optical interconnects) is being carried out by Professor Rajesh Kumar as a PI, and Prof. Vipul Rastogi as a Co-PI.
(c) GIAN course on "High Speed Optical Transmitters for Optical Interconnects" was organized in October 2018 by Professor Rajesh Kumar, as a host faculty and Prof. Vipul Rastogi as a co-host faculty.
(d) Prof. Ajay Wasan and his group has been working in the area of quantum optics. His group is working on achieving Rydberg atoms using these trapped neutral Rb atoms. The quantum states of these trapped Rydberg atoms will be manipulated for the realization of CNOT gates which is an initial stage towards achieving a scalable Quantum Computer. The DST has sanctioned a grant of Rs. 7.13 crore to achieve quantum gates under their QuEST program. Prof. Wasan is also involved in teaching Quantum Computing course to our BTech students for the last ten years.
(e) Microsoft has been helping IITR by providing their quantum computing experts for the last four years. These experts demonstrate their QuantumKatas programming exercises aimed at teaching the elements of quantum computing and Q\# programming at the same time. They cover mainly the quantum algorithms that are covered in the regular class lectures.
(f) A recently sanctioned REVAMPERS project (from DST) lead by Professor Sachin K. Srivastava, Department of Physics in collaboration with CSE Department along with doctors from ILBS Delhi has opened new avenues in the area of Medical Photonics supported with advanced computational techniques. This is also indicative of the importance of establishment of the proposed center, as it has potential for tremendous futuristic research ideas aligned with the priorities of the Govt. of India and hence, funding opportunities.
(g) Existing collaborative activities/projects with DRDO-IRDE (Vipul Rastogi \& Akhilesh K. Mishra) and DRDO-INMAS (Sachin K. Srivastava) will provide opportunities to develop these small projects to joint mega-projects through team effort from the proposed centre for futuristic defense technologies.
(h) Prof. N. P. Pathak has a project on affordable sub millimeter-wave/THz components using 3D printed dielectric integrated guides by ISRO.
(i) International collaboration with University of Calgary under SPARC scheme looks upon measurement and implementation aspects of optical communication systems and their role in 5G/6G communication. Prof. Fadhel Ghannouchi (University of Calgary) and Prof. Meenakshi Rawat (IITR) discussed the limitations and feasible solutions in lecture series organized in Dec. 2019. Prof. Rajesh Kumar has provided device level insight on the optical communications and interconnects.
(j) Prof. Vishvendra S. Poonia and Prof. Akhilesh K. Mishra have recently started working together on device realization for quantum random number generation.

Many faculties involved in this proposal across the Departments have been making joint efforts in terms of supervising the students at various levels and has not been made official. They have close research interactions and already have plans to make their collaboration stronger and official.

## Need for establishing the centre

In view of national gaps identified by TIFAC concept note and rapid coming up of dedicated centres in this field in various academic institutes, there is an immediate need for establishing the proposed centre at IIT Roorkee.

Establishment of the proposed centre (i) will provide a platform for the faculty members with complementary expertise to work together on focused problems requiring interdisciplinary expertise, (ii) will facilitate creation of resources in terms of equipment and manpower required to advance research and development in the field, (iii) will facilitate funding in this very important and emerging area, and (iv) will facilitate development of new academic programs to create skilled manpower in this area. In addition, it will remove difficulties faced in recruiting faculty in this specialized area as the core Departments often face restrictions in recruiting a faculty if his expertise is not in the core discipline or the degrees earned are not from the core Department.

## Vision

The centre envisions that IITR emerges and remains a major player in the research and development of photonics and quantum technology by carrying out frontier research with specific objectives including, but not limited to, development of components, devices and systems for quantum communication, quantum sensors, and algorithms and tools for quantum computing and simulations. The centre also aims at creating skilled manpower required for implementation and advancement of these technologies in industry and academia in India, which would be carried out by running relevant academic programs.

## Mission

## Phase-I

In Phase-I, we plan to carry out the following
(a) Collaborative research by (i) pooling existing resources, (ii) establishment of financial resources by securing funding from government agencies and private companies such as Microsoft, IBM, and HPE etc., (iii) establishment of human resources by faculty recruitment and (joint )doctoral thesis guidance
(b) formulation of MTech program in Photonics \& Quantum Communication and creation of resources to run the programs.
(c) Offering elective courses from the centre to UG and PG students. Some of these courses may be Photonic Information Processing, Quantum Electronics, Advanced Photonics for Communication, Quantum Sensors and Quantum Computing.

## Phase-II

In Phase-II, in addition to continuing collaborative research, continued efforts towards sponsored research, securing funding, and doctoral research, MTech program in Photonics \& Quantum Communication would be opened for admissions.

## Brief description of MTech program to be offered

MTech (Photonics \& Quantum Communication)


#### Abstract

This flagship program of the centre would aim to produce skilled human resource capable of fulfilling county's industrial demands in the domain of emerging technology of quantum communication and allied technologies on quantum information processing, photonics devices and circuits and quantum sensing. One of the prominent features of this program includes the dynamism in terms of the courses to be included at a faster pace due to the unprecedented pace at which Quantum 2.0 will proceed globally. The skillsets imparted will be unique and would help in progressing in forefront research in quantum communication and allied technologies. The program will have courses such as digital signal processing, photonic fabrication and characterization techniques, quantum electronics, quantum photonics, quantum information processing, quantum communication, quantum sources and detectors, terahertz devices and sensors.


## List of contributing faculty members

Following is the list of faculty members who are willing to join hands for the formation of the centre. We expect many more to join once the centre is formed.

1. Arumugam, $\mathbf{P}$ (Physics)
2. Dasgupta, Avirup (Electronics \& Communication)
3. Jaiswal, Anshul (Electronics \& Communication)
4. Kaushik, Brijesh Kumar (Electronics \& Communication)
5. Kumar, Rajesh (Physics)
6. Mishra, Akhilesh Kumar (Physics)
7. Mitra, Anirban (Physics)
8. Pathak, Nagendra Prasad (Electronics \& Communication)
9. Poonia, Vishvendra Singh (Electronics \& Communication)
10. Pramanik, Tanmoy (Electronics \& Communication)
11. Rastogi, Vipul (Physics)
12. Rawat, Meenakshi (Electronics \& Communication)
13. Roy, Sourajit (Electronics \& Communication)
14. Roy, Sudip (Computer Science and Engineering)
15. Srivastava, Sachin Kumar (Physics)
16. Tiwari, Anjani Kumar (Physics)
17. Wasan, Ajay (Physics)

## Conclusion

Fast advancements in the field of Photonics and Quantum Communication Technology, government's initiatives in this direction and rapid embracement of these technologies by sister academic institutes by establishment of dedicated centres, there is a need for IIT Roorkee to make focussed efforts in this direction. To take a step in this direction we propose to create the Centre for Photonics \& Quantum Communication Technology at IIT Roorkee. In view of urgent need to make directional efforts towards carrying out focussed research, development, and creation of skilled manpower in this field, the centre may function in virtual mode to begin with.

## Item No. 89.15 To consider the following proposals of Department of Applied Science and Engineering:

## 1. To rename the Department of Applied Science and Engineering as Department of Applied Mathematics and Scientific Computing.

## 2. To introduce a M.Tech. Program in 'Applied Mathematics and Scientific Computing' along with its course structure and admission procedure.

The Department of Applied Science and Engineering (DASE) was formed in the year 2012 at Saharanpur mainly to support the other departments - the Department of Pulp and Paper Technology and the Department of Polymer and Process Engineering at the campus. Presently, the Department is offering doctoral degree program only. The Department has faculty members with expertise in Applied Mathematics and Computing and, therefore, has potential to contribute more to the Institute.

A committee was constituted by the Director on Aug 04, 2021 for the academic restructuring of the Department. The report of the committee w.r.t. the above proposals is placed as (Appendix-A).

The committee, after due deliberations, suggested that an academic degree program be offered by the Department. Renaming of the existing name Department was also suggested as the present name is too generic in nature.

The IAPC, in its $114^{\text {th }}$ meeting held on 01.12.2021, considered the proposals of the Department of Applied Science and Engineering and recommended as under:

1. The Department of Applied Science and Engineering be renamed as 'Department of Applied Mathematics and Scientific Computing'.
2. The IAPC recommended the proposal to introduce M.Tech. Program in 'Applied Mathematics and Scientific Computing'.
3. Modified structure of the M.Tech. Program 'Applied Mathematics and Scientific Computing’ as placed at (Appendix -B).
4. Admission process for the M.Tech. Program 'Applied Mathematics and Scientific Computing' as placed at (Appendix- C).

The above is submitted for the consideration and approval of the Senate.

# Appendix - A Item No. Senate / 89.15 

## Report on the academic restructuring of Department of Applied Science and Engineering, Saharanpur Campus of IIT Roorkee

The following committee was constituted by the Director on August 4, 2021 for the academic restructuring of the Department of Applied Science and Engineering at the Saharanpur Campus of IIT Roorkee:

| Deputy Director | Chairperson |
| :--- | :--- |
| Dean, SRE Campus | Member |
| Dean, SRIC | Member |
| Head, PPE | Member |
| Prof. Dharam Dutt, PT | Member |
| Prof. Sanjay Palsule, PPE | Member |
| Prof. SC Sharma, PT | Member |
| Prof. VC Srivastava, CH | Member |
| Prof. Kaushik Ghosh, CY | Member |
| Prof. R Balasubramanian, CSE | Member |
| Prof. GD Verma, PHY | Member |
| Prof. Rajan Arora, ASE | Member |
| Prof. Jaydev, ASE | Member |
| Prof. Millie Pant, ASE | Member |
| Prof. Y.S. Negi, PPE | Member |

Terms of Reference:
(a) Propose academic programs to be run by the department of ASE.
(b) Accordingly, propose an appropriate name for ASE.

## Report:

The first meeting of the committee was held on August 6, 2021. The members discussed the status of the Department of Applied Science and Engineering (DASE), formed in the year 2012 and serving as a 'service department' for the Department of Pulp and Paper Technology and the Department of Polymer and Process Engineering, the other two departments of the campus. Presently, the only degree program being offered by DASE is PhD. More importantly, no faculty has been hired in DASE since its inception in 2012, hindering the growth of the department.
Deliberating on the terms of reference, it was suggested that there should be an academic degree program, besides PhD, offered by DASE according to the competence of its faculty members. Further, it was observed by the members that the present name of the department is too generic in nature which is not able to echo its vision and mission properly.
At present all the three faculty members of DASE have expertise in the areas of mathematics including computational and applied mathematics and it was felt that this aspect should be reflected in the name of the department showcasing a focused approach that is able to generate interest not only among the prospective students but is also able to attract competent faculties towards the program. Thereby promoting the growth and development of the primary stakeholders viz. students and teachers and the Institute as a whole.
It was also debated that the structure of the new course should be such that it is able to generate sufficient employment opportunities for the prospective students.

## DAB



## The committee made the following recommendations:

1. The Department of Applied Science \& Engineering be renamed as Department of Applied Mathematics \& Scientific Computing.
2. The name to start the new M.Tech. Program shall be Applied Mathematics \& Scientific Computing.
A sub-committee was constructed on November 14, 2021 to develop a course structure and to formulate some eligibility criteria on the basis of the recommendations made by the core sub-

| Prof. Millie Pant | Coordinator |
| :--- | :--- |
| Prof. Balasubramanyam | Member |
| Prof. Jaydev | Member |
| Prof. Kusumdeep | Member |
| Prof. Rajan Arora | Member |
| Prof. RK Pandey | Member |
| Prof. Sanjeev Kumar | Member |
| Prof. SK Gupta | Member | committee. The committee consisted of the following members:

The sub-committee placed the proposal before the core-committee on November 19, 2021 and it was suggested that:
(A) There will be 7 core courses (PCC), including seminar and 5 elective courses The list of core courses finalized by the members is as follows:

1) Stochastic processes
2) Computational Differential Equations
3) Numeric Linear Algebra (PCC)
4) Data Structures and Algorithms
5) Programming Lab
6) Optimization Techniques
7) Seminar

Out of the seven PCCs, 5 will be running in the first semester and 2 will be running in the second semester. The electives will be segregated into three baskets viz. computational mathematics, decision making and operations research, data science and artificial intelligence. The student will have to take at least one course from each basket.
(B) The eligibility criteria for admission in the program shall be:

1) B. Tech./ BE in CS, Electrical, Electronics, Information Technology, Mechanical, Industrial, Chemical, Engineering Physics or equivalent
2) 4 years BS program in Mathematics, Mathematics and Computing, Statistics, Physics or equivalent
3) MSc in Mathematics, Statistics, Physics, Operations Research, MCA

## Employment opportunities:

The proposed course structure is an integration of areas like Computational and Industrial Mathematics, Statistics, Data Science and Artificial Intelligence in a collaborative manner. The placement opportunities for the graduates of this course are likely to be in the following areas:
a. Higher studies
b. Scientific labs
c. Data driven industries

The proposed course structure is attached as Annexure 1.


उप द्यिशक


Detailed Syllabic can be prepared if the Institute decides to go ahead with the proposed M. Tech. program.

## Recommendations and concluding remarks

1. M. Tech. degree program by the name M. Tech. in Applied Mathematics \& Scientific Computing may be initiated.
2. The Department of Applied Science \& Engineering may be renamed as Department of Applied Mathematics \& Scientific Computing.
3. The eligibility criteria for admission in the program shall be:
a. B.Tech./ BE in CS, Electrical, Electronics, Information Technology, Mechanical, Industrial, Chemical, Engineering Physics or equivalent
b. 4 years BS program in Mathematics, Mathematics and Computing, Statistics, Physics or equivalent
c. MSc in Mathematics, Statistics, Physics, Operations Research, MCA


(Member)





उप निद्षेशक
Deputy Director
भा० प्रौ० सं०
1.1.T. Roorkee

Appendix－B
Item No．Senate／ 89.15
Appendix－B
DEPARTMENT OF APPLIED MATHEMATICS AND SCIENTIFIC COMPUTING INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
$\begin{array}{lll}\text { Program Code：} & \text { XXX } & \text { M．Tech．（Applied Mathematics and Scientific Computing）} \\ \text { Department：} & \text { AMS } & \text { Department of Applied Mathematics and Scientific Computing } \\ \text { Year：} & \text { I } & \end{array}$

| Teaching Scheme |  |  |  |  | ContactHours／Week |  |  | $\begin{gathered} \text { Exam } \\ \text { Duration } \end{gathered}$ |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\dot{\dot{z}} \dot{\dot{\sim}}$ | Subject Code | Course Title |  | \％ | L | T | P | 或 | 或 | $\sum_{u}^{\infty}$ | $\frac{n}{x}$ | $\sum_{E}$ | 弐 | 徃 |
| Semester－I（Autumn） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AMS－501 | Stochastic Processes | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | AMS－503 | Numerical Linear Algebra | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | AMS－505 | Data Structures and Algorithms | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | AMS－507 | Programming Lab | PCC | 2 | 0 | 0 | 4 | 0 | 2 | － | 50 | － | － | 50 |
| 5. |  | Program Elective－I | PEC | 3／4 | － | － | － | － | － | － | － | － | － | － |
| 6. |  | Program Elective－II | PEC | 3／4 | － | － | － | － | － | － | － | － | － | － |
|  |  | Total |  | 20／22 |  |  |  |  |  |  |  |  |  |  |
| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AMS－502 | Applied Optimization Techniques | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | AMS－700 | Seminar | SEM | 2 | － | － | － | － | － | － | － | － | 100 | － |
| 3. |  | Program Elective－III | PEC | 3／4 | － | － | － | － | － | － | － | － | － | － |
| 4. |  | Program Elective－IV | PEC | 3／4 | － | － | － | － | － | － | － | － | － | － |
| 5. |  | Program Elective－V | PEC | 3／4 | － | － | － | － | － | － | － | － | － | － |
|  |  | Total |  | 15／18 |  |  |  |  |  |  |  |  |  |  |

DEPARTMENT OF APPLIED MATHEMATICS AND SCIENTIFIC COMPUTING INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
XXX M．Tech．（Applied Mathematics and Scientific Computing）
AMS Department of Applied Mathematics and Scientific Computing II Program Code： Department： Year：

| Teaching Scheme |  |  |  |  | $\begin{gathered} \text { Contact } \\ \text { Hours/Week } \end{gathered}$ |  |  | $\begin{gathered} \text { Exam } \\ \text { Duration } \end{gathered}$ |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\mathbf{Z}} \\ & \dot{\sim} \end{aligned}$ | Subject Code | Course Title |  | （\％ | L | T | P | ？ | 或 | 会 | $\underset{A}{n}$ | $\sum_{2}^{E}$ | 式 | 代 |
| Semester－I（Autumn） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AMS－701A | Thesis Stage－I （to be continued next semester） | DIS | 12 | － | － | － | － | － | － | － | － | 100 | － |
|  |  | Total |  | 12 |  |  |  |  |  |  |  |  |  |  |
| Note：Students can take 1 or 2 audit courses as advised by the supervisor，if required． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | AMS－701B | Thesis Stage－II （continued from III semester） | DIS | 18 | － | － | － | － | － | － | － | － | 100 | － |
|  |  | Total |  | 18 |  |  |  |  |  |  |  |  |  |  |


| Summary |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Semester | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ |  |
| Semester－wise Total Credits | $20 / 22$ | $15 / 18$ | 12 | 18 |  |
| Total Credits | $\mathbf{6 5 - 7 0}$ |  |  |  |  |

Department of Applied Mathematics and Scientific Computing INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

|  | Elective Basket - 1 (Computational Methods) |  | Elective Basket - 2 <br> (Decision making and operations research) |  | Elective Basket - 3 (Data analysis and Machine Learning) |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. No. | Title | Code | Title | Code | Title | Code |
| 1. | Advanced Computational Fluid Dynamics | AMSXXX | Advanced Operations Research | AMSXXX | Machine Learning Methods | AMSXXX |
| 2. | Dynamical Systems | AMSXXX | Evolutionary Algorithms for Optimization | AMSXXX | Data Analysis and Visualization Techniques | AMSXXX |
| 3. | Approximation Theory | AMSXXX | Logistics and Supply Chain Management | AMSXXX | Industrial Applications of ML and AI | AMSXXX |
| 4. | Integral equations and calculus of variations | AMSXXX | Computational Decision Making | AMSXXX | Industrial Internet of Things | AMSXXX |
| 5. | Advanced Transform Techniques | AMSXXX | Quality Management | AMSXXX | Deep Learning * | AID-552 |
| 6. | Discrete Mathematical Structures | AMSXXX | Queuing Theory and Applications | AMSXXX | Digital Image Processing * | AID-553 |
| 7. | Finite Element Method | AMSXXX | Soft Computing Methods | AMSXXX | Computer Vision * | AID-565 |
| 8. | Stochastic Methods in Industry | AMSXXX | Fuzzy Systems with Applications | AMSXXX | Time Series Analysis | AMSXXX |
| 9. | Statistical Inference | AMSXXX | Applied Game theory | AMSXXX | Combinatorial Mathematics | AMSXXX |
| 10. |  | AMSXXX | Multi Criteria and Multi Objective Optimization | AMSXXX | Ethics in Data Science and explainable AI | AMSXXX |

*Will be offered if running in an online mode by the concerned department

## Appendix - C

## Appendix- C

## Proposed Admission Process for M. Tech (Applied Mathematics and Scientific Computing) Program

1. Intake- The intake of the proposed program is as under:-

Presently applied mathematics and scientific computing is not a part of GATE disciplines, but since it is a multidisciplinary program, candidates with valid GATE score in the following disciplines may be considered:

| Discipline | Code | Proposed seats |
| :--- | :--- | :---: |
| Mathematics | MA | 5 |
| Computer Science and Information Technology | CS | 5 |
| Other GATE disciplines |  | 5 |

2. Eligible GATE disciplines for admission

| Discipline | Code |
| :--- | :--- |
| Mathematics | MA |
| Computer Science and Information Technology | CS |
| Statistics | ST |
| Production and Industrial Engineering | PI |
| Electronics and Communication Engineering | EC |
| Chemical Engineering | CH |
| Mechanical Engineering | ME |
| Electrical Engineering | EE |
| Physics | PH |
| Engineering Sciences | XE |

3. MEQ- The proposed Minimum Education Qualifications are as under:-
(i) B.Tech./ BE in CS, Electrical, Electronics, Information Technology, Mechanical, Production and Industrial, Chemical, Engineering Physics or equivalent
(ii) 4 years BS program in Mathematics, Mathematics and Computing, Statistics, Physics or equivalent
(iii) MSc in Mathematics, Applied Mathematics, Statistics, Operations Research, Physics, MCA or equivalent

## Item No. 89.16 To consider the revised structure of M.Sc. Mathematics to be implemented from session 2022-23.

The IAPC, in its $113^{\text {th }}$ meeting held on 24.11.2021, considered the revision in the structure of the existing M.Sc. Mathematics program. The structure modification was necessitated to align the structure with the changes due to introduction of the BS-MS curriculum. The changes include - shifting of courses, changes in course codes and updating the list of electives. The IAPC suggested few modifications in the structure and further deliberations.

The IAPC, in its $114^{\text {th }}$ meeting held on 01.12.2021, considered the revised structure and recommended it as placed at (Appendix-A).

The above is submitted for the consideration and approval of the Senate.
DEPARTMENT OF MATHEMATICS INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Revised Structure (To be implemented from academic session 2022-2023)
613 M.Sc. (Mathematics)
Program Code :
MA Mathematics
Teaching Scheme

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam. Duration (Hrs) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { ه } \\ & \end{aligned}$ | Subject Code | Course Title |  |  | L | T | P | $\begin{aligned} & \text { 구 } \\ & \text { 人} \\ & \text { ò } \end{aligned}$ |  | $\sum_{\infty}^{0}$ | ס | $\frac{3}{n}$ | $\frac{m}{7}$ | \% |
| Semester-I (Autumn) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-401 | Abstract Algebra | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-403 | Introduction to Computer Programming | PCC | 4 | 3 | 0 | 2 | 3 | 0 | 10-25 | 25 | 15-25 | 30-40 | - |
| 3. | MA-405 | Linear Algebra | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-407 | Probability and Statistics | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MA-409 | Real Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MA-411 | Theory of Ordinary Differential Equations | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Total |  |  |  | 24 | 18 | 5 | 2 |  |  |  |  |  |  |  |
| Semester-II (Spring) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-402 | Complex Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-404 | Functional Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-406 | Technical Communication | PCC | 2 |  |  |  |  |  | 100 |  |  |  |  |
| 4. | MA-408 | Theory of Partial Differential Equations | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 5. | MA-410 | Topology | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 6. | MA-ELE | Program Elective-1 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Total |  |  |  | 22 | 17 | 5 | 0 |  |  |  |  |  |  |  |

DEPARTMENT OF MATHEMATICS INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Revised Structure (To be implemented from academic session 2022-2023)
$\begin{array}{lcll}\text { Program Code : } & 613 \text { M.Sc. (Mathematics) } \\ \text { Department } & : & \text { MA } & \text { Mathematics } \\ \text { Year } & : & \text { II } & \\ & & \end{array}$

| Teaching Scheme |  |  |  |  | Contact Hours/Week |  |  | Exam Duration (Hrs) |  | Relative Weight (\%) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Subject Code | Course Title |  | $\begin{aligned} & \frac{0}{2} \\ & \frac{0}{0} \\ & \frac{2}{i} \end{aligned}$ | L | T | P |  | $\begin{aligned} & 0 \\ & 0 \\ & \stackrel{2}{7} \\ & \end{aligned}$ | $\sum_{6}^{0}$ | D | 3 <br> 3 <br> 1 | $\frac{m}{\pi}$ | 另 |
| Semester-III (Autumn) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-501 | Numerical Analysis | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 2. | MA-503 | Operations Research | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-ELE | Program Elective-2 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 4. | MA-ELE | Program Elective-3 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
|  |  |  | tal | 16 | 12 | 4 | 0 |  |  | 20-35 | - | 20-30 | 40-50 | - |
| Semester-IV (Spring) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA-599 | Project | PCC | 8 | - | - | - | - | - | - | - | 30 | 70 | - |
| 2. | MA-ELE | Program Elective-4 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 3. | MA-ELE | Program Elective-5 | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| Total |  |  |  | 16 | 6 | 2 | 0 |  |  |  |  |  |  |  |


| Summary |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Semester | I | II | III | IV |  |
| Credits | 24 | 22 | 16 | 16 |  |
| Total Credits | $\mathbf{7 8}$ | (PEC: 20, PCC: $\mathbf{5 8}$ (including $\mathbf{8}$ credits for Project and 2 credits for Tech. Comm.) |  |  |  |

DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Revised Structure（To be implemented from academic session 2022－2023）
List of the Program Elective Courses M．Sc．（Mathematics）
MATHEMATICS 613
MA

> Teaching Scheme

| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | Exam Duration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{Z} \\ & \dot{\sim} \end{aligned}$ | Subject Code | Course Title |  | N | L | T | P | 交 |  | ¢ | cos | $\stackrel{\text { E }}{\boldsymbol{\Sigma}}$ | Ш | $\underset{\sim}{\text { 山 }}$ |
| Program Elective Courses（Elective－1 to Elective 5）to be chosen in First Year and Second Year |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA－301 | Fluid Dynamics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | MA－411 | Analytic Number Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | MA－412 | Combinatorial Mathematics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | MA－413 | Credit Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. | MA－414 | Differential Geometry | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 6. | MA－415 | Financial Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 7. | MA－416 | Graph Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 8. | MA－417 | Mathematical Image Processing | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 9. | MA－418 | Numerical Optimization | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 10. | MA－419 | Stochastic Calculus | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 11. | MA－511 | Abstract Harmonic Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 12. | MA－512 | Advanced Complex Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 13. | MA－513 | Advanced Matrix Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 14. | MA－514 | Advanced Numerical Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 15. | MA－515 | Advanced Operations Research | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 16. | MA－516 | Advanced Partial Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |


| Teaching Scheme |  |  |  |  | Contact Hours／Week |  |  | Exam Duration （Hrs．） |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{Z} \\ & \dot{\sim} \end{aligned}$ | Subject Code | Course Title |  | N | L | T | P | 交 |  | ¢ | cos | $\stackrel{\text { E }}{\boldsymbol{\Sigma}}$ | Ш | $\underset{\sim}{\text { 山 }}$ |
| Program Elective Courses（Elective－1 to Elective 5）to be chosen in First Year and Second Year |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | MA－301 | Fluid Dynamics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | MA－411 | Analytic Number Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | MA－412 | Combinatorial Mathematics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | MA－413 | Credit Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. | MA－414 | Differential Geometry | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 6. | MA－415 | Financial Risk Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 7. | MA－416 | Graph Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 8. | MA－417 | Mathematical Image Processing | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 9. | MA－418 | Numerical Optimization | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 10. | MA－419 | Stochastic Calculus | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 11. | MA－511 | Abstract Harmonic Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 12. | MA－512 | Advanced Complex Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 13. | MA－513 | Advanced Matrix Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 14. | MA－514 | Advanced Numerical Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 15. | MA－515 | Advanced Operations Research | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 16. | MA－516 | Advanced Partial Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |

Department
DEPARTMENT OF MATHEMATICS INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Proposed Revised Structure (To be implemented from academic session 2022-2023)

| 17. | MA-517 | Algebraic Number Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 18. | MA-518 | Algebraic Topology | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 19. | MA-519 | Approximation Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 20. | MA-520 | Coding Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 21. | MA-521 | Commutative Algebra | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 22. | MA-522 | Computational Fluid Dynamics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 23. | MA-523 | Control Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 24. | MA-524 | Dynamical Systems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 25. | MA-525 | Financial Mathematics | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 26. | MA-526 | Finite Element Methods | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 27. | MA-527 | Fuzzy Sets and Fuzzy Systems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 28. | MA-528 | Hyperbolic Conservation Laws | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 29. | MA-529 | Integral Equations and Calculus of Variations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 30. | MA-530 | Machine Learning in Finance | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 31. | MA-531 | Mathematical Biology | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 32. | MA-532 | Mathematical Cryptography | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 33. | MA-533 | Measure Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 34. | MA-534 | Multivariate Techniques | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 35. | MA-535 | Numerical Linear Algebra | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 36. | MA-536 | Operator Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 37. | MA-537 | Optimal Control Theory | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 |  |
| 38. | MA-538 | Orthogonal Polynomials and Special Functions | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 39. | MA-539 | Portfolio Optimization | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 40. | MA-540 | Regularization Theory for Inverse Problems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |
| 41. | MA-541 | Representation Theory of Finite Groups | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20-35 | - | 20-30 | 40-50 | - |

DEPARTMENT OF MATHEMATICS
Proposed Revised Structure (To be implemented from academic session 2022-2023)

| 42. | MA-542 | Semigroup Theory and Applications | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 43. | MA-543 | Sobolev Spaces and Applications | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |
| 44. | MA-544 | Statistical Inference | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |
| 45. | MA-545 | Stochastic Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |
| 46. | MA-546 | Stochastic Partial Differential Equations | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |
| 47. | MA-547 | Wavelet Analysis | PEC | 4 | 3 | 1 | 0 | 3 | 0 | $20-35$ | - | $20-30$ | $40-50$ | - |

Item No. 89.17 To consider the revision in the eligibility criteria for admission to MIM programme of the Department of Design.

The MIM program is primarily aimed to train mid-level working executives. However, application strata for the program indicate that there are interested candidates who have good academic credentials, but do not have working experience.

In view of the above, the Department of Design has proposed the REVISED eligibility criteria as follows:

| Existing eligibility criteria | Revised eligibility criteria |
| :---: | :---: |
| Any candidate who has | Any candidate who |
| completed graduate | completed graduate degree in |
| degree in any discipline | any discipline with either post- |
| with post-degree | degree experience of 5 years |
| experience of 5 years with | company of repute/ |
| a valid CAT/GMAT/ | government sector/recognized |
| GATE score. | NGO/ education sector OR a |
|  | valid CAT/GMAT/ GATE/GRE |
|  | score. |

The IAPC, in its $114^{\text {th }}$ meeting held on 01.12.2021, recommended the proposal.

The above is submitted for the consideration and approval of the Senate.

Item No. 89.18 To consider the proposal of Department of Water Resource Development and Management to introduce M.Tech. programme on "Drinking Water and Sanitation" along with its proposed structure and admission process.

The Department of Water Resource Development and Management offers Postgraduate Degree programs in Water Resources Development (for Civil, Electrical, and Mechanical Engineers) and in Irrigation Water Management (for Civil, Agricultural Engineers, and Agricultural Scientists). The Department has been hosting in-service engineers from AfroAsian countries through cooperation and support from MEA, Govt. of India under ITEC program for Masters and Ph.D. programs for more than a decade. It has been identified that drinking water and sanitation are the major challenges in the water sector being faced by most of these countries. Accordingly, the Department has proposed a new M.Tech. course (2-year duration) on 'Drinking Water and Sanitation' to disseminate knowledge and to create a research ecosystem in the area.

The IAPC, in its $113^{\text {th }}$ and $114^{\text {th }}$ meetings held on 24.11.2021 and 01.12.2021, respectively, considered the proposal of the Department (Appendix-A) along with its structure and admission process.

The IAPC recommended the following:

1. The IAPC in principle recommended the proposal to introduce M.Tech. programme on "Drinking Water and Sanitation". However, the IAPC recommended that the proposal of P.G. Diploma programme be considered later as per the comprehensive Exit Policy of the institute according to Senate's decision vide Item No. 87.10 as and when formalized.
2. Intake to be 20 for the initial year, which includes 10 seats through GATE and 10 seats under sponsored category.
3. The revised structure as placed at (Appendix-B).

The above is submitted for the consideration and approval of the Senate.

## Appendix - A

## Item No. Senate / 89.18

Minutes of the Departmental Faculty Committee (DFC) meeting held on 08.11.2021 at 4.00 PM in the committee room of the department.

Following members were present:

1. Prof. Chelliah. T.R.
2. Prof. Chandhiran Idhaya
3. Prof. Khare Deepak
4. Prof. Kansal, M.L.
5. Prof. Kasiviswanathan
6. Prof. Mishra. SK
7. Prof. Mohanty Prakash Mohit
8. Prof. Pandey, Ashish
9. Prof. Yadav Basant

Member
Member
Member
Member
Member
Member
Member
Chairman
Member Secretary

1. Confirmation of the minutes of the last meeting held on 02.11 .2021 at $4: 00$ PM in the committee room.

No comments were received on the minutes, hence the minutes of the meeting were confirmed.
2. To discuss the proposal for organizing the offline training of WRD officials of Rajasthan.

DFC discussed the proposal and agreed that the training programs should be taken up at the department level with the involvement of all the faculty members. Courses were allocated after the taking consent of the faculty members (Annexure 1). HoD requested all the faculty members to submit the detailed syllabus conetent by November 12, 2021. HoD agreed to finalize the budget proposal.
3. To discuss the email of DORA on initiation of a student award at the Deparment on CGPA basis in the name of the donor Alumni

DFC discussed the email of DORA. DFC agreed that there is no such already existing award in the WRDM department in which any student obtains the highest CGPA in their final exam and is awarded.
4. To discuss the orientation program for new faculty members scheduled to be held on tomorrow.

Head, WRDM apprised the faculty members about the scheduled orientation program on 9th November 2021 in the Senate Hall, J.T. Building, and requested the concerned faculties to attend the event.
5. To discuss the draft reply of Prof. Goel related to the proposal of the International Centre on Dam (ICD).

DFC discussed the proposal/reply, and the following were suggested:
a) The Centre of Excellence for Dams must emphasize research themes related to dam safety and rehabilitation. As such, "reservoir sedimentation and management" is already under focus in the Department of Water Resources Devevelopment \& Management /Department of Hydrology/ Department of Hydro and Renewable Energy/Civil Engineering Department. Under such lines, it is felt that the proposed center should primarily focus on core areas of dam safety and rehabilitation.
b) The proposed Centre of Excellence for Dams may operate for a limited duration (5 to 10 years) and address specific purposes. Also, the center is expected not to overshadow the existing departments.
c) Creating a "Virtual center for excellence for dams" may be more appropriate and solve the purpose.
d) The dam is one of the major storages/hydraulic structures, which has been a crucial focus of R\&D in Water Resources Development. It is hopeful that while creating such a center, the interest of the Department of Water Resources Devevelopment \& Management will be protected.
6. To discuss the consideration of the newly introduced course on "Drinking Water and Sanitation" in next IAPC meeting.
Head, WRDM apprised the faculty members about the updated course content of the newly introduced course on "Drinking Water and Sanitation". DFC agreed to submit the course in the next IAPC meeting.
7. Any other items with the permission of Chair.
a. Distribution of marks at the stage-I thesis evaluation of M.Tech second years students.

DFC discussed the institute guidelines and agreed to the following distribution:

| Report | 20 |
| :--- | :---: |
| Presentation | 20 |
| Viva-voice | 10 |
| *Supervisors | 50 |
| Total | 100 |

*The supervisor marks will include the marks on the report, presentation, viva-voice, personal interaction.

The meeting ended with a vote of thank the Chair.

(Basant Yadav) Member Secretary, DFC

## DEPARTMENT OF WATER RESOURCES DEVELOPMENT AND MANAGEMENT INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No: WR/DFC/103
Copy to:
All members of DFC, WRDM.


# M.Tech/PG-Diploma Programme 

## on

'Drinking Water \& Sanitation'

## Preamble

Since its inception in 1955, the Department of Water Resources Development \& Management (DWRDM), IIT Roorkee, has played a pioneering role in actively imparting knowledge and practical training to the students and in-service personnel from multiple engineering backgrounds. Its unique and distinct feature is to bring together the experience and knowledge in the water sector for the service of society at large. The department helps in first-hand understanding and appreciation of various water related regional, national and international problems. Through its international academic and training programs, it fosters a feeling of brotherhood amongst the engineers of various countries from the Afro-Asian regions.

The department offers Postgraduate Degree programs in both Water Resources Development (for Civil, Electrical, and Mechanical Engineers) and Irrigation Water Management (for Civil, Agricultural Engineers, and Agricultural Scientists). For the last several decades, DWRDM has been hosting in-service engineers from Afro-Asian countries through cooperation and support from MEA, Govt. of India under ITEC program for Master and Ph.D. degrees. DWRDM also hosted the GATE-qualified students and sponsored candidates from various Central and State Government organizations of India. The candidates earned Master's \& Ph.D. degrees in the field of practical application. It has been an exhilarating experience while interacting with the International and National students to share advanced knowledge with them. So far, the department has trained more than 2850 serving engineers from 52 countries. It offers education and training programs in all aspects of Water Resources Development and Irrigation Water Management to inservice engineers and professionals as well as young water resources professionals. Even during the unprecedented hardships realized during COVID-19, the department successfully organized online teaching, research, and other academic-related activities.

Safe drinking-water, sanitation, and hygiene (WASH) are crucial to public health and its wellbeing. Safe WASH is not only a prerequisite to health but also contributes to its livelihoods. The unplanned disposal of wastewater and untreated excreta contaminates the groundwater and surface water sources which is further used for drinking-water, irrigation, bathing, and household purposes. Chemical contamination such as arsenic and fluoride may be either due to geogenic origin or problems like that of nitrate which may be due to various anthropogenic activities pose a long-lasting health issue. Most of the countries in the world, particularly the Afro-Asian countries, have launched WASH program. Safely managed drinking-water and sanitation such as regulated piped water and well-connected and well-designed sewer system are need of the hour. Water \& wastewater treatment can significantly reduce the deaths due to water borne diseases and will dramatically improve the public health. Government of India has emphasized a lot for developing
infrastructure related to Drinking Water and Sanitation for its Urban \& Rural settings and managing the same to improve the status of public health in the country. To achieve this objective, there will be a need for capacity building in this sector. At present, only a few masters level programmes are available which are directly related to WASH.

It is with this background, the Department of WRD\&M proposes a M.Tech/PG-Diploma Programme on 'Drinking Water \& Sanitation' which would broadly addresses to the issues of Drinking water sustainability, water security, water conservation, reuse and recycle, water treatment, storage and distribution, wastewater collection, treatment and disposal, impact of risks \& uncertainties like climate change on water sustainability and water availability at consumer-end. The issues like supply and demand-based management and use of latest techniques like RS\&GIS, Drone Technology, water treatment techniques like that of De-salinization, coastal and underground reservoirs, circular economy in water sector etc. will be the part of curriculum. The course will cover all the 4 realms like society, governance, economics, and technology and will be in line with the UN Sustainable Development Goal- 6 "Clean water and sanitation".

Based on the feedback and interaction with the students and industry, DWRDM has identified drinking water and sanitation as one of the major challenges in the water sector being faced by most of the Afro-Asian Countries, including India. Accordingly, DWRDM has proposed a new M. Tech course (2 years' duration) on Drinking Water and Sanitation to disseminate knowledge and conduct research in this important area. The COVID pandemic has further emphasized implementing sustainable sanitation programmes and techniques in urban and rural areas to avoid and mitigate the impact of virus infection in the area. I believe it is the first of its kind course being offered by DWRDM, IIT Roorkee in India. The course structure is designed to cover broad aspects and emerging concerns related to Drinking Water and Sanitation, including Technological \& Governance issues.

We want to inform you that we circulated the draft course content to around 70 organizations working in the water sector and received their feedback. We are happy to inform you that the proposed course has received an overwhelming response and positive feedback from 12 organizations. Many organizations have expressed the need for such a course to plan and manage drinking water and sanitation services effectively. We would also like to mention that on September 21, 2021, an interaction meeting with Shri Pankaj Kumar, Secretary, Department of Drinking Water and Sanitation, Ministry of Jal Shakti and faculty members of the Department of WRDM, IIT Roorke was held at New Delhi. The suggestions provided by the Secretary has been already incorporated by the Department. The attached revised structure has been prepared after incorporating several suggestions from various stakeholders including those of Secretary, JJM.

I believe this will help DWRDM, IIT Roorkee to develop trained human resources and conduct research in the vital subject area of drinking water and sanitation to cater to the nation's needs, which would promote sustainable development goals of the society.

Appendix－B
Item No．Senate／ 89.18
DEPARTMENT OF WATER RESOURCES DEVELOPMENT AND MANAGEMENT INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

| Teaching Scheme |  |  |  |  | ContactHours／Week |  |  | $\underset{\text { Duration }}{\text { Exam }}$ |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\dot{8}$ $\dot{\text { B }}$ $\dot{B}$ | Subject Code | Course Title |  | 类 | L | T | P | 家 | 或 | U | 年 | 䛼 | 䟼 | 毞 |
| Semester－I（Autumn） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | WRN－503 | Water Resources Planning and Management | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | WRN－507 | Drinking Water and Sanitation Sustainability | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | WRN－509 | Water Sanitation，Hygiene and Infrastructural Management | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | WRN－516 | Rural and Urban Water Supply | PCC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. |  | Program Elective－I | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
|  |  | Total |  | 20 |  |  |  |  |  |  |  |  |  |  |
| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | WRN－506 | Mini Project on Drinking Water and Sanitation | PCC | 2 | － | － | 4 | － | － | － | 50 | － | － | 50 |
| 2. | WRN－700 | Seminar | SEM | 2 | － | － | － | － | － | － | － | － | 100 | － |
| 3. |  | Program Elective－II | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 4. |  | Program Elective－III | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 5. |  | Program Elective－IV | PEC | 4 | － | － | － | － | － | － | － | － | － | － |
| 6. |  | Program Elective－V | PEC | 4 |  |  |  |  |  |  |  |  |  |  |
|  |  | Total |  | 20 |  |  |  |  |  |  |  |  |  |  |

DEPARTMENT OF APPLIED MATHEMATICS AND SCIENTIFIC COMPUTING INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
XXX M．Tech．（Drinking Water and Sanitation）
Department of Water Resources Development and Management
路
Program Code：
Department：方

| Teaching Scheme |  |  |  |  | $\begin{gathered} \text { Contact } \\ \text { Hours/Week } \end{gathered}$ |  |  | $\begin{gathered} \text { Exam } \\ \text { Duration } \end{gathered}$ |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\dot{\dot{R}}$ | Subject Code | Course Title |  | \％ | L | T | P | 苞 | 或 | 会 | $\frac{\tilde{n}}{\underline{A}}$ | $\sum_{\sum}^{\|x\|}$ | 钅 | 断 |
| Semester－I（Autumn） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | WRN－701A | Thesis Stage－I （to be continued next semester） | DIS | 12 | － | － | － | － | － | － | － | － | 100 | － |
|  |  | Total |  | 12 |  |  |  |  |  |  |  |  |  |  |
| Note：Students can take 1 or 2 audit courses as advised by the supervisor，if required． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semester－II（Spring） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. | WRN－701B | Thesis Stage－II （continued from III semester） | DIS | 18 | － | － | － | － | － | － | － | － | 100 | － |
|  |  | Total |  | 18 |  |  |  |  |  |  |  |  |  |  |


| Summary |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Semester | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ |  |
| Semester－wise Total Credits | 20 | 20 | 12 | 18 |  |
| Total Credits | $\mathbf{7 0}$ |  |  |  |  |

Program Elective Courses for M．Tech．（Drinking Water and Sanitation）

| Teaching Scheme |  |  |  |  | ContactHours／Week |  |  | Exam Duration |  | Relative Weight（\％） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \dot{\mathbf{Z}} \\ & \dot{\sim} \end{aligned}$ | Subject Code | Course Title |  | 苞 | L | T | P |  |  | $\sum_{u}^{\infty}$ | $\frac{n}{\alpha}$ | $\underset{E}{E}$ | 弐 | 動 |
| 1. | WRN－501 | System Design Techniques | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 2. | WRN－580 | Renewable Energy System Technology | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 3. | WRN－581 | Water Quality Monitoring and Modeling | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 4. | WRN－586 | Groundwater $\quad$ Development Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 5. | WRN－587 | Watershed Development and Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 6. | WRN－588 | Remote Sensing and GIS Applications in Water Systems | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 7. | WRN－589 | Drinking－Water for Low－Income Societies | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 8. | WRN－590 | Wastewater and Fecal Sludge Management | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 9. | WRN－591 | Resilience，Shocks and Emergencies | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 10. | WRN－592 | Management and Operation of Water Utilities | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 11. | WRN－593 | Water Works Engineering | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 12. | WRN－594 | Flow Hydraulics and Urban Drainage | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 13. | WRN－595 | Water in Circular Economy | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |
| 14. | WRN－596 | Sustainable Water Resources | PEC | 4 | 3 | 1 | 0 | 3 | 0 | 20－35 | － | 20－30 | 40－50 | － |

## Item No. 89.19 To consider the revised seat matrix for UG programs in the academic year 2022-2023.

The Mehta Family School of Data Science and Artificial Intelligence has been established at IIT Roorkee vide the BOG Resolution No. BG/37/2021. The School offers two Masters programs and PhD programs on Data Science and Artificial Intelligence w.e.f. the academic year 2021-2022. The School will offer UG program on DS\&AI mainly to create young professionals and Data Scientist. The School is in the process of developing its UG curriculum.

It is proposed that the School will admit 40 students in its UG programme w.e.f. the academic year 2022 - 2023. The seats required may be drawn by readjusting the intakes of the existing programmes. Currently, the Institute admits 1353 students into its 18 different UG programmes.

In view of the above, the UG Seat Matrix for the academic year 2022-2023 is proposed as follows:

| S. <br> No. | Discipline | Intake <br> 2020 | Intake <br> 2021 | Proposed <br> $(2022)$ |
| :--- | :--- | :---: | :---: | :---: |
| 1 | B.Tech. (Biosc. \& Bioengg.) | 46 | 46 | 46 |
| 2 | B.Tech. (Chemical) | 120 | 127 | $110(-17)$ |
| 3 | B.Tech. (Civil) | 194 | 194 | $183(-11)$ |
| 4 | B.Tech. (CSE) | 109 | 109 | 109 |
| 5 | B.Tech. (Electrical Engg.) | 165 | 165 | 165 |
| 6 | B.Tech. (E \& CE) | 109 | 109 | 109 |
| 7 | B.Tech. (Engg. Physics) | 40 | 50 | 50 |
| 8 | B.Tech. (Mechanical Engg.) | 150 | 150 | 150 |
| 9 | B.Tech. (Met.\& Mat. Engg.) | 112 | 92 | $80(-12)$ |
| 10 | B.Tech. (PSE) | 40 | 00 | 00 |
| 11 | B.Tech. (Prod.\& Ind.Engg.) | 58 | 58 | 58 |
| 12 | B.Arch. | 37 | 37 | 37 |
| 13 | Int. M.Tech. (GT) | 38 | 38 | 38 |
| 14 | Int. M.Tech. (GPT) | 41 | 41 | 41 |
| 15 | IMS/BSMS Mathematics | 42 | 42 | 42 |


| 16 | IMS/BSMS Chemistry | 25 | 35 | 35 |
| :--- | :--- | :---: | :---: | :---: |
| 17 | IMS/BSMS Physics | 27 | 27 | 27 |
| 18 | IMS/BSMS Economics | 0 | 33 | 33 |
| 19 | B.Tech. (DS \& AI) | 00 | 00 | +40 |
|  | Grand Total | $\mathbf{1 3 5 3}$ | $\mathbf{1 3 5 3}$ | $\mathbf{1 3 5 3}$ |

The above is submitted for the consideration and approval of the Senate.

Item No. 89.20 To report the approvals accorded by the Chairman, Senate.

## (a) Recommendations of IRC.

1. The IRC in its $52^{\text {nd }}$ meeting held on 30.11.2021 recommended the proposal for MoUs between IIT Roorkee and the following Institutes:
a. ARIES (Aryabhatta Research Institute of Observational Sciences), Nainital, Uttarakhand.
b. HBNI (Homi Bhabha National Institute), Mumbai.
2. The IInd request of Mr. Vikas Surana (20909031), Ph.D. student, Department of Chemistry for allowing course addition after the Senate approved date i.e. 09.08.2021

## (b) Recommendations of IAPC

1. Requests of students regarding dropping of course after the last date and year withdrawal (Item No.: $113.2 .7,113^{\text {th }}$ IAPC dt: 24.11.2021)
2. Requests of students regarding academic registration and course drop/ change after the last date (Item No.: $114.2 .3,114^{\text {th }}$ IAPC dt: 01.12 .2021 )
3. Request of B.Tech. (final year) students regarding minor specialization in CSE. (Item No.: 114.2.4, 114th IAPC dt: 01.12.2021)
4. Senate Committee to create a comprehensive 'Exit Policy' for the academic programs. (Item No.: 87.10, 87 ${ }^{\text {th }}$ Senate dt: 28.07 .2021 )

## Item No.89.21 To consider the proposal of rewording the Centre of Nanotechnology as Centre for Nanotechnology.

Head, Centre of Nanotechnology has proposed a note dated 22.11.2021, for rewording the name of the 'Centre of Nanotechnology' as 'Centre for Nanotechnology'. A concept note to establish a centre of Nanotechnology at IIT Roorkee was initially approved by the Board vide resolution no.BG/79/2005.

The CFC, Centre of Nanotechnology in its meeting dated 16.11.2021 has recommended the said proposal for this minor change.

The proposal to reword the Centre is placed before the Senate for consideration and to recommend the Board.


[^0]:    "S/U refers Satisfactory/Unsatisfactory

[^1]:    ** This is a foundation course which will be running for 7-10 days to give orientation of Design course. It will be held before actual start of the semester teaching.

