

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



सीनेट की छिहत्तरवीं बैठक हेतु कार्य सूची
AGENDA FOR THE
76th MEETING OF THE SENATE

बैठक सं०	: छिहत्तरवीं
MEETING NO.	: 76th
स्थान	: सीनेट हॉल, भा० प्रौ० सं० रुड़की
VENUE	: Senate Hall, IIT Roorkee
दिनांक	: 2 जनवरी 2019
DATE	: 2nd January 2019
समय	: 4.00 बजे अपरान्ह
TIME	: 4.00 P.M.

भारतीय प्रौद्योगिकी संस्थान रुड़की
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कार्यसूची / A G E N D A

मुद्दा सं०/ Item No.	विवरण / Particulars	पृष्ठ / Page(s)
76.1	सीनेट की दिनांक 01.10.2018 को आयोजित हुई 75वी बैठक के कार्यवृत्त की पुष्टि करना। To confirm the minutes of the 75 th meeting of the Senate held on 01.10.2018.	1
76.2	सीनेट की दिनांक 01.10.2018 को आयोजित हुई 75वी बैठक में लिए गए निर्णयों के क्रियान्वयन हेतु की गई कार्रवाई को रिपोर्ट करना। To report on the actions taken to implement the decisions of the Senate taken in its 75 th meeting held on 01.10.2018.	2-3
76.3	पहले वर्ष के पाठ्यक्रमों के लिए 3 से 5 वें वर्ष के असाधारण यूजी छात्रों को शिक्षण सहायक (यूजीटीए) के रूप में संयोजन के प्रस्ताव पर विचार करना। To consider the proposal regarding addition of Exceptional 3 rd to 5 th year UG Students as Teaching Assistants (UGTA) for the courses of first year.	4-6
76.4	एफ ग्रेड प्राप्त पाठ्यक्रम दोहराने वाले छात्रों के लिए उपस्थिति आवश्यकता को माफ करने के प्रस्ताव पर विचार करना। To consider the proposal to waive off attendance requirement for the students who received 'F' grade and are repeating the course.	7
76.5	यूजी पाठ्यक्रम से वापसी के संबंध में ऐकेडमिक प्रोग्राम के विनियम 31 (a) में संशोधन के प्रस्ताव पर विचार करना। To consider the proposal to amend the Regulation 31(a) of Academic Programmes Regulations for UG regarding withdrawal from course.	8
76.6	यूजी पाठ्यक्रम में सिस्टर विभागों से 2 कोर्सस (अधिकतम 8 क्रेडिट) पीईसी की अनुमति देने के प्रस्ताव पर विचार करना। To consider the proposal of allowing up to 2 courses (maximum 8 credits) PECs from sister Departments in UG curriculum.	9

76.7	अनुचित माध्यम नियम समिति की रिपोर्ट पर विचार करना। To consider the Report of Unfair Means Rules Committee.	10-13
76.8	बैकलॉग पेपर के साथ प्रचलित सेमेस्टर में विषय पंजीकरण पर प्रतिबंधों के संबंध में यूजी के लिए ऐकेडेमिक प्रोग्राम विनियम 18(2) में संशोधन के प्रस्ताव पर विचार करना। To consider the proposal to amend the Regulation 18(2) of Academic Programmes Regulations for UG regarding restrictions on subject registration in current semester with backlog papers.	14-15
76.9	विद्युत अभियांत्रिकी विभाग के कोर कोर्स ईईएन-310 (जनलर वाइवा) को बंद करने के प्रस्ताव पर विचार करना। To consider the proposal of Department of Electrical Engineering to discontinue the core course EEN-310 (General Viva).	16
76.10	प्रबंधन विभाग में आईआईटी रूडकी एमबीए में प्रवेश के लिए सभी स्नातकों को अनुमति देने के प्रस्ताव पर विचार करना। To consider the proposal of Department of Management Studies to allow all graduates for MBA Admission at IIT Roorkee.	17-18
76.11	रसायन विज्ञान विभाग द्वारा प्रस्तावित एकीकृत एमएससी के सभी तृतीय, चतुर्थ और पंचम वर्ष के निम्नलिखित संरचना और पाठ्यक्रम के प्रस्ताव पर विचार करना: सीवाईएन-301 क्वांटम रसायन विज्ञान और रासायनिक बंधन। सीवाईएन-303 उन्नत समन्वय रसायन विज्ञान। सीवाईएन-305 कार्बनिक रसायन विज्ञान तृतीय। सीवाईएन-311 प्रयोगशाला प्रथम। सीवाईएन-302 ग्रुप थ्योरी एंड स्पेक्ट्रोस्कोपी। सीवाईएन-304 सोलिड स्टेट रसायन और अनुप्रयोग। सीवाईएन-306 कार्बनिक रसायन विज्ञान चतुर्थ। सीवाईएन-312 प्रयोगशाला द्वितीय। सीवाईएन-515 वैज्ञानिक/तकनीकी लेखन की कला। सीवाईएन-521 उन्नत विश्लेषणात्मक तरीके। सीवाईएन-523 कार्बनिक रसायन विज्ञान पंचम। सीवाईएन-525 उन्नत आणविक स्पेक्ट्रोस्कोपी। सीवाईएन-531 प्रयोगशाला तृतीय। सीवाईएन-522 सामग्री रसायन विज्ञान। सीवाईएन-524 फ्रंटियर अकार्बनिक कैमिस्ट्री। सीवाईएन-526 कार्बनिक रसायन विज्ञान षष्ठम। सीवाईएन-532 प्रयोगशाला चतुर्थ। To consider the following Structure & Syllabi of all courses for III, IV and V year of Integrated M.Sc. (Chemistry) proposed by the Department of Chemistry:	19-52

	CYN-301: Quantum Chemistry and Chemical Bonding CYN 303: Advanced Coordination Chemistry CYN-305: Organic Chemistry III CYN-311: Laboratory I CYN-302: Group Theory and Spectroscopy CYN-304: Solid State Chemistry and Applications CYN-306: Organic Chemistry IV CYN-312: Laboratory II CYN-515: Art of Scientific/Technical Writing CYN-521: Advanced Analytical Methods CYN-523: Organic Chemistry V CYN-525: Advanced Molecular Spectroscopy CYN-531: Laboratory III CYN-522: Materials Chemistry CYN-524: Frontier Inorganic Chemistry CYN-526: Organic Chemistry VI CYN-532: Laboratory IV	
76.12	इलेक्ट्रॉनिक्स और संचार अभियांत्रिकी विभाग के एम.टेक (माइक्रोइलेक्ट्रॉनिक और वीएलएसआई) में प्रवेश के लिए बी.टेक/बी.ई.(इलेक्ट्रॉनिक्स और संचार अभियांत्रिकी या समकक्ष एम.एससी फिजिक्स/ इलेक्ट्रॉनिक्स या ईसी/भौतिकी स्ट्रीम के साथ मान्य गेट स्कोर) की योग्यता बदलने के प्रस्ताव पर विचार करना। To consider the proposal of Department of Electronics and Communication Engineering to change the eligibility criteria for admission to M.Tech. (Microelectronics and VLSI), to B. Tech./B.E. (Electronics and communication Engg. or equivalent, M.Sc.(Physics)/(Electronics) or equivalent with a valid GATE score in EC/Physics streams.	53-54
76.13	छात्रों के खराब इनफ्लो और प्लेसमेंट रिकार्ड के कारण एम.टेक. (एडवांस्ड मेथड आफ कैमिकल एनालिसिस) को बंद करने के लिए रसायन विज्ञान विभाग की डीएफसी की सिफारिश पर विचार करना। To consider the recommendation of DFC of Department of Chemistry to close the M.Tech. (Advanced Method of Chemical Analysis) programme due to poor inflow of the students and placement record.	55
76.14	आईआईटी स्नातकों (सीजीपीए 8 और उससे ऊपर) के वर्ष 2019 से एम.टेक. कार्यक्रमों में स्वीकृत इनटेक से अधिक प्रवेश के प्रस्ताव पर विचार करना। To consider the proposal for admission of IIT graduates (with CGPA 8 and above) over and above the sanctioned intake for M.Tech. programmes from the year 2019 onwards.	56
76.15	हाल ही में सीनेट की बैठकों में लिए गए निर्णयों के अनुरूप पीएचडी प्रपत्र में संशोधन पर विचार करना। To consider the modification in Ph.D. Forms in line with the decisions taken in recent Senate meetings.	57-77

76.16	प्रो० मनीष श्रीखंडे समिति द्वारा प्रस्तावित पीचडी नियमों और विनियमों भाग 2: पीएचडी प्रक्रिया पर विचार करना। To consider Part-II: Ph.D. Procedures as proposed by Prof. Manish Shrikhande Committee on Ph.D. Rules & Regulations.	78-129
76.17	पीएचडी कार्यक्रम की उम्मीदवारी के लिए मौखिक कमप्रहैन्सिव परीक्षा को अनुसंधान प्रस्ताव प्रस्तुति में विलय पर विचार करना। To consider merging of Oral Comprehensive examination with Research Proposal presentation as a part of candidacy for Ph.D. Programme.	130
76.18	विदेशी विश्वविद्यालयों के साथ सहयोगात्मक डाक्टोरल कार्यक्रमों के माडल्स पर विचार करना। To consider Models for Collaborative Doctoral Programmes with Foreign Universities.	131-132
76.19	वैकल्पिक हाइड्रॉ एनर्जी सेंटर को हाइड्रॉ और नवीकरणीय उर्जा विभाग के रूप में नामित करने के प्रस्ताव पर विचार करना। To consider the proposal of renaming the Alternate Hydro Energy Centre as Hydro and Renewable Energy Department.	133-145
अन्य मद अध्यक्ष की अनुमति से/Under any item with the permission of the Chair.		

Item No. 76.1: To confirm the minutes of the 75th meeting of the Senate held on 01.10.2018.

The minutes of the 75th meeting of the Senate held on 01.10.2018 were circulated to the members vide e-mail dated 12.11.2018. No comments has been received.

The Senate may consider confirming the said minutes.

Item No.76.2: To report on the actions taken to implement the decisions of the Senate taken in its 75th meeting held on 01.10.2018.

The minutes of the 75th meeting of the Senate held on 01.10.2018 were circulated to the members vide e-mail dated 12.11.2018. The status of actions taken to implement the decisions of the Senate are as under:

Item No.	Reference to the Senate minutes	Abstract of the Minutes	Status of action taken															
75.3	Award of Degrees/Diplomas to the students who have qualified for the award of Degrees/Diplomas in various disciplines/courses for the session 2017-18.	The Senate considered and recommended to the Board of Governors the award of Degrees/Diplomas to 2026 students, as given below, who have duly qualified for the same: <table><tr><th>Sl. No.</th><th>Name of the Degrees</th><th>No. of Degree</th></tr><tr><td>1.</td><td>B.Tech./B.Arch./IDD/Integrated Degrees</td><td>949</td></tr><tr><td>2.</td><td>M.Tech./M.Arch./M.U.R.P./M.Sc./M.B.A./M.Tech. (SSEM)/M.Tech. (Advanced Methods of Chemical Analysis)/ Diplomas</td><td>785</td></tr><tr><td>3.</td><td>Ph.D. Degrees (to be recommended) (185 Nos. have already been recommended by the Senate in the earlier meetings)</td><td>107 185</td></tr><tr><td colspan="2">Total</td><td>2026</td></tr></table>	Sl. No.	Name of the Degrees	No. of Degree	1.	B.Tech./B.Arch./IDD/Integrated Degrees	949	2.	M.Tech./M.Arch./M.U.R.P./M.Sc./M.B.A./M.Tech. (SSEM)/M.Tech. (Advanced Methods of Chemical Analysis)/ Diplomas	785	3.	Ph.D. Degrees (to be recommended) (185 Nos. have already been recommended by the Senate in the earlier meetings)	107 185	Total		2026	Degrees/Diplomas were awarded.
Sl. No.	Name of the Degrees	No. of Degree																
1.	B.Tech./B.Arch./IDD/Integrated Degrees	949																
2.	M.Tech./M.Arch./M.U.R.P./M.Sc./M.B.A./M.Tech. (SSEM)/M.Tech. (Advanced Methods of Chemical Analysis)/ Diplomas	785																
3.	Ph.D. Degrees (to be recommended) (185 Nos. have already been recommended by the Senate in the earlier meetings)	107 185																
Total		2026																

75.6	Report of Prof. Manish Shrikhande Committee on Ph.D. Regulations.	Due to paucity of time, the complete report on Ph.D. Regulations of Prof. Manish Shrikhande Committee could not be taken up. However, keeping in view the urgency of Ph.D. Admissions, the Senate considered Part-I: ADMISSION PROCESS of the said report.	Uploaded on the Institute Website and action is being taken accordingly.
75.7	Change in the existing rule for short-listing candidates for Ph.D. admissions.	The Senate approved that the short-listing criteria be decided by the departments/centres. Specialization-wise different short-listing criteria can be adopted by the departments/centres from the next semester. This may need modification in application forms and other changes for which the Academic Office may do the needful.	Notified.
75.8	Modified program structure and syllabi of the courses of M. Tech. (Communication Systems) of the Department of Electronics and Communication Engineering.	The Senate approved the modified program structure and syllabi	Notified.
75.9	Extension in the date by which all the required documents for admission in Ph.D. programmes are to be submitted for the students admitted in July 2018.	The Senate approved the extension in date upto December 26, 2018.	Notified.
Items Nos. 75.4 & 75.5 were only for ratification of the Senate.			

Item No. 76.3: To consider the proposal regarding addition of Exceptional 3rd to 5th year UG Students as Teaching Assistants (UGTA) for the courses of first year.

The IAPC in its 67th Meeting held on December 11, 2018 recommended the proposal **(Appendix 'A')**.

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

Appendix 'A'

Item No. Senate/76.3

To
Dean of Academic Affairs
IIT Roorkee

Proposal: Addition of Exceptional UG students as Teaching Assistants(UGTA) for common courses of first year

This proposal is to provide a provision for the faculties interested in hiring an UGTA for their course, by no means will it be necessary to hire an UGTA if the faculty feels otherwise. It would be up to the faculty to employ the UGTA's, it will not be a compulsion. This is just to make this option available for the faculties interested in doing so.

Aim:

- To allow the exceptional Undergraduate students who did really well in that course to take up teaching assistantship for those subjects.
- To give these students an exposure to teaching, this will help them when they apply for Masters and PhDs abroad.
- UG students have undergone a similar experience, so they are able to effectively reach out to the freshmen.
- These exceptional UG students have already aced the same course during their freshman course, most of their fundae's and concepts would still be intact in their memory, so they would be able to effectively pass it on to their juniors.
- This would ensure that TA's are employed on the basis of merit, not on mere requirements.

Structure:

- This would be launched on a pilot run for the common courses of freshmen students, i.e MAN-001 and MAN-002. As these courses require a large number of TA's, that translates into a compromise on the quality of TA's being recruited as all of them are recruited from Maths Department.
- A Notice would be circulated on Channeli and promoted by SAC and other student bodies for the recruitment of TA's. Only the students with the best of grades (A+, A and B+) and good application forms reflecting quality teaching principles, would then be interviewed by the faculty of that course. The faculty would then choose 1 UG and 1 PG (earlier 2 PG) for a batch, for the course.
- The faculty and PG TA would lightly monitor the attendance and performance of the UG TA. The monthly stipend of the UG TA would then be approved by faculty on the basis of his performance (As is the case with PG TAs).
- A review would then be sought from the freshmen students on their TAs by UG academic council of SAC, which would be provided to the faculty for his consideration and also to the UG TA for his own reflection.
- According to existing rules, the marking of tutorials will be done by the faculty of the course and not by the Teaching Assistants.

If the proposal is accepted by the IAPC and Senate, then the selected UGTA's would receive a fellowship from the institute for their services, which will be roughly Rs 6000 pm/- (figure adopted from the average of UGTaship in sister IITs). The system of undergraduate teaching assistant also exists in a few sister IITs.

Yours Sincerely,



Sarim Khan

General Secretary, Academic Affairs(UG), SAC

Item No. 76.4: To consider the proposal to waive off attendance requirement for the students who received F grade and are repeating the course.

The students who have obtained grade F in a course and repeat the course in a subsequent semester often find it difficult to meet the requirement of 75% attendance due to clash of time-table.

The IAPC in its 67th meeting held on December 11, 2018 recommended the proposal as the students have already attended the classes of the course once. However, this would not be applicable to the students who have received FS grade (failing grade due to shortage of attendance).

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

Item No. 76.5: To consider the proposal to amend the Regulation 31(a) of Academic Programmes Regulations for UG regarding withdrawal from course.

Existing	Proposed
Student who wants to withdraw from a course shall apply through the Chairman, DAPC/CAPC, to the Dean, Academics, on a prescribed form <u>within one week from the end of the Mid Term Examination</u> under the advice of his/her programme Advisor. If his/her request for withdrawal is granted, it will be recorded in the registration record of the student and the concerned Course Coordinator will be informed about it. The student will be awarded a withdrawal grade at the end of the semester.	Student who wants to withdraw from a course shall apply through the Chairman, DAPC/CAPC, to the Dean, Academics, on a prescribed form <u>up to one week of End Term Examination.</u> If his/her request for withdrawal is granted; it will be recorded in the registration record of the student and the concerned Course Coordinator will be informed about it. The student will be awarded a withdrawal grade at the end of the semester.

The IAPC in its 67th meeting held on December 11, 2018 recommended the proposal.

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

Item No. 76.6: To consider the proposal of allowing up to 2 courses (maximum 8 credits) PECs from sister Departments in UG curriculum.

Students of a branch/program often find it useful to do a couple of courses from sister Departments. In view of this, it is proposed to allow students to do up to 2 courses (maximum 8 credits) from sister Departments as a part of the PEC requirements of their programs.

The IAPC in its 65th Meeting held on Sep 27, 2018, recommended that the provision of allowing PECs of one Department to the programs of other Departments, with the mutual consents of the Departments, currently existing for PG programs (Senate Resolution No. 60.5) may be extended to the UG programs up to 2 courses (maximum 8 credits).

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

Item No. 76.7: To consider the Report of Unfair Means Rules Committee.

A committee to review the current rules dealing with the usage of unfair means in the examination had been constituted. The report of the committee (**Appendix 'A'**) has been discussed and recommended in the IAPC in its 65th Meeting held on Sep. 27, 2018.

The recommendations of the committee are submitted for the consideration and approval of the Senate.

Appendix 'A'
Item No. Senate/76.7

Appendix-F

Proposed Guidelines: Punishment for using unfair means during examinations (MTE/ETE)

Severity of Offence	Details	1 st offence	2 nd offence
Level 1	• If a student is found carrying un-authorised material like chits, electronic gadgets like tablets, calculators, mobile phone etc., using prohibited facilities like the internet etc. • If a student is found verbally communicating with another student during the examination. • Communicating with others during toilet breaks during exams.	Warning to be issued to the concerned student.	Penalty of one grade point in the concerned course.
Level 2	• A student is found using a mobile phone, chits, books and other unauthorized material. • Identical answers in the answer books. • Answer Script / Question paper carried out of the examination room during/after the examination.*	Zero marks to be awarded to the student in the concerned examination (MTE/ETE).	Semester Backlog i.e. the running semester will be treated null & void for the student.
Level 3	• Impersonation. • Answer Script / Question paper carried out of the examination room during/after the examination.*	Semester Backlog in the running semester. In addition to this, the student will be allowed to register only for 8 credits in the next semester.	Expulsion from the institute.

*Level of the offence (Level 2 or 3) to be decided by the committee.

Note: On repetitive offence after 2nd offence in levels 1 and 2 the case would be considered under the offence of immediate next level.

UNFAIRMEANS USAGE REPORTING FORM
INDIAN INSTITUTE OF ROORKEE

Note: One sheet should be used for one candidate only.

PART - A (To be filled by the invigilator)

- (1) Name of examination: MTE/ETE
- (2) Enrolment No. of the student.....
- (3) Name of the student.....
- (4) Course code and name in which the candidate is reported to have used or intended to use unfair means.....
- (5) Day.....Date.....Time.....
- (6) Item(s) found in possession of the student (to be submitted along with answer script)
Books/Papers/Electronic Gadget/Any other to be specified
- (7) Comments, if any:

.....
.....

Date..... Time..... (Signature of the Invigilator)

PART - B (To be filled by the student after the submission of answer script at the end of the examination)

- (1) Were the above articles recovered from your possession?
.....
- (2) Did you make any use of them?
.....
- (3) Comments, if any
.....
.....

Date..... Time..... (Signature of the student)

Instructions overleaf

INSTRUCTIONS FOR PENALTY FOR USE OF UNFAIR MEANS

1. The main instructions for the conduct of a student in the examination hall shall be printed on the cover page of the answer book. Any contravention of these instructions and the use of any unfair means will render the student liable for punishment.
2. In case of unfair means being suspected by the invigilator, the reporting will be carried out as per form UF-0. Student will be allowed to continue in the same answer script.
3. A committee appointed by the Director shall enquire into cases of attempt at unfair means in the examination. The student will be given an opportunity to present his case before the committee. The committee shall submit its recommendation after laying down clearly the nature of the offence (table below) to the Director for consideration and necessary orders.
4. A student whose guilt is established shall be dealt with under the provisions of the disciplinary regulations.

Item No. 76.8: To consider the proposal to amend the Regulation 18(2) of Academic Programmes Regulations for UG regarding restrictions on subject registration in current semester with backlog papers.

Some clauses of the Regulation 18(2) of Academic Programmes Regulations allows registering only for back papers. As a result the students often find it difficult to meet the requirement of minimum earned credits. A simplified proposal has, therefore, been placed before the IAPC in its 65th Meeting held on Sep. 27, 2018. The IAPC recommended the proposal with modification that "student should first register for backlog courses of respective semester and thereafter for the remaining courses, within the credit limit, for the current semester taking into account the time table of courses." **(Appendix 'A')**

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

Appendix 'A'
Item No. Senate/76.8

REGULATION 18(2)

Existing	Proposed	Justification
Student should <u>first register for the courses in which he/she has been declared failed</u> in the previous year/semester as back papers and then register for the remaining courses of the semester to make up the total required credits for that semester. However, a student shall <u>not be allowed to register</u> for the courses offered to students of <u>third year, if he/she has not cleared all the courses of first year</u> and a student shall not be allowed to register for the courses offered to students of <u>fourth year, if he/she has not cleared all the courses of second year</u> and a student shall not be allowed to register for the courses offered to students of fifth year, if he/she has not cleared all the courses of third year. In addition, <u>students of III, IV and V year having backlog in ONE paper only in I, II and III year respectively are allowed to continue with the registration of current year papers along with back paper.</u> Due to slot system based time table, these students are not allowed to take the course(s) of current year clashing with pack paper. These students have to pay one semester additional fee as penalty.	Student should <u>first register for backlog courses</u> and thereafter for the remaining courses, within the <u>credit limit</u>, for the current semester taking into account the <u>time table of courses.</u>	The condition imposed on registration in III, IV & V year with respect to backlog courses in I, II & III year respectively causes hindrance to students in continuing studies within stipulated time frame. No. of applications are being received from students/ Dept. to allow them to register in current semester with backlog papers irrespective of the year. Students having backlog in courses of only one semester have to wait for whole semester idle to clear the backlog to be eligible for further registration.

Item No. 76.9: To consider the proposal of Department of Electrical Engineering to discontinue the core course EEN-310 (General Viva).

The IAPC in its 65th meeting held on Sep 27, 2018, recommended the proposal of Department of Electrical Engineering to discontinue the core course EEN-310 (General Viva).

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

Item No. 76.10: To consider the proposal of Department of Management Studies to allow all graduates for MBA Admission at IIT Roorkee.

The Department of Management Studies proposed that allowing graduates from all the disciplines to apply for MBA program would improve the diversification in the class.

The IAPC in its 67th meeting held on December 11, 2018 recommended the proposal (**Appendix 'A'**) that the eligibility criteria be amended as graduates (or professional qualification equivalent to that of a University degree recognized by the UGC) in any discipline with first class from a recognized/reputed university be eligible to apply. Final year students are also eligible to apply. However, the IAPC did not recommend the proposal at S. No. 2 that IIT graduates who have obtained a CGPA of 8 and above on 10 point scale be exempted from CAT score.

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

Admission Eligibility to MBA programme at IIT Roorkee

Admissions to MBA programme at IIT Roorkee are made on the basis of CAT score. As per the current practice, following eligibility criteria is applicable:

Bachelor's degree in any discipline of Engineering/Technology with first class or its equivalent, or a Master's degree with first class or equivalent in any discipline from a recognized Institution or University. Final year students are also eligible to apply.

It is proposed and discussed in DFC meeting on September 24, 2018 to change the eligibility criteria as follows:

- (1) Graduates (or professional qualification equivalent to that of a University degree recognized by the UGC) in any discipline with first class earned in their degree from a recognized/ reputed university. Final year students are also eligible to apply.
- (2) IIT graduates who have obtained a CGPA of 8 and above on 10 are exempted from CAT score.

Earlier admissions were done through JMET which was conducted by IITs, in which only engineering graduates were eligible to apply. Later JMET was discontinued and CAT was adopted as written examination for admission to MBA programmes of IITs. To improve class diversification, it is recommended to allow graduates from all discipline to apply for IIT Roorkee MBA programme.

25/9/18

Shal

Vinay

IIT R

Pr

Chairman

M. K. Baner

Signature

Item No.76.11:To consider the following Structure & Syllabi of all courses for III, IV and V year of Integrated M.Sc. (Chemistry) by the Department of Chemistry:

**CYN-301: Quantum Chemistry and Chemical Bonding
CYN 303: Advanced Coordination Chemistry
CYN-305: Organic Chemistry III
CYN-311: Laboratory I
CYN-302: Group Theory and Spectroscopy
CYN-304: Solid State Chemistry and Applications
CYN-306: Organic Chemistry IV
CYN-312: Laboratory II
CYN-515: Art of Scientific/Technical Writing
CYN-521: Advanced Analytical Methods
CYN-523: Organic Chemistry V
CYN-525: Advanced Molecular Spectroscopy
CYN-531: Laboratory III
CYN-522: Materials Chemistry
CYN-524: Frontier Inorganic Chemistry
CYN-526: Organic Chemistry VI
CYN-532: Laboratory IV**

The IAPC in its 65th meeting held on Sep. 27, 2018 recommended the proposed structure and syllabi of all courses for III, IV and V year of Integrated M.Sc. (Chemistry) by the Department of Chemistry (**Appendix 'A'**).

It is submitted for the consideration and approval of the Senate.

Appendix 'A'
Item No. Senate/76.11

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-301 Course Title: **Quantum Chemistry and Chemical Bonding**
2. Contact Hours: **L: 3 T: 1 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: **4 6. Semester: Autumn 7. Subject Area: PCC**
8. Pre-requisite: Fundamental knowledge in physical chemistry
9. Objective: To introduce the formalism, mathematical treatment and applications of quantum mechanics relevant to chemistry problems

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Quantum Chemistry: Separation of variables, power series solution of differential equations, Harmonic oscillator - classical and quantum mechanical treatment, wave functions and energy levels; particle in a ring and a sphere, spherical polar coordinates, angular momentum, Legendre and associated Legendre functions, spherical harmonics, Hydrogenic systems, separation of θ , ϕ and R-equations, solving the radial equations, radial functions, quantum states, Zeeman effect.	12
2.	Many Electron Systems: Electron spin, spin orbitals, symmetric and antisymmetric wave functions, Slater determinants for ground and excited states of small species, Hamiltonian for many electron systems, self-consistent field theory; Hartree and Hartree-Fock methods, spin-orbit interaction, Term symbols for atoms	10
3.	Approximation Methods: Need for approximations methods, selection of trial function, variation theorem, linear and nonlinear variation functions, perturbation methods, perturbation parameter, first, second and higher order corrections to wave functions and energies, use of approximation methods to various systems.	8
4.	Chemical Bonding: Born-Oppenheimer approximation, nuclear motion in diatomic molecules, bonding in H_2^+ and H_2 , molecular orbital and valence bond theory treatments, homo and hetero nuclear diatomic molecules, poly atomic molecules, Virial theorem and Hellmann-Feynmann theorem, Hückel molecular orbital theory-applications to π -electron systems; Hybridisation-sp, sp^2 , sp^3 mathematical treatment, semi-empirical and <i>abinitio</i> methods.	12
	Total	42

11. Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Levine, I. N., "Quantum Chemistry", 5 th Edition, Pearson Education	2000
2.	McQuarrie, D. A., "Quantum Chemistry", Student Edition, Viva Books	2011
3.	Atkins, P. W., "Molecular Quantum Mechanics", 4 th Ed., Oxford University Press	2010
4.	Engel, T., "Quantum Chemistry and Spectroscopy", 3 rd Edition, Pearson	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

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|---|--|--|--|-----------------------------|--|
| 1. Subject Code: CYN-303 | | Course Title: Advanced Coordination Chemistry | | | |
| 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 | |
| 5. Credits: 3 | | 6. Semester: Autumn | | 7. Subject Area: PCC | |
| 8. Pre-requisite: Fundamental knowledge in coordination chemistry and organometallics | | | | | |
| 9. Objective: To impart advanced concepts of transition metal chemistry. | | | | | |
| 10. Details of the Course: | | | | | |

Sl. No.	Contents	Contact Hours
1.	Stereochemistry of Coordination Compounds: Stereoisomerism in inorganic complexes; isomerism arising out of ligand and ligand conformation; chirality and nomenclature of chiral complexes; optical rotatory dispersion (ORD) and circular dichroism (CD).	4
2.	Molecular Orbital Theory of Coordination Compounds: Introduction to character table and symbols, construction of ligand group orbitals, molecular orbital energy diagrams of octahedral, tetrahedral, square planar complexes including both σ - and π -bonding; angular overlap model.	7
3.	Electronic Spectra of Coordination Compounds: Energy states from spectral terms of d^n configurations, selection rules for ligand-field and charge transfer transitions in metal complexes, band intensities, factors influencing band widths, splitting of various terms, Orgel and Tanabe-Sugano diagrams of octahedral and tetrahedral d^n complexes, ligand field parameters; fluorescent and phosphorescent complexes.	8
4.	Molecular Magnetism and Magnetic Properties of Coordination Compounds: Magnetic susceptibility and magnetic moment; molecular magnetism - diamagnetic and paramagnetic behavior of transition metal complexes, spin-orbit coupling effects (L-S coupling and j-j coupling), orbital angular moment and its quenching in octahedral and tetrahedral complexes, temperature independent paramagnetism (TIP) of complexes, spin crossover phenomenon, spin admixed states, metal-metal direct spin interaction and super exchange spin-spin interaction through bridging ligands, ferromagnetic, anti-ferromagnetic, ferromagnetic behaviour of transition metal compounds, single molecular magnets.	14
5.	Photochemistry of Coordination Compounds: Introduction to inorganic photochemistry, photochemically excited states and excited state processes for transition metal complexes, types of photochemical reactions of coordination compounds—substitution, decomposition, fragmentation, rearrangement and redox reactions. Unimolecular charge-transfer photochemistry of cobalt (III) complexes. Mechanism of ligand to metal charge transfer photoreduction. Ligand-field photochemistry of Cr(III) complexes, Adamson's rules, photoactive excited states, Vincenzo-Carassiti model – photophysics and photochemistry of ruthenium polypyridyl complexes, emission and redox properties and Reinecke's salt as a chemical actinometer.	9

	Total	42
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11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Douglas B.E., McDaniel D.H. and Alexander J.J., "Concepts and Models in Inorganic Chemistry", 3 rd Ed., John Wiley & Sons.	2001
2.	Purcell, K.F., Kotz, J.C., "Inorganic Chemistry", Saunders, London,	1977
3.	Figgis, B.N. and Hitchman, M. A "Ligand Field Theory and Its Applications"	1999
4.	Huheey, J.E.,Keiter, E.A.,Keiter, R.L., "Inorganic Chemistry Principle of Structure and Reactivity" 4 th Ed, Pearson Education, Inc.	2003
5.	Adamson, A.W. "Inorganic Photochemistry", Wiley, New York.	1975
6.	Roundhill, D.M. "Photochemistry and Photophysics of Metal Complexes", Springer, New York.	1994

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-305 Course Title: **Organic Chemistry III**
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: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Fundamental knowledge in organic chemistry
9. Objective: To impart knowledge of stereochemistry and reaction mechanism in Organic Chemistry
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Stereochemistry: BasicDynamic stereochemistry: Conformation and Reactivity. Various chemo, region and stereoselective reactions.	5
2.	Reactive Intermediates: Carbenes and carbenoids; structure, reactivity, selectivity and mechanisms of radicals and radical based reactions involving various functional groups; radical cations and radical anions;Nonclassical carbocation; sigma and pi-participation.	9
3.	Mechanistic and Stereochemical Aspects: Baeyer-Villiger, Claisen (including Johnson-Claisen, Ireland-Claisen, Eschenomser, Overman modifications) Cope, oxy-Cope and Wittig rearrangements; ene and metalloene reactions; (2+2), (3+2) and (4+2) cycloadditions; Barton reaction.	11
4.	Organometallics in organic synthesis: Mechanism and stereochemistry of metal catalyzed organic transformations:Palladium- catalyzed reactions such as Heck, Stille,Suzuki, Sonogashira, Kumada, Negishi, Buchwald-Hartwig couplings; Tsuji-Trostreaction; Cr-catalyzed reactions.	9
5.	Enzymatic Reactions: Mechanistic and stereochemical aspects of hydrolases (including esterases and lipases), oxidoreductases.	4
6.	Green Chemistry: Twelve principles, examples, sustainability and advantages for organic reactions, aqueous organometallic reactions.	4
	Total	42

11. Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Smith, M.B., "March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure", 7th Edition John Wiley & Sons, Inc.	2013
2.	Carey, Francis A., Sundberg, Richard J., "Advanced Organic Chemistry Part A: Structure and Mechanisms" 5th Edition Springer	2007
3.	Carey, Francis A., Sundberg, Richard J., "Advanced Organic Chemistry Part B: Structure and Mechanisms", 5th Edition, Springer	2007

4.	Clayden, J., Greeves N. Warren S., "Organic Chemistry Second Edition", Oxford University Press.	2015
5.	Carruthers W., Coldham I., "Modern Methods of Organic Synthesis South Asia Edition", Cambridge University Press.	2015
6.	Sykes, P.A., "Guidebook to Mechanism in Organic Chemistry", 6th Edition, John Wiley & Sons, New York.	2013

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-311 Course Title: **Laboratory 1**
2. Contact Hours: **L: 0 T: 0 P: 12**
3. Examination Duration (Hrs.): **Theory 0 Practical 6**
4. Relative Weightage: **CWS 0 PRS 50 MTE 0 ETE 0 PRE 50**
5. Credits: **6** 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Basic concepts in chemistry
9. Objective: To provide knowledge laboratory based experiments
10. Details of the Course:

Physical Chemistry:

1. Determination of pK_1 and pK_2 of dibasic acids.
2. Determination of cell constant and verification of Kohlrausch's law.
3. Determination of specific rotation and molar rotation of lactic acid/sucrose by polarimetry.
4. Determination of molar refraction equivalent of $-\text{CH}_2$, C, H, and O.
5. Determination of composition of liquid mixture by refractive index measurements.
6. Determination of dimerization constant of benzoic acid.
7. Conductometric titration of different acids against bases
8. Determination of surface excess concentration and thickness of interfacial adsorbed layer by surface tension measurements of water-n-butanol mixture using capillary rise method
9. Determination of the Parachor of binary mixture of miscible solutes by surface tension measurements.
10. Verification of Hardy-Schulze rule for positive/negatively charged colloids.
11. Determination of critical micelle concentration of sodium dodecylsulphate/cetyltrimethylammonium bromide by surface tension method.
12. Determination of λ_{max} of compounds by UV-Vis spectroscopy
13. Measurement of viscosity of solutions of a polymer and calculation of its average molecular weight.
14. Study of oscillatory reactions.

Inorganic Chemistry

1. Semi-micro qualitative analysis involving six/eight radicals with interfering radicals
2. Following experiments are based on volumetric method :
 - a) Determination of Cr(III) volumetrically.
 - b) Determination of Fe(III) volumetrically.
 - c) Determination of Cu(II) and Zn(II) in a mixture. (two experiments)
 - d) Determination of Mn(II) and Fe(III) in a mixture.
 - e) Determination Ni(II) and Fe(III) in a mixture.
 - f) Determination of Cu(II) and Ni(II) in a mixture.
 - g) Determination of chloride content in water samples by Mohr's/ Volhard's method/ by use of tetrazine as indicator.
 - h) Iodo and iodimetric titrations for estimation of Cu, Fe and Mn salts.

Organic Chemistry

1. Qualitative analysis: Identification of binary mixtures of organic compounds through TLC, crystallization, melting point, derivatisation, and IR spectroscopy (3 turns)
2. Estimations of organic functional groups in (i) glucose and (ii) phenol (2 turns)
3. Separation of binary mixture by column chromatography.
4. Kinetic and thermodynamic control of reactions: Semicarbazone formation of cyclohexanone and 2-furfuraldehyde in different buffers
5. Kinetics of solvolysis of 2-chloro-2-methylbutane (2 turns)
6. The aldol condensation: Synthesis of dibenzalacetone
7. Oxidation of benzoin to benzil
8. Reduction of benzil to hydrobenzoin
9. Bromination of acetanilide nitration of bromobenzene

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

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|---|----------------------------|--|------------------|
| 1. Subject Code: CYN-302 | | Course Title: Group Theory and Spectroscopy | |
| 2. Contact Hours: | L: 3 | T: 1 | 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: 4 | 6. Semester: Autumn | 7. Subject Area: PCC | |
| 8. Pre-requisite: Fundamental knowledge in physical chemistry | | | |
| 9. Objective: To provide knowledge on molecular symmetry and spectroscopy | | | |
| 10. Details of the Course: | | | |

Sl. No.	Contents	Contact Hours
1.	Molecular symmetry: Symmetry elements and symmetry operations, groups mathematical and molecular groups, Abelian, cyclic and polymorphic groups, identification of molecular point groups, subgroups, group multiplication table, classes.	6
2.	Representation of groups: Matrix representation of various symmetry operations, reducible representation, basis, great orthogonality theorem and its consequences, irreducible representation, construction of character table, representation of cyclic groups.	8
3.	Applications of Group theory: Direct product, vanishing and non-vanishing integrals, spectral transition probabilities, electronic transitions, symmetry of normal modes of vibrations, prediction of infrared and Raman active modes, orbital overlap, symmetry adapted linear combinations, projection operator.	7
4.	Microwave spectroscopy: Classification of rotors, population of energy levels and intensity of rotational lines, anharmonicity and centrifugal distortion, effect of isotopic substitution, rotational spectra of linear, spherical top and asymmetric top polyatomic molecules, instrumentation.	7
5.	Infrared and Raman spectroscopy: Vibration of polyatomic molecules, harmonic and anharmonic oscillators, types of vibration bands-overtone, combination bands, Fermi resonance, finger print region, FT-IR spectroscopy and applications, Raman Spectroscopy- Rayleigh and Raman scattering, polarisabilities, rotational and vibrational Raman spectra, selection rules, laser Raman spectroscopy.	5
6.	UV-visible spectroscopy: Electronic spectra, Franck-Condon principle, pre-dissociation spectra, Fortrat diagram, electronic spectra of organic compounds, types of transitions, solvent effects, Woodward Fieser rule for prediction of λ_{max} in conjugated polyenes and enones, electronic transition in inorganic complexes, charge transfer spectra of organic and inorganic compounds.	4
7.	Photoelectron spectroscopy: Ionization process, Koopman's theorem, spectrum of core electron, spectrum of some specific cases like dinitrogen, dioxygen, hydrogen fluoride, spin-orbit coupling, X-ray photoelectron spectroscopy, zero kinetic energy spectroscopy, Auger electron spectroscopy, electron energy loss spectroscopy with examples.	5
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Ladd,M., "Symmetry and Group Theory in Chemistry", Horwood publishing,	2000
2.	Cotton, F.A., "Chemical Applications of Group Theory",3 rd Edition, Wiley	2008
3.	Banwell, C.N. and McCash, E. L. M., "Fundamentals of Molecular Spectroscopy", 4 th Edition, McGraw Hill, N. Y.	2017
4.	Graybeal, J.D., "Molecular Spectroscopy", 1 st Rev. Edn, McGraw-Hill	2014

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

1. Subject Code: CYN-304 Course Title: Solid State Chemistry and Applications
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: Spring 7. Subject Area: PCC
8. Pre-requisite: Fundamental concepts in physical and inorganic chemistry
9. Objective: To provide knowledge on crystal symmetry, structure, bonding and properties of solids
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Descriptive crystal chemistry and crystal defects: Binary and ternary solid compositions and some important structure types: AB- rock-salt, CsCl, zinc blende, wurtzite, NiAs; AB ₂ - fluorite, rutile, antiferite, CdCl ₂ , CdI ₂ ; ABX ₂ - ordered and disordered rock-salt, delafossite; AX ₃ - ReO ₃ and skutterudite; ABX ₃ - perovskite, ilmenite, tunnel structures, AB ₂ X ₄ /A ₂ BX ₄ - spinel, K ₂ NiF ₄ ; A ₂ B ₂ O ₇ -pyrochlore, layered oxides; A ₃ B ₂ (SiO ₄) ₃ -garnets. Imperfections in solids- point and extended defects, non-stoichiometric defects- vacancy and interstitial; stacking faults, dislocations, CS planes and Wadsley defects; grain and anti-phase boundaries.	10
2.	Geometrical crystallography: Crystal habit and symmetry in the crystalline state, translational symmetry- screw axis and glide planes, symmetry in different crystal systems, point groups and their stereographic projections, space symmetry and space groups, Schoenflies and Hermann-Mauguin notations, Wyckoff symbols, general and special positions, representation of space groups and international table of crystallography.	8
3.	Structure determination: X-ray diffraction, quadratic form of the Bragg's law, concept of reciprocal space, Bragg's law in the reciprocal space, Ewald sphere construction, amplitude and phase of X-ray diffraction, structure factor and integrated intensity, crystal symmetry and systematic absences, indexing and identification of crystal systems.	6
4.	Bonding in solids: Bonding in molecular solids- polymorphism, bonding in extended solids- ionic, covalent and metallic; Band theory of solids- classification of insulators, semiconductors and metals, free electron theory, Bloch's theorem, concept of density of states and elementary band theory, band structures of one-, two- and three-dimensional solids.	8
5.	Properties of solids: Optical properties, electrical conductivity, mobility, thermal conductivity, specific heat, magnetic properties- magnetization, susceptibility, hysteresis, magnetic anisotropy, dielectric properties- paraelectric, pyroelectric, piezoelectric and ferroelectric	6

6.	Physical methods for characterization of solids: Thermal analysis; optical and electron microscopy; UV-visible and IR spectroscopy; X-ray spectroscopy; photoelectron spectroscopy, Mössbauer spectroscopy.	4
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	West, A.R., "Solid State Chemistry and its Applications", Reprint, Wiley India	2013
2.	Stout, G.H. and Jensen, L.H., "X-Ray Structure Determination: A Practical Guide", 2 nd Edn., Wiley-Interscience	1989
3.	Giacovazzo, C., Artioli, G. and Monaco, H.L."Fundamentals of Crystallography", Oxford University Press	2006
4.	Wells, A.F. "Structural Inorganic Chemistry", 5 th Edn.,Clarendon Press, Oxford	1984
5.	Spaldin, N., "Magnetic Materials: Fundamentals and Device Applications", Cambridge University Press	2003
6.	Sutton, A.P. and Sutton, A.D. "Electronic Structure of Materials", Oxford University Press	1993

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

1. Subject Code: CYN-306 Course Title: Organic Chemistry- IV
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: Autumn 7. Subject Area: PCC
8. Pre-requisite: Basic concepts in organic chemistry
9. Objective: To impart knowledge of structure and mechanism in Organic Chemistry
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Conformation in cyclic structures: Conformations in cyclobutane, cyclopentane and cycloheptanes; Monosubstituted cyclohexanes: characteristics of chair form, ring inversion, flexible conformers and their stability, isolation and characterization of conformers; di- and polysubstituted cyclohexanes, normal and atypical disubstituted cyclohexanes, twist boat conformers; cyclohexane ring with one or two sp^2 carbon atoms, alkylidenecyclohexanes, cyclohexenes; conformational analysis of four, five and six membered heterocycles, anomeric effect, rabbit ear effect; conformational effect on base-induced and pyrolytic eliminations, solvolysis, esterification, hydrolysis, oxidation, reduction. Fused ring systems- decalin, perhydroanthracene, perhydrophenanthrene and cyclopentanoperhydrophenanthrene, bicycloheptanes, norbornylation.	12
2.	Heterocyclic chemistry: Classification and naming of heterocyclic compounds, molecular orbital picture; characteristics of pyrrole, furan, thiophene and pyridine; methods of preparation (Paal-Knorr, Feist-Benary, Hantzsch and Knorr syntheses); electrophilic and nucleophilic substitution reactions in pyridines; five and six membered rings with two or more heteroatoms (thiazoles, isoxazoles, imidazoles, pyrazines) and their synthesis, basicity and reactivity; fused heterocycles -preparation and reactions of indoles, quinolines and isoquinolines (Fisher indole, Skraup, and Bischler-Napieralski syntheses); mechanism of electrophilic substitution reactions in indoles, quinolines and isoquinolines.	11
3.	Pericyclic Reactions: Woodward-Hoffmann description of the Diels-Alder reaction, trapping reactive intermediates by Diels-Alder reaction, other thermal cycloaddition reactions, 1,3-dipolar cycloadditions, ene reaction, sigmatropic rearrangement, orbital description and the direction of [3,3]-sigmatropic rearrangement, [2,3]- and [1,5]-sigmatropic rearrangements, electrocyclic reactions, Cope and aza-Cope rearrangements.	11
4.	Disconnection approach: Disconnection Approach: Synthons and synthetic equivalents, definitions, guidelines, functional group interconversions, use of acetylenes and aliphatic nitrocompounds in organic synthesis; two-group C-C disconnections – Diels-Alder reaction, 1,3- & 1,5-difunctional compounds (Michael addition & Robinson annulation); order of events in organic synthesis, chemoselectivity, reversal of polarity (umpolung), cyclisation reactions, and amine synthesis.	8

	Total	42
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11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Carey F.A. and Sundberg, R.J.,“Advanced Organic Chemistry Part A: Structure and Mechanisms”, 5th Edn, Springer Publishers	2007
2.	Clayden J., Greeves N. and Warren S., “Organic Chemistry”, 2nd Edn,Oxford University Press	2012
3.	Eicher T. and Hauptmann S.,“The Chemistry of Heterocycles”, 2nd Edn, Wiley-VCH Verlag GmbH & Co. KGaA.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-312 Course Title: **Laboratory II**
2. Contact Hours: **L: 0 T: 0 P: 12**
3. Examination Duration (Hrs.): **Theory 0 Practical 6**
4. Relative Weightage: **CWS 0 PRS 50 MTE 0 ETE 0 PRE 50**
5. Credits: **6** 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Basic concepts in chemistry
9. Objective: To provide knowledge in laboratory based experiments
10. Details of the Course:

Physical Chemistry

1. To study the kinetics of H^+ -catalysed hydrolysis of sucrose by polarimetry.
2. Verification of Freundlich and Langmuir adsorption isotherms.
3. Determination of the equilibrium constant for $KI + I_2 = KI_3$ reaction using partition method.
4. Determination of the fluorescence quantum yield of the given substance.
5. Verification of Ostwald's dilution law by conductometric measurements of acetic acid.
6. Analysis of a mixture of metal cations by electroanalytical methods.
7. Determination of cation concentrations in soil by flame photometry and MP-AES
8. To calculate the surface energy of given organic liquid from surface tension versus temperature relationship.
9. To determine the variation of miscibility of phenol in water with temperature and to find the critical solution temperature. Analysis of effect of impurity on the CST.
10. To determine ΔG , ΔH and ΔS for the reaction, $Zn(Hg) + 2AgCl = ZnCl_2(aq) + 2 Ag (s)$ from e.m.f measurements.
11. To determine the ionization constant of bromophenol blue indicator by spectroscopy.

Inorganic Chemistry

1. Gravimetric determination of copper as cuprous thiocyanate.
2. Gravimetric determination of nickel as nickel dimethylglyoxime.
3. Determination of zinc as zinc ammonium phosphate in white metal decorative items.
4. Determination of magnesium as magnesium pyrophosphate in Mg ribbon.
5. Determination of iron as ferric oxide in folic acid/ iron tablets/ iron waste.
6. Estimation of metal ions by gravimetric-cum-volumetric analysis (2 components), e.g.,
 - a) Ag(I) gravimetrically and Cu(II) volumetrically.
 - a) Cu(II) gravimetrically and Zn(II) volumetrically.
 - b) Cu(II) and Ni(II) gravimetrically.
 - c) Cu(II), Ni(II) and Zn(II) gravimetrically
 - d) Cu(II), Ni(II) and Mg(II)
7. Preparation of Metal complexes

Organic Chemistry

1. Nucleophilic Aromatic Substitution: Preparation of 2,4-dinitrophenylthiocyanate from 2,4-dinitrobenzene
2. Preparation of 1,4-di-t-butyl-2,5-dimethoxybenzene by Friedel-Crafts alkylation

3. Bromination of alkenes (trans-cinnamic acid or styrene) and subsequent dehydrohalogenation
4. Cannizaro reaction: Conversion of *p*-nitrobenzaldehyde into *p*-nitrobenzoic acid and *p*-nitrobenzyl alcohol.
5. Preparation of Orange II or para red and dyeing cloth
6. Sandmeyer reaction: preparation of 2-iodobenzoic acid
7. Synthesis of chalcone from an aromatic aldehyde and acetophenone
8. Henry reaction: Synthesis of ω -nitrostyrene from an aromatic aldehyde and nitromethane
9. Coumarin synthesis from salicylaldehyde and diethylmalonate
10. Diels-Alder reaction of anthracene with maleic anhydride
11. Conversion of benzil to quinoxaline
12. Green synthesis of binaphthol
13. Preparation of *p*-nitroaniline from acetanilide (2 turns)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-515 Course Title: **Art of Scientific/Technical Writing**

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

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

4. Relative Weightage: **CWS 20-35 PRS 0 MTE 20-30 ETE 40-50 PRE 0**

5. Credits: **2** 6. Semester: **Autumn** 7. Subject Area: **PCC**

8. Pre-requisite: Basic chemistry knowledge

9. Objective: To introduce research ethics and methodologies for scientific writing in Chemistry

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Information and resources: Sources and their authenticity, methods for collecting information- search Engines, Google scholar, Scifinder, Web of Science, Scopus; Features of Chemdraw and its uses; searching of chemical resources, reactions, reagents and their chemical and physical properties.	6
2	Data collection: Spectral data bases, NMR data bases, CCDC, PDB, JCPDS, NIST. Recording of experiments: Log book and lab notebook, accuracy, precision, fitting of data, error bar, noise and data, IUPAC guidelines of presentation of data for experimental and theoretical studies. Figures, legends, tables, foot notes, abbreviations, references, different software used for plotting. Typesetting, templates, formulas and equations, reference formats, supplementary data	5
3	Writing style: Abstract, report, dissertation, thesis, manuscript, monographs, books, research proposals. Types of publications: letters, communications, perspectives, research articles, reviews, accounts. Outline, drafting, refinement, common errors, editing services, proof reading	8
4	Ethics in research and publishing: Authorship, plagiarism, checking of plagiarism, duplicate and redundant publications, copyright, open access licenses, embargo period, and repositories. Conflicts of interest, Bio-ethics. Social networks for promotion. Review, Originality, physical insights, reproducibility, Renowned publishers in the field of chemistry, citations, impact factor, Ranking: journals, institutes (e.g. NIRF), individuals, h-index, i-index, i-10 index, Author identification: ORCID and RESEARCHER IDs, ISSN and ISBN, Intellectual property rights	7
5	Presentation: Different modes: board, poster, power-point, audio-visual.	2

11. Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Hoffman, A., "Scientific Writing and Communication", Oxford University Press, 2 nd Edn.	2014
2.	Katz, M. J., "From Research to Manuscripts: A Guide to Scientific Research", Springer, 2 nd Edn.	2009
3.	Ebel, H. F., Bliefert, C., and Russey, W. E., "The Art of Scientific Writing", Wiley-VCH, 2 nd Edn.	2004

4.	Tufte, E. R., "The Visual Display of Quantitative information", Graphics Press, 2 nd Edn	2001
5.	Strunk, W. Jr. and White, E.B., "The Elements of Style", Allyn and Bacon, 4 th Edn.	2003

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-521 Course Title: **Advanced Analytical Methods**
2. Contact Hours: **L: 3 T: 1 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: **4** 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Basic knowledge in analytical chemistry
9. Objective: To impart knowledge on various instrumental analytical methods.
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Chromatographic separation techniques: van Deemter equation, processes leading to non-ideal chromatography; theory, instrumentation and applications of gas chromatography, high performance liquid chromatography; types of columns, impregnated, bonded and crosslinked stationary phases, Kovat's index; ion chromatography; size exclusion chromatography; affinity chromatography; electrophoresis.	8
2.	Mass spectrometry and hyphenated systems: Types of ion sources, mass analysers and detectors, resolution, nitrogen rule, ring rule, interpretation of data and applications, hyphenated techniques- GC-MS, LC-MS, MS-MS, examples.	5
3.	Electroanalytical techniques: Principle, instrumentation and applications of AC polarography, rapid scan, pulse, square wave, anodic stripping and cyclic voltammetric methods.	4
4.	Atomic spectroscopy: Optical atomic spectra, atomic linewidth and line broadening, sample atomization techniques, hydride generation, cold vapour technique, instrumentation of atomic absorption spectroscopy, interferences in atomic absorption spectroscopy and their correction methods, inductively coupled plasma optical emission spectroscopy and inductively coupled plasamass spectrometry and applications.	8
5.	Radiochemical methods: Generation of radioisotopes as radiotracers, radiolabelling, radioactivity measurement- GM-counter, NaI (Tl) scintillation detector, semiconductor detectors, applications of radioisotopes – Mossbauer spectroscopy; positron annihilation spectroscopy; activation analysis.	6
6.	Thermal methods of analysis: Instrumentation on thermogravimetric analysis (TGA); differential thermal analysis (DTA); differential scanning calorimetry (DSC); thermogravimetry coupled with mass spectrometer (TG-MS) and infrared spectrophotometer (TG-FT-IR).	3
7.	Automated methods of analysis: Importance of automation in chemical analysis, types of automated system, segmented and continuous flow, flow injection analysis – principle, instrumentation, applications; stopped flow method, sequential injection analysis, discrete analyzer, automated organic elemental analyser. Microfluidic devices in analytical chemistry, lithographic techniques for fabrication of microfluidic devices.	8
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Mendham, J., Denney, R.C., Barnes, J.D. and Thomas, M.J.K., "Vogel's Text Book of Quantitative Chemical Analysis" 6 th Ed., Pearson Education.	2004
2.	Skoog, D.A., West, D.M., Holler F.J. and Crouch S.R., "Fundamentals of Analytical Chemistry", 8 th Ed., Thomson Brooks/Cole.	2004
3.	Christian, G.D., Dasgupta P.K., Schug K.A., "Analytical Chemistry", 7 th Ed., John Wiley & Sons Inc.	2013
4.	Bond, A.M., "Modern Polarographic Methods in Analytical Chemistry".1 st Ed., CRC Press.	1980
5.	Sood, D.D., Reddy A.V.R. and Ramamoorthy N., "Fundamentals of Radiochemistry", IANCAS Publication, BARC, Mumbai	2004

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-523 Course Title: **Organic Chemistry V**
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: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Basic concepts in chemistry of hydrocarbons
9. Objective: To impart knowledge in synthetic organic chemistry
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Functional Group Transformations : Introduction of functional groups (alcohols, halides, nitriles, amines, azides) by substitution at saturated carbon, cleavage of ethers, esters and amides, interconversion of nitriles and carboxylic acid derivatives (esters, acids, acid chlorides, amines), protecting groups – acetals, ethers, silyl ethers and esters, protection of diols, amines, carbonyls and carboxylic acids.	10
2.	Main group metals mediated synthesis : Addition reactions of electrophilic sulfur and selenium reagents, iodolactonization, sulfenylcyclization, selenenylcyclization, α -sulfenylation and α -selenylation to carbonyl compounds, hydroboration of alkenes and alkynes, reactions of organoboranes, enantioselective hydroboration; hydroalumination, carboalumination.	8
3.	Reductions : Reduction of alkenes, alkynes, hydrogenation using heterogeneous and homogeneous catalysts, enantioselective hydrogenation, hydrogen transfer reagents, hydrogenation of carbonyls, hydrogenolysis, hydrogen donor reagents - NaBH_4 , LiAlH_4 and modified reagents, silicon hydrides, tin hydrides; reduction of imines, imides and amides, chemoselectivity and stereoselectivity of reductions, enantioselective reduction of carbonyl compounds, Meerwein-Ponndorf-Verley reduction, dissolving metal reductions, McMurrycoupling, Clemmensen reduction, Wolff-Kishner reaction, Shapiro reaction.	12
4.	Oxidations : Oxidation of alcohols- Jones reagent, Swern oxidation, Dess-Martin reagent; dihydroxylation of alkenes, metal catalyzed epoxidation of alkenes, Sharpless asymmetric epoxidation, epoxidation by peroxy reagents, dioxirane derivatives, nucleophilic and reductive ring opening of epoxides, rearrangements of epoxides, oxidation of allyl compounds, selenium derivatives as oxidants, oxidative cleavage of alkenes, ozonolysis, oxidation of aldehydes and ketones, Baeyer-Villiger oxidation, oxidation of enolates, glycols, carboxylic acids and non-functionalized carbons.	12
	Total	42

11. Suggested Books:

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Larock, R.C. "Comprehensive Organic Transformations", John Wiley & Sons	2018
2.	Carey, F.A. and Sundberg, R.J. "Advanced Organic Chemistry. Part B: Reaction and Synthesis", Springer.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

1. Subject Code: CYN-525 Course Title: **Advanced Molecular Spectroscopy**
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: Autumn 7. Subject Area: PCC
8. Pre-requisite: Quantum chemistry, group theory and basic concepts in spectroscopy
9. Objective: To impart knowledge on some of the widely used spectroscopic methods for understanding molecules and compounds.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Optical rotatory dispersion and circular dichroism: Optical activity, Basic principles of optical rotatory dispersion and circular dichroism, Cotton effect, Selection rules – magnetic transition moment, rotational strength, absolute configuration, spectropolarimeter, applications	4
2.	Nonlinear spectroscopy: History of nonlinear optics, theoretical foundations, second harmonic generation, phase matching, symmetry considerations, optical rectification, Pockels effect, sum frequency generation, difference frequency generation and optical parametric amplification, third order processes.	6
3.	Nuclear magnetic resonance: Nuclear magnetism, nuclear spin states in a magnetic field and the resonance phenomenon, relaxation processes and their importance. Bloch equation, Larmor frequency, shielding constant and chemical shifts. Factors affecting chemical shifts – local diamagnetic shielding, magnetic anisotropy of chemical bond, hydrogen bonding effect; spin-spin coupling and quantum chemical description of spin systems-spectra AX ₂ and AX ₃ spin systems, spectra of AMX and AMX _n spin systems. Chemical exchange process, spin decoupling, dynamic NMR and line shapes. double resonance experiments and nuclear overhauser effect, chemical shift reagents, NMR spectra of ¹³ C, ¹⁹ F and ³¹ P systems; solid state NMR, magic angle, 2D NMR.	14
4.	Electron spin resonance: g-factor, interaction of magnetic dipole with microwave radiation, hyperfine splitting from proton and from nuclei with spin greater than ½, hyperfine interaction, anisotropic system; triplet state – spin transition, effect of dipolar field, zero field splitting, spectrum of naphthalene triplet, spectral interpretation - g-value determination, complexes of transition metals ions, double resonance techniques	8
5.	X-ray Absorption spectroscopy: X-ray emission spectrum, X-ray absorption spectrum, XANES and EXAFS – theory and applications in inorganic materials.	4
6.	Mossbauer Spectroscopy: Principles, experimental details – line width and recoil energy; Mossbauer spectral parameters – isomer shift, electric quadrupole interaction, magnetic splitting; applications with ⁵⁷ Fe and ¹¹⁹ Sn systems.	6
Total		42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Sathyanarayana, D.N.“Handbook of Molecular Spectroscopy from Radiowaves to Gamma rays”. IK International Publishing House Pvt. Ltd., New Delhi	2015
2.	Banwell, C.N. and McCash, E.L.M. “Fundamentals of Molecular Spectroscopy”, 4th Ed. McGraw-Hill N. Y	1999
3.	Graybeal, J.D. “Molecular Spectroscopy”, 1 st Rev. Edn, McGraw-Hill	2014
4.	Gunther, H.“NMR spectroscopy”, 2 nd Edition, Wiley-India	2010
5.	Poole, C.P., “Electron Spin Resonance, A Comprehensive Treatise on Experimental Techniques”, 2 nd Edition, Dover Publications Inc, NY	1996
6.	Boyd R.W.,“Nonlinear Optics”, 3 rd Edn, Academic Press	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-531 Course Title: **Laboratory III**
2. Contact Hours: **L: 0 T: 0 P: 12**
3. Examination Duration (Hrs.): **Theory 0 Practical 6**
4. Relative Weightage: **CWS 0 PRS 50 MTE 0 ETE 0 PRE 50**
5. Credits: **6** 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Knowledge in different areas of chemistry
9. Objective: To provide knowledge in laboratory based experiments
10. Details of the Course:

Physical Chemistry

1. To study the kinetics of H^+ catalyzed hydrolysis of an ester.
2. To study the kinetics of saponification of an ester.
3. To study the kinetics of Fe^{3+} catalyzed decomposition of hydrogen peroxide.
4. Determine the composition of KCl-KBr mixtures by potentiometric titration against silver nitrate solution.
5. To study the quenching of fluorescence of organic dye(s).
6. To determine the molecular weight of a volatile substance using Victor Meyer method.
7. To determine the cell potentials for different electrochemical cells and also to measure different thermodynamic parameters.

Inorganic Chemistry

1. Synthesis of nickel complexes e.g., $[Ni(H_2O)_6]^{2+}$, $[Ni(NH_3)_6]^{2+}$ and $[Ni(en)_3]^{2+}$ for
 - (a) Comparison of the electronic spectra;
 - (b) Qualitative verification of the spectrochemical series, and
 - (c) Quantitative estimation of nickel by spectrophotometry
2. Synthesis and spectrophotometric study of bis(salicylaldimine)copper(II) and cis-bis(glycinato)copper(II),
3. Record spectra of Cu^{2+} in water, NH_3 , ethylene diamine and glycine, and arrange the ligands in increasing order of field strength.
4. Quantitative estimation of copper by spectrophotometry.
5. (i) Study of the complex formation between Fe(III) and thiocyanate/salicylic acid/sulphosalicylic acid or between Ni(II) and o-phenanthroline;
(ii) spectrophotometric determination for formation constant of the metal complex (Job's method and molar ratio method).
6. Preparation of (i) $[Ni(NH_3)_6]Cl_2/SO_4$, (ii) $[Ni(en)_3]Cl_2/SO_4$, (iii) bis(salicylaldimine)nickel(II), and characterization by FT-IR, UV-vis and ^1H NMR spectroscopy.
7. Synthesis of potassium tris(oxalato)aluminate, potassium tris(oxalato)chromate and potassium tris(oxalato)ferrate, and their characterization by metal determination, various spectroscopic (I.R. and UV-vis) methods, magnetic moment determination, and photochemical behavior of iron complex.
8. Synthesis and characterization of $[Co(en)_3]Cl_3$. Separation of its optical isomers and determination of their optical rotation by using polarimeter.

Organic Chemistry

1. Fisher indole synthesis (2 turns)
2. Preparation of trans-9-(2-phenylethenyl)anthracene from anthracene (formylation and Wittig reaction). (2 turns)
3. Synthesis of *N*-benzylbarbituric acid from diethylmalonate (2 turns)
4. Luminol synthesis and chemiluminescence (3 turns)
5. Synthesis of hexaphenylbenzene from diphenylacetone and *E*-stilbene or benzil via cyclopentadienone and diphenylacetylene. (5 turns)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

1. Subject Code: CYN-522 Course Title: **Materials Chemistry**
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: **Spring** 7. Subject Area: **PCC**
8. Pre-requisite: Knowledge in solid state chemistry
9. Objective: To provide knowledge on materials chemistry, synthesis, characterization and properties of materials

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Introduction: Historical perspective, classifications, approaches to produce new materials, role of chemistry in material science and applications, role of structure, composition and bonding on the properties of materials.	4
2.	Synthesis of materials: Conventional methods - colloidal synthesis, precipitation and co-precipitation, sol-gel synthesis, ceramic method, combustion method, arc melting, mechanical attrition. Non-conventional methods: hydrothermal and solvothermal, electrochemical reduction, sonochemistry, microwave assisted synthesis, arc discharge, biomineralization and biomimetic synthesis. Soft-chemistry methods: ion-exchange, intercalation and exfoliation. Thin film growth - dip coating, spin-coating, chemical vapour transport, metal organic chemical vapour deposition, sputtering, pulsed laser deposition, atomic layer deposition.	14
3.	Materials based on composition: Metals and alloys, semiconductors, ceramics, zeolites and glasses, organic soft materials/molecular materials, liquid crystals, polymers and composites, carbon based materials and biomaterials.	5
4.	Materials based on morphology and microstructure: Powders, thin films, monoliths, amorphous materials; nanomaterials – nanocrystals, porous materials, photonic crystals.	5
5.	Application of materials: structural materials, optical materials, superconducting materials, thermoelectric materials, magnetic materials, dielectrics, multiferroics, energy materials (supercapacitors, batteries, fuel cells, solar cell, hydrogen storage and nuclear materials), materials for healthcare, materials for environmental remediation (control of greenhouse gas emission and water treatment).	14
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Allcock, H.R., "Introduction to Material Chemistry" John Wiley & Sons, Inc.	2008
2.	Fahlman, B.D., "Material Chemistry" Springer	2011
3.	Klabunde, K.J., and Richards, R.M. "Nanoscale Materials in Chemistry" K. J. Klabunde, R. M. Richards, 2 nd Edn., John Wiley & Sons, Inc.	2009
4.	Callister, Jr. W. D. and Rethwisch, D. G. "Material Science and Engineering: An Introduction" 8 th Edn., John Wiley & Sons, Inc.	2009
5.	Delhaes, P. "Carbon-based Solids and Materials". John Wiley & Sons, Inc.	2011
6.	West, A.R., "Solid State Chemistry and its Applications" Wiley India	2013

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-524 Course Title: **Frontier Inorganic Chemistry**
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: **Spring** 7. Subject Area: **PCC**
8. Pre-requisite: Knowledge in coordination chemistry and organometallics
9. Objective: To impart advanced knowledge in Inorganic Chemistry
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Advanced Organometallic Chemistry: Metallocene catalysis for olefin polymerization, catalytic cycle for hydrosilation and hydrocyanation, Davies-Green-Mingos rule for organometallic clusters, Kuba's dihydrogen complex, synthesis of CCC-chelates using Os complexes, organometallic dendrimers with Fe and Pt, third generation Grubb's catalyst for ring opening polymerization, decarbonylation of acid chlorides, reaction of metal acyl enolates with electrophile, C-H activation and use of weakly coordinating anions, alkane metathesis, heterogeneous catalysis for organic transformations using organometallic frameworks of Zn-Pd and Co.	8
2.	Reaction mechanisms: Substitution reactions in octahedral complexes- exchange reactions, acid- and base-hydrolysis, anation, solvolytic and catalyzed reactions. Substitution reactions in square-planar complexes-effect of non-participation of ligands on reactivity, <i>cis</i> and <i>trans</i> effects, outer- and inner-sphere mechanisms, factors affecting electron transfer reaction rates, theories of electron transfer reactions, solvated electron, photochemically excited states and excited state processes for transition metal complexes, photochemical reactions of coordination compounds.	14
3.	Bioinorganic chemistry: Metalloproteins and enzymes- role of metal ions in the active sites, structural and functional models of metalloproteins and enzymes containing Mg, Ca, V, Mn, Fe, Co, Ni, Cu and Zn ions. Detailed structure and mechanistic studies of the following: Mn-photosystem-II, catalases, peroxidases, pseudocatalase, hydrolases, oxygen carriers- haemoglobin, myoglobin; non-haem proteins-hemerythrin, hemocyanin, Fe-ribonucleotidoreductase, cytochrome c oxidases, cytochrome P-450s, Ni-urease, hydrogenase, nitrogen fixation, blue copper proteins, tyrosinase, galactose oxidase, superoxide dismutases, carbonic anhydrase, carboxypeptidase, alcohol dehydrogenase. Roles of transition metals (Ti, V, Fe, Co, Tc, Hg, Pt, Au and Ru) in biology and medicine.	20
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Crabtree, R. H. "The Organometallic Chemistry of Transition Metals" 6 th ed. John Wiley & Sons.	2014
2.	Huheey, J.E., Keiter, E.;Keiter, R. and Medhi, O.K., "Inorganic Chemistry: Principles of Structure and Reactivity", 4 th Ed., Pearson Education Asia.	2006
3.	Gibbs, W., "Concepts and Applied Principles of Bioinorganic Chemistry", Vol. III Callisto Reference.	2015
4.	Gupta, B. D., Elias, A. J. "Basic Organometallic Chemistry" 2 nd Edition, University Press (India) Pvt Ltd	2013
5.	Lippard, S.J. and Berg, J., "Principles of Bioinorganic Chemistry", University Science Books, U.S.A.	1994
6.	Bertini, I., Gray, H.B., Lippard, S.J. and Valentine, J.S., "Bioinorganic Chemistry", University Science Books, U.S.A.	1994

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: Department of Chemistry

1. Subject Code: CYN-526 Course Title: Organic Chemistry VI
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: Autumn 7. Subject Area: PCC
8. Pre-requisite: Knowledge of functional groups in organic chemistry and their reactivity
9. Objective: To develop concepts in structure elucidation in Organic Chemistry
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Infrared Spectroscopy: Factors influencing vibrational frequencies, interpretation of IR spectra, characteristic group absorptions of hydrocarbons, aromatic systems, alcohols, phenols, ethers, carbonyl compounds, amines, nitriles and related compounds, nitro, sulfur and phosphorous compounds, alkyl halides and aryl halides	4
2.	UV-vis Spectroscopy: Solvent effect, chromophores, auxochromes, effect of conjugation; empirical rules to predict $\lambda_{\max}$ for dienes, enones and α,β -unsaturated aldehydes and acids; aromatic compounds, polynuclear aromatic hydrocarbon and heterocyclic compounds, electronic transition for charge transfer complexes, keto-enol tautomerism.	5
3.	Mass Spectrometry: Determination of molecular formula, isotope effects, nitrogen rule, McLafferty rearrangement, metastable ions, fragmentation patterns of acyclic and cyclic hydrocarbons, aromatic hydrocarbons, alcohols, phenols, ethers, aldehydes, ketones, esters, carboxylic acids, nitrogen and sulfur compounds, alkyl halides.	5
4.	NMR Spectroscopy: Fundamentals of NMR sensitivity and resolution, chemical shift, chemical and magnetic equivalence, shielding, magnetic anisotropy, origin of spin-spin splitting, (n+1) rule, chemical shifts of common NMR solvents, NMR spectra at low and high field strengths, deuterium exchange experiments, coupling constant, types of coupling – vicinal, geminal, long-range; spin decoupling, spin systems – AX_2 , A_2B_2 & A_2X_2 and AMX , ABX , & ABC types; homotopic, enantiotopic and diastereotopic systems, chemical shift reagents, chiral resolving agents, ^1H NMR spectra of compounds of various functional groups, nuclear Overhauser effect.	14
5.	^{13}C and heteronuclear NMR Spectroscopy: Introduction to ^{13}C NMR, chemical shifts in ^{13}C NMR, proton-coupled and decoupled ^{13}C NMR, chemical shifts of common NMR solvents, DEPT spectroscopy. NMR spectroscopy of other common NMR-active nuclei such as ^{15}N , ^{19}F , ^{29}Si , and ^{31}P .	5
6.	Two-dimensional NMR Spectroscopy: 2D NMR techniques – homo- and hetero-nuclear correlation (COSY, HETCOR, TOCSY, HSQC, HMBC), NOESY, ROESY and INADEQUATE.	5
7.	Structure elucidation of complex molecules: Solving structures utilizing IR, UV, MS, NMR data.	4
	Total	42

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Silverstein,R.M.,Webster,F.X.,Kiemle,D.J. and Bryce,D.L. "Spectrometric Identification of Organic Compounds", 8th Edn., Wiley.	2014
2.	Pavia,D.L. Lampman,G.M., Kriz, G.S. and Vyvyan,J.A. "Introduction to Spectroscopy", 5 th Edn., Cengage Learning.	2015
3.	Uauglitz, G and Vo-Dinh,T. (Eds), "Handbook of Spectroscopy", Wiley.	2003
4.	Pretch,E., Bühlmann,P and Badertscher, M. "Strucutre Determination of Organic Compounds", Springer.	2009
5.	Field, L.D., Sternhell, S., Kalman,J. R. "Organic Structures from Spectra", 4 th Edn, Wiley.	2008
6.	Simpson, J.H. "Organic Structure Determination using 2-D NMR Spectroscopy", Academic Press.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

1. Subject Code: CYN-532 Course Title: **Laboratory IV**
2. Contact Hours: **L: 0** **T: 0** **P: 12**
3. Examination Duration (Hrs.): **Theory 0** **Practical 6**
4. Relative Weightage: **CWS 0** **PRS 50** **MTE 0** **ETE 0** **PRE 50**
5. Credits: **6** 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Basic knowledge of synthesis, characterization and analysis of compounds
9. Objective: To provide advanced level laboratory based experiments
10. Details of the Course:

Name of the experiments:

1. Separation of binary mixture of organic compounds using column chromatography.
2. Simultaneous spectrophotometric determination of concentration of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a given mixture.
3. Determination of Na, K in a soil sample by flame photometry.
4. Determination of metal in alloy samples by AAS.
5. Radiation measurement by NaI(Tl) and GM counter.
6. Determination of metal ions by polarography and voltammetry methods.
7. Extraction of Fe^{3+} using 8-hydroxyquinoline.
8. Catalytic oxidation of organic substrates and analysis by GC.
9. Structure elucidation of organic molecules using ^1H and ^{13}C NMR spectra.
10. Synthesis, characterization and applications of ZnO or CdS or CdSe nanoparticles
11. Literature search in organic chemistry using e-sources
12. Michael addition followed by Robinson annulation: Reaction of methylvinyl ketone with aldehyde or ketone.
13. Preparation of anthracene from phthalic anhydride.
14. Esterification and nitration of *p*-hydroxybenzoic acid.
15. Synthesis of 4-cyano-2-aminophenol from 4-hydroxybenzaldehyde.
16. Spectrophotometry: (a) Simultaneous spectrophotometric determination of Cr and Mn in a given sample. (b) To analyse aspirin in a commercial tablet using spectrophotometric and titrimetric methods.
17. Magnetic measurement: Synthesis of iron/chromium complexes and their characterization by IR, UV-Vis spectrometry, Magnetic measurements and photochemical studies.

LIST OF PECs

For Autumn Semester:

1. Separation Techniques and Microanalysis (CYN-605)
2. Electroanalytical Chemistry (CYN-607)
3. Frontiers in Bioinorganic Chemistry (CYN-613)
4. Crystal and Molecular Structure (CYN-615)
5. Supramolecular Chemistry (CYN-617)
6. Organic Semiconductors (CYN-623)
7. Proteins and Polypeptides (CYN-625)
8. Advanced Surface and Colloidal Chemistry (CYN-627)
9. Advanced Physical Chemistry (CYN-629)
10. Nanoscale Materials: Properties and Applications (CYN-633)
11. Advanced Magnetic Resonance Spectroscopy (CYN-635)
12. Analysis of Industrial Polymers (CYN-751)

For Spring Semester:

1. Nuclear and Radiochemistry (CYN-512)
2. Heterocyclic Chemistry (CYN-514)
3. Total Synthesis (CYN-606)
4. Chemical Biology (CYN-608)
5. Molecular Modeling and Simulations (CYN-610)
6. Carbon Nanomaterials and their Applications (CYN-612)
7. Pharmaceutical Organic Synthesis (CYN-722)
8. Environmental Chemistry (CYN-732)
9. Analysis of Materials (CYN-742)
10. Analysis of Food and Drugs (CYN-752)
11. Chemistry of Industrial Processes (CYN-782)

Note: all the above PECs are Senate Approved 3-credit courses.

Item No. 76.12: To consider the proposal of Department of Electronics and Communication Engineering to change the eligibility criteria for admission to M.Tech. (Microelectronics and VLSI), to B.Tech./B.E.(Electronics and communication Engg. or equivalent, M.Sc. (Physics)/ (Electronics) or equivalent with a valid GATE score in EC/ Physics streams.

The IAPC in its 67th meeting held on December 11, 2018, recommended the proposal **(Appendix 'A')**.

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

(1)

Appendix 'A'
Item No. Senate/76.12

To

Dean Academic Affairs

IIT Roorkee

Please make the following correction of typo errors in the attached letter:

Kindly change the eligibility criterion for admission to M.Tech (Microelectronics and VLSI) to B.Tech (Electronics and Communication Engg.)/B.E. (Electronics and Communication Engg.) or equivalent, M.Sc (Physics)/M.Sc (Electronics) or equivalent with a valid GATE score in EC/Physics streams.

Yours truly

Prof. D. Ghosh

HOD, EC&E

डॉ. देबाशिस घोष / Dr. Debashis Ghosh
प्रोफेसर एवं विभागाध्यक्ष / Prof. & Head
इलेक्ट्रॉनिक्स एवं संचार इंजी. विभाग
Deptt. of Electronics & Communication Engg.
भा. प्रौ. सं. रुड़की / I.I.T. Roorkee

Item No. 76.13: To consider the recommendation of DFC of Department of Chemistry to close the M.Tech. (Advanced Method of Chemical Analysis) programme due to poor inflow of the students and placement record.

The IAPC in its 67th meeting held on December 11, 2018 recommended the proposal of Department of Chemistry.

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

Item No. 76.14: To consider the proposal for admission of IIT graduates (with CGPA 8 and above) over and above the sanctioned intake for M.Tech. programme from the year 2019 onwards.

At present, upto 10% of intake are offered admission directly in M. Tech. programme to IIT graduates having CGPA 8 or above. However, with this 10% cap limits the intake of IIT graduates to M Tech program.

The IAPC in its 67th Meeting held on December 11, 2018, recommended the proposal that all the eligible IIT graduates fulfilling the eligibility criteria for admission be given admission to M Tech programs over and above the sanctioned intake from the year 2019 onwards.

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

Item No. 76.15: To consider the modification in Ph.D. Forms in line with the decisions taken in recent Senate meetings.

Decision regarding time of allocation of Supervisor, admission categories, number of institute assistantship students per faculty, Ph.D. students in different schemes to be considered over and above institute assistantships, etc. are taken in recent Senates.

It may be noted that the present Ph.D. forms were approved with Ph.D. Ordinances and Regulations vide Senate resolution No.60.23 in its meeting held on 8th July, 2015.

The IRC in its 24th meeting held on 10.12.2018 discussed the modification in Ph.D. forms in this light and recommended them for the consideration and approval of the Senate. **(Appendix A)**



FINALIZATION OF SUPERVISOR(S)

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. Name of the Research Scholar and Department/Centre:
2. Date of Registration :
3. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
4. Proposed Area of Research :
5. Name, Designation, department/organization of Supervisor
 - (i) Supervisor-1: Designation:
Department:
 - (ii) Supervisor-2: Designation:
Department:
 - (iii) Supervisor-3 (from outside institute if any):
Designation: Organization:
6. Specified research area of supervision in case of Joint Supervision
Attach separate sheet with proper justification
7. Particulars of Proposed Supervisor (s)

Name & Designation	No. of students being supervised including candidate(s) of other institution(s), excluding this Student						Signature of Supervisor (s)
	Single			Jointly			
	With IITR Assistantship	Without IITR Assistantship	Other Institution(s)	With IITR Assistantship	Without IITR Assistantship	Other Institution(s)	

Signature of the Supervisor(s)

Recommended based on student and
Faculty choice

Approved and Forwarded/Not Approved

Chairperson, DRC/CRC
DATED:

HEAD OF THE DEPARTMENT/CENTRE

Note: The Proforma is to be sent to Academic Section for record.

FOR USE OF ACADEMIC OFFICE

Checked and found as per regulation / Revision is requested under

Asstt. Registrar (Evaluation)

Joint Registrar - Academics



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

The SRC shall be constituted as soon as the supervisor is finalized. Information shall be sent to Academic office.

1. Name and department of Research Scholar:
2. Date of Registration :
3. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
4. Proposed Area of Research :
5. Supervisor(s), organization :
:
:
6. Panel of the members proposed by the supervisor(s), including two members of Senate:
 - (i) Member from within the department
 1.
 2.
 3.
 - (ii) Member from outside the department/institute (Give organization in case outside the institute).
 1.
 2.
 3.

Signature of the Supervisor (s)

SRC is constituted as follows:

1. Chairperson, SRC :
[Chairperson SRC should be a Senator as per Rule R.1.4]
2. Member within department:
3. Member outside department:
4. Supervisor(s):

Chairperson, DRC/CRC
DATED:

HEAD OF THE DEPARTMENT/CENTRE

FOR USE OF ACADEMIC OFFICE

Checked and found as per regulation / Revision is requested under

Asstt. Registrar (Evaluation)

Joint Registrar - Academics



APPLICATION FOR COURSES TO BE COMPLETED

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

- A.1 Name of the Research Scholar _____ Enrollment No. _____
2. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
3. Date of Initial Registration _____
4. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
5. Proposed Area of Research _____

B.1. Total No. of Credits to be completed (As per Regulation R.4 Table 1) _____

2. Courses proposed to be completed [Seminar is compulsory even if courses are waived-off]

Semester	Session	PG Course No.	Title	Credits	Remarks

3. Certified that the courses as mentioned above have not been taken by me during earlier studies leading to graduate/post-graduate degrees.

Dated: _____

Signature of Research Scholar

Sign C.1 if SRC has been constituted, otherwise C.2

C.1 SRC discussed candidate's educational back ground, research area and credit requirements and approved the contents as mentioned under point-B

Member within department

Member outside department

Supervisor(s)

Chairperson, SRC

C.2 Recommended as above

Chairperson, DRC/CRC

HEAD OF THE DEPARTMENT/CENTRE

DATED:

FOR USE OF ACADEMIC OFFICE

Checked and found as per regulation / Revision is requested under

Asstt. Registrar (Evaluation)

Joint Registrar - Academics



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. Name of the Research Scholar _____
2. Enrollment No. _____
3. Session _____ 4. Semester (Autumn/Spring): _____
5. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
6. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
7. Title of Seminar: _____

8. Course Credit: _____ 9. Grade Obtained _____
10. Date on which seminar was delivered _____
11. Proficiency in English: Satisfactory/Unsatisfactory
12. A course on Communication Skills is required.....Yes/No

Member SRC

Member SRC

Supervisor(s)

Date: _____

Signature of Chairperson, SRC

Forwarded to Academic Office

Signature of Head of the Department/Centre

FOR USE OF ACADEMIC OFFICE

Checked and found as per regulation / Revision is requested under

Asstt. Registrar (Evaluation)

Joint Registrar – Academics

ADAAE



PROGRESS AND PERFORMANCE REPORT

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

A. PROGRESS REPORT

1. Name of the Research Scholar _____ Enrollment No. _____
2. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
3. Category: FTRS (IARS/EFERS/ISERS) / PTRS (P-IRERS/P-ISERS)
4. Date of Initial Registration _____
5. Date of Candidacy (if applicable) _____
6. Brief report of the work (Please attach separate sheet)
7. Date of presentation in front of SRC : _____
8. Any other information regarding work done _____

Dated: _____

Signature of Student

B. PERFORMANCE REPORT AND RECOMMENDATIONS FROM DEPARTMENT /CENTRE

PERIOD : From _____ To _____

- (a) Performance: _____ Satisfactory/Unsatisfactory
- (b) Recommended for registration: _____ Yes/No
- (c) Date of yearly seminar presentation (if applicable) _____
- (c) Attach a copy of communication issued after last report, if performance is graded unsatisfactory.
- (d) Reason if not recommended for registration _____

Member, SRC

Member, SRC

Signature of Supervisor(s)

Chairperson, SRC

Chairperson, DRC/CRC

Head of the Department/Centre

Date: _____

FOR USE OF ACADEMIC OFFICE

Recommendation submitted for consideration / _____

Dealing Asstt./Junior Supdt./Supdt.

Asstt. Registrar (Evaluation)

Joint Registrar - Acad

Approved/Not Approved

DEAN OF ACADEMIC AFFAIRS



REQUEST FOR COMPREHENSIVE EXAMINATION

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

CHAIRPERSON, SRC

Department / Centre _____

Through: SUPERVISOR(s)

I have earned the required number of credit(s) as per clause R.4 after taking the following courses as approved by SRC.

Sl.No.	Course No.	Title	Semester/ Session	Credit(s) Earned	Grade Obtained
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
CGPA					

Note: Self attested photocopies of the grade sheets are enclosed.

It is requested that my comprehensive written examination may kindly be arranged.

Date: _____

Signature _____

Name of Scholar _____

Forwarded

Enrolment No. _____

Supervisor(s) _____

The comprehensive written examination may be fixed on

The syllabus for the comprehensive written examination as approved by SRC is enclosed.

Chairperson, SRC

FOR USE OF ACADEMIC OFFICE

Checked and found as per regulation / Revision is requested under

Asstt. Registrar (Evaluation)

Joint Registrar - Academics



Notification for Comprehensive Examination

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Copy of notification should be sent to academic office

DEPARTMENT /CENTRE: _____

The written comprehensive examination / presentation on research plan of Mr./Ms.
_____ Research Scholar, Enrollment No. _____ in this

Department/centre will be held as follows:

A-1* Written comprehensive examination:

1. Date _____ 2. Time _____

3. Venue _____

A-2* Oral comprehensive examination:

1. Date _____ 2. Time _____

3. Venue _____

B* Presentation on the proposed research plan:

1. Date _____ 2. Time _____

3. Venue _____

CHAIRPERSON, SRC

Copy through email to: All members of SRC

CHAIRPERSON, SRC

*** Note:** Separate notification is to be issued for each component of comprehensive examination/presentation. Please delete whichever is not applicable.



Report on Comprehensive Examination and Recommendation for Candidacy INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. Name of the Research Scholar _____ Enrollment No. _____

2. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)

3. Category: FTRS (IARS/EFERS/ISERS) / PTRS (P-IRERS/P-ISERS)

4. Report of Comprehensive Examination:

(i) Date of Written Examination: _____

Result of Written Examination: Marks _____ / To reappear after _____ months

(ii) Date of Oral Examination: _____

Result of Oral Examination: Pass / To reappear after _____ months

Remarks if any: _____

4. CANDIDACY FOR Ph.D. DEGREE

(i) Date of presentation of research proposal _____

(ii) Has the candidate completed review work in his/her area of research: Yes/ No.

(iii) The SRC considered the research proposal entitled _____

(Copy attached, in single space, Times New Roman 10 Font size, 12 pages both side print)

* The research proposal is: _____ Recommended/Not Recommended

* SCI/Scopus indexed journals of proposed area where publication is required before submission of thesis _____

5. PERFORMANCE AND RECOMMENDATION FROM DEPARTMENT/CENTRE

(a) Performance upto the date of research proposal _____ Satisfactory / Unsatisfactory

(b) Recommended for candidacy _____ Yes/No

Member, SRC

Member, SRC

Supervisor(s)

Chairperson, SRC

Dated: _____ Signature of Chairperson DRC/CRC Head of the Department/Centre

FOR USE OF ACADEMIC OFFICE

Recommendations of the Department/Centre are submitted for consideration.

Dealing Asstt./Junior Supdt./Supdt.

Asstt. Registrar (Evaluation)

Joint Registrar - Acad

Approved/Not Approved

DEAN OF ACADEMIC AFFAIRS

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

1. Name of the Research Scholar _____ Enrollment _____
2. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
3. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
4. Title of Research (In English) _____

5. Date of Initial Registration _____ Date of Candidacy _____
6. Is the meeting held for Mid Term Review? YES/NO
- Period of Performance for Review: From _____ to _____
- Reason of Mid Term Review _____

[Attach detailed report]

7. Is it a Special Student Research Committee Meeting? YES/NO
- (A) Is there change of topic? YES/NO
- Revised Topic if YES
(In English) _____

Justification: _____

- (B) Is there change of Supervisor(s)? YES / NO
- Addition of Supervisor(s) _____
- Deletion of Supervisor(s) _____

**(Enclosed Bio-data of proposed supervisor other than IITR)*

Following information is required if proposed additional supervisor is from IITR

Name & Designation	Deptt./Center/ Organization	No. of Students Supervising Excluding this Student and Including candidate of other institution(s).						Signature Of Supervisor
		Single			Jointly			
		With IITR Assistantship	Without IITR Assistantship	Other Institution(s)	With IITR Assistantship	Without IITR Assistantship	Other Institution(s)	

Enclose detailed justification in case of joint supervision or deletion of supervisor

- (C) Whether a case of probation due to course work requirement YES/NO
- If YES, New Courses recommended: _____

- (D) Whether a case of up gradation from JRF to SRF YES/NO
- Date of conversion to SRF _____
- Period considered for conversion _____

- (E) Semester Withdrawal on medical ground / Re-registration YES/NO
(F) Whether a case for extension of time YES/NO

(Strike-off whichever is not applicable out of F-1 and F-2)

F-1: For completion of thesis work within admissible time

F-2: For submission of thesis:

Provide following details for above request:

Due date _____ Previous extension, if any _____

Date of Proposed extension _____

Reason: _____

- (G) Continuation of assistantship up to viva-voce examination YES/NO

- (H) Any Other: _____

Member, SRC

Member, SRC

Supervisor(s)

Chairperson, SRC

Chairperson, DRC/CRC

HEAD OF THE DEPARTMENT/CENTRE

DATED:

FOR USE OF ACADEMIC OFFICE

The recommendations of the Department/Centre are submitted for consideration / _____

Dealing Asstt./Junior Supdt./Supdt.

Asstt. Registrar (Evaluation)

Joint Registrar - Acad

APPROVED/NOT APPROVED

DEAN OF ACADEMIC AFFAIRS



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. Name of the Research Scholar
(English) _____ Enrollment No.: _____
(Hindi) _____
2. Département/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
3. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
4. Title of Thesis (at the time of candidacy)
In **English** (In Capital Letters) _____

In **Devanagari** _____

5. Name (s) of the Supervisor (s) 1. _____
2. _____
3. _____
6. Date of Initial Registration _____ Extension (s), if any _____
7. Date of Candidacy _____
8. Date of Final SRC _____
9. Whether the candidate's Research Papers have been published in the refereed journals as per clause R.8 of the regulations: YES / NO
If not reasons therefore _____
10. Recommendation of the Student Research Committee
(a) Work is satisfactory, and
(i) Recommended for submission YES / NO
(ii) The title of the thesis remains unchanged YES / NO
(iii) The title of the thesis is reworded for clarity as specified below
In **English** (In Capital Letters) _____

In **Devanagari** _____

(iv) Recommended list of Examiners from References
(covering geographical locations across globe). **LIST ATTACHED**
- (b) (i) Work is not adequate. Another SRC of the candidate may be held after a period of _____ months.

(ii) Suggestions Made _____

(c) Rough draft of thesis submitted YES / NO

(d) Likely submission date of thesis: _____

SRC certifies that the examiners are actively involved in Research.

The concerned candidate has submitted 2 copies of synopsis and electronic version (C.D.)

Member, SRC

Member, SRC

Supervisor(s)

Chairperson, SRC

Chairperson, DRC/CRC

HEAD OF THE DEPARTMENT/CENTRE

DATED:

(Note: All members of SRC should sign on each page of the Final report & list of Examiners)

FOR USE OF ACADEMIC OFFICE

1. Recommendations on submission of thesis may be accepted / cannot be accepted due to _____

2. Board of Examiners may please be appointed.

Dealing Asstt./Junior Supdt./Supdt.

Asstt. Registrar (Evaluation)

Joint Registrar - Acad

APPROVED & BOARD APPOINTED / NOT APPROVED

DEAN OF ACADEMIC AFFAIRS

(a) Panel of Examiners

1.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____ _____
2.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
3.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
4.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
5.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
6.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
7.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____
8.	Name _____ Designation _____ Address _____ _____	Telephone No. _____ E-Mail Address. _____ Cited as reference No. _____

Member, SRC

Member, SRC

Supervisor(s)

Chairperson, SRC

9. Name _____
Designation _____
Address _____

Telephone No. _____
E-Mail Address. _____
Cited as reference No. _____

10. Name _____
Designation _____
Address _____

Telephone No. _____
E-Mail Address. _____
Cited as reference No. _____

Member, SRC

Member, SRC

Supervisor(s)

Chairperson, SRC

Chairperson, DRC/CRC

HEAD OF THE DEPARTMENT/CENTRE

DATED:



INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. The thesis shall be typed or printed on A4 size paper.
2. The thesis shall be typed on both side with 1.5 line spacing and a margin of 3.5 cms on the left, 2.5 cms on the top and 1.25 cms on the right and bottom.
3. The thesis must contain the following copyright certificate in the beginning of the thesis, on a separate page on the left side:

© INDIAN INSTITUTE OF TECHNOLOGY ROORKEE, 20____ ALL RIGHTS RESERVED

4. In a thesis, the title page should be given first, then the certificate by the candidate and the supervisors followed by an abstract of the thesis not exceeding 1500 words. This should be followed by acknowledgement and a table of contents.
5. The references should be given at the end of the thesis preferably in alphabetic order of the authors' names.
6. In the body of the text, a reference can be indicated either by a number as [No] or as author name with year. These references can be listed giving (i) the author's name and his initials (ii) the title of the paper and the name of the journal (iii) the name of the book and the publisher (iv) the number of volume, page numbers and the year of publication. Standard abbreviations may be used in the names of the journals.
7. The diagrams should be printed on a light background. Tabular matter should be clearly arranged. Decimal points may be indicated by a full-stop. SI units shall be used.
8. The thesis shall be spiral bound at the time of initial submission.
9. After the viva-voce examination the thesis shall be submitted in hard bound (card board) using green colour card sheet paper as cover. The name of the candidate, the degree and the year shall be printed in bold on the cover and in gold on the bound edge.



TO BE USED IN INITIAL SUBMISSION

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled

.....
in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy and
submitted in the Department/Centre of
of the Indian Institute of Technology Roorkee is an authentic record of my own work carried out
during a period from to
under the supervision of

The matter presented in the thesis has not been submitted by me for the award of any
other degree of this or any other Institute.

Signature of the Candidate

This is to certify that the above statement made by the candidate is correct to the best of my
(our) knowledge.

Dated: _____

Signature of Supervisor(s)



TO BE USED IN FINAL SUBMISSION

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled
.....
in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy and
submitted in the Department/Centre of
of the Indian Institute of Technology Roorkee is an authentic record of my own work carried out
during a period from to
under the supervision of

The matter presented in the thesis has not been submitted by me for the award of any
other degree of this or any other Institute.

Signature of the Candidate

This is to certify that the above statement made by the candidate is correct to the best of my
(our) knowledge.

Signature of Supervisor (s)

The Ph. D. Viva-Voce Examination of, Research Scholar, has
been held on

Chairperson, SRC

Signature of External Examiner

This is to certify that the student has made all the corrections in the thesis.

Signature of Supervisor (s)
Dated: _____

Head of the Department



THESIS SUBMISSION FORM

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

1. Name of the Research Scholar:
(English) _____ Enrollment No. _____
(As printed in Master's degree)
(Hindi) _____
2. Department/Centre (1) _____ (2) _____
(Where Enrolled) (Where Working)
3. Date of Initial Registration _____
4. Category: FTRS (IARS/EFRS/ISERS) / PTRS (P-IRERS/P-ISERS)
5. Date of Final SRC _____
6. Date of Thesis Submission _____
8. Title of Research
In English _____
In Devanagari _____
9. Address for Correspondence: _____
Phone No. with STD Code _____ Mobile No. _____
E.mail ID _____
10. Copy of plagiarism check report enclosed YES/NO

Signature of Research Scholar

Countersigned:

Name & Signature of Supervisor(s)

Signature of Chairperson, SRC

Signature of Chairperson, DRC/CRC

Head of the Department/Centre



REPORT OF THE VIVA-VOCE EXAMINATION FOR THE AWARD OF Ph.D. DEGREE

- 1 Name of the Candidate.....
- 2 Name of the Department / Centre
- 3 Title of the Thesis.....
- 4 Date of Submission of the Thesis.....
- 5 Date of Viva-Voce Examination.....
- 6 Examiner's report of Viva-Voce Examination.....

(A) We are satisfied with the performance of the candidate and recommend that the candidate be awarded Ph.D. Degree. The report of Viva-Voce Examination is given below:

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 76 -

(B) The candidate be asked to undergo another Viva-Voce Examination for the reasons given below:

- (i) The candidate is not sufficiently acquainted with the area of this research.
- (ii) The candidate has not shown a capacity for critical examination.
- (iii) The candidate does not appreciate the implications of his/her work.

We certify that the modification/correction suggested by the examiners and accepted by candidate have been incorporated in the thesis.

1..... 2..... 3.....
(Name & Signatures) (Name & Signatures) (Name & Signatures)
Internal Examine(s)/Supervisor(s)

Chairperson, SRC

**External Examiner
(Indian Examiner)**

Chairperson, DRC

Head of the Department / Centre

This is certified that the revisions corrections of errors/omission pointed out during the Viva-Voce Examinations have been incorporated in the thesis by the candidate.

The short abstract of the thesis (600-800) is enclosed herewith.

Dated :

SUPERVISOR(S)

Item No. 76.16: To consider Part-II: Ph.D. Procedures as proposed by Prof. Manish Shrikhande Committee on Ph.D. Rules & Regulations.

The recommendations of Prof. Manish Shrikhande Committee on PhD Rules and Regulations were placed in 75th Senate Meeting in its meeting held on 01.10.2018 as Item 75.6. Part I: Admission process was approved by the Senate.

Recommendations of the committee on Part II: Procedures **(Appendix 'A')** are placed for the consideration and approval of the Senate.

PREAMBLE *(Item No. 60.23, Appendix 'L', dt 08.07.2015)*

Indian Institute of Technology (I.I.T.) Roorkee offers academic programmes leading to the award of Ph.D. degree through its Departments/Centres. The award of Ph.D. degree is in recognition of high academic achievements, independent research and application of knowledge to the solution of technical and scientific problems in Science, Technology, Architecture & Planning, Humanities & Social Sciences and Management; creative and productive inquiry is the basic concept underlying the research work.

The academic programme leading to the Ph.D. degree is broad-based and involves a prescribed course credit requirement and a research thesis. The institute also encourages interdisciplinary areas through a system of Co-supervision and provides excellent opportunities for such programmes. The institute undertakes sponsored research and development projects from industrial and other organizations in the public as well as private sector.

The degree of Doctor of Philosophy shall be abbreviated as Ph.D. The Degree of Doctor of Philosophy is granted for research work in areas recognized by the Academic Departments/Centres of the Institute subject to the conditions and regulations contained hereinafter.

The research work shall be an original work characterized either by the discovery of facts, or by a fresh approach towards the interpretation and application of facts, or development of innovative products and technologies. It shall evince the candidate's capacity for critical examination and sound judgment and shall represent original contribution to the existing knowledge.

The degree of doctor of philosophy (Ph.D.) of the Indian Institute of Technology, Roorkee shall be conferred on a candidate who successfully completes all the requirements specified in these ordinances and regulations, which were approved by Board of Governors/Senate.

ORDINANCES FOR THE DOCTOR OF PHILOSOPHY (Ph.D.) PROGRAMMES

Definitions (Unless the context requires otherwise) (Item No. 60.23 Appendix 'L' dt 08.07.2015)	1	(i) "DRC/CRC" shall mean the Research Committee of the Department/Centre. (ii) "Applicant" shall mean an individual who applies for admission to the Ph.D. programme of Indian Institute of Technology, Roorkee on a prescribed Application Form. (iii) "IRC" shall mean the Institute Research Committee of Indian Institute of Technology, Roorkee (iv) "Candidate" shall mean a person registered for the Ph.D. Degree and who has successfully completed the course requirement, the written and oral comprehensive examinations, and has submitted and presented the research plan and approved as per clauses R.5 and R.6 of the Regulations. (v) "DA" shall mean the Dean, Academics. "DoAA" shall mean the Dean of Academic Affairs. (vi) "Research Student" shall mean a person registered for the Ph.D. programme of Indian Institute of Technology, Roorkee before becoming the candidate. (vii) "Supervisor(s)" shall mean member(s) of the academic staff of the Institute approved by Competent Authority to guide/supervise the research/ academic work of the research student/candidate. (viii) "Co-supervisor(s)" shall mean member(s) of the academic staff of the Institute or any person from other organization recommended by SRC, DRC, Head of the Department/Centre and approved by Competent Authority to guide/supervise the research/ academic work of the research student/candidate. (ix) "Caretaker Supervisor" shall mean a member of the academic staff appointed to look after the administrative	<u>Manish Shrikhande Committee</u>
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		interests of a research student/candidate in the absence of the Supervisor(s) and after the submission of the thesis, if necessary as per clause R.3.5 of the Regulations.	
(x)		"Course Work" shall mean courses of study prescribed by the Department/Centre through the Student Research Committee, to be undertaken by a research student registered for the Ph.D. Degree.	
(xi)		"Degree" shall mean the Degree of Doctor of Philosophy (Ph.D.) of the Indian Institute of Technology, Roorkee.	
(xii)		"Educational Institution" shall mean those Institutes, which offer Bachelor's or higher Degree.	
(xiii)		"Institute" shall mean the Indian Institute of Technology, Roorkee (IIT Roorkee).	
(xiv)		"Full-time Research Student/Candidate" shall mean a person registered for the Ph.D. Degree devoting full time at the Institute for completing the degree requirements.	
(xv)		"Part time Research Student/Candidate" is a person who is registered for the Ph.D. degree and has been allowed to devote part of his time towards this pursuit.	
(xvi)		"Registration Period" shall mean the length of time span commencing with the date of initial registration at the Institute.	
(xvii)		"ODC" shall mean Oral Defence Committee.	
(xviii)		"Residency" shall mean the minimum period for which a student/candidate must attend the institute.	
(xix)		"SRC" shall mean Student Research Committee.	
(xx)		"Sponsored Research Student/Candidate" shall mean a research student/candidate sponsored by an organization /his employer who provides full financial support for doing Ph.D.	
(xxi)		"Competent Authority" shall mean the Director of IIT, Roorkee or any officer to whom the Director delegates	

		the authority.	
		NOTE: 'HE' & 'HIS' IMPLY 'HE'/SHE' AND 'HIS'/HER' RESPECTIVELY.	
REGISTRATION, APPOINTMENT OF SUPERVISOR AND SRC (Item No. 60.23 Appendix 'L', dt 08.07.2015)	R.1	1. Fresh research students admitted to the Ph.D. programmes are required to report to the Head of the Department/Centre one week in advance before the scheduled date of opening the Institute. Their registration will also take place one week in advance.	R.1.0 Selection The procedure for shortlisting and selection of candidates to PhD programme shall be decided by the respective department/centre. The list of selected candidates, in the order of merit (with provision for waitlisted candidates), shall be sent to the Dean Academic Affairs by the department/centre within two working days of the date of interview. The list of selected candidates shall be notified by the office of Dean Academic Affairs. R.1.1 Registration a) New Students: All applicants who have been selected and offered admission to the PhD programme and have accepted the offer should report at the institute on the day as specified in the offer of admission. They should carry all the required documents as specified therein. New entrants, awaiting the results of the qualifying examination, will be allowed to register "provisionally" on submission of a certificate from their institutions to the effect that they have completed all the requirements of the programme. The students should submit self-attested copies of the certificates of having passed the qualifying examination by the last date for document submission as specified in the academic calendar (usually about 8 weeks from the date of registration), failing which the admission

			may be cancelled. b) Old Students: All students are required to register for each (Autumn and Spring) semester for the courses/thesis credits in consultation with their thesis supervisors. The registration process involves: • Filling a Course Detail Form (before candidacy)/Progress Report (after candidacy), as specified by the institute, • Depositing prescribed fee and dues, if any. All students who are not on authorized leave must continue to register in every semester till they submit the thesis. If, however, a student is likely to submit his/her thesis within two weeks from the date of registration, he/she need not register in that semester. PhD students who have submitted their thesis and wish to continue their stay in the campus shall continue to register every semester till the defence of thesis. In such cases, the institute assistantship will be admissible, if due. In exceptional cases, the Dean Academic Affairs on the recommendation of the DRC may consider registration beyond the date of late registration. In such a case, the student will be allowed to register without any course credits. The students joining PhD programme, under fellowships other than the institute assistantship, after the last date of registration as specified in the academic calendar should register for the required course credits in the next semester. However, the duration for completing the candidacy requirements shall be counted from the
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			date of admission to the PhD programme. In case the thesis is to be revised and resubmitted for evaluation, the student should register for the current semester at the time of submission of the thesis. c) Change of Registration from M Tech/IDD to PhD The candidates pursuing master's programmes in Engineering or Architecture or are in IDD programme from IIT Roorkee having CGPA of at least 8.50 on a 10 point scale (after first year/ completing all courses for IDD) shall have a choice of internal lateral entry to PhD programme.
			R.1.2 Thesis Supervisor Thesis supervisor shall be allocated as per the process enumerated in Admission Process Part under section XX.VY ~~The list of selected candidates shall be uploaded on the institute web page by the office of Dean Academic Affairs within a day of receiving the information from departments/centres. The selected candidates shall fill their preferences for thesis supervisor on the link provided on the web page and confirm their acceptance of the offer of admission to PhD programme by depositing the requisite fees within the stipulated period, failing which the offer of admission will stand withdrawn and the candidate on the waiting list shall be offered the admission to PhD programme.~~
	2	During the admission process, faculty members who do not have Ph.D scholar under MHRD fellowship working under their supervision, shall be given the highest priority to facilitate reasonable uniform distribution of MHRD scholars amongst the faculty members of Departments/Centres. The candidates are required to give their choice for supervisors based on his/her area of interest and supervisor is allocated to him/her at the time of recommending the candidates for admission. The candidates shall be informed about the supervisor allocated in the admission letter. The candidates shall have to work with the supervisor allocated. Only one MHRD scholar shall be taken by a faculty in a semester, in general. In case, if the faculty member wants to take another MHRD scholar in a semester, no-objection from other faculty members of the concerned academic group is required.	

(Item No. 63.7 Minutes (Page No. 07) dt 11.01.2016)	<table border="1"> <tr> <td data-bbox="454 246 662 929">3</td><td data-bbox="662 246 1340 929"> The research supervisor of a student after the registration shall be approved by the Head of the Department/ Centre. Proforma Ph.D-0, given in Appendix-A, is to be filled for the approval of supervisor(s). In case of joint supervision, supervisors shall be approved by the competent authority as determined from time to time. </td></tr> <tr> <td data-bbox="454 929 662 2004">4</td><td data-bbox="662 929 1340 2004"> The Student Research Committee (SRC) for a research student shall be appointed within a week but not later than a month from the date of initial registration by HoD on the recommendation of supervisor through the Chairman, DRC. The SRC shall consist of: (a) Any Senator from the department (preferably subject area expert but not necessarily from DRC) can be nominated as Chairman SRC. Any senator preferably subject area expert either from the department or outside can be nominated as Chairman, SRC. (b) One expert in the field from the department/centre. (c) One institute faculty expert, preferably in the concerned area, from outside the department/ centre to which the student belongs. (d) Supervisor(s). Proforma Ph.D-1, given in Appendix-A, is to be filled for the appointment of SRC of the candidate. Note 1: Names for 4(b) and 4(c) shall be proposed by the supervisor(s) and nominated by the Chairman, DRC and Head of the Department/Centre. Note 2: Once approved, the member of SRC can be changed only under exceptional circumstances on recommendations from the department by competent </td></tr> </table>	3	The research supervisor of a student after the registration shall be approved by the Head of the Department/ Centre. Proforma Ph.D-0, given in Appendix-A, is to be filled for the approval of supervisor(s). In case of joint supervision, supervisors shall be approved by the competent authority as determined from time to time.	4	The Student Research Committee (SRC) for a research student shall be appointed within a week but not later than a month from the date of initial registration by HoD on the recommendation of supervisor through the Chairman, DRC. The SRC shall consist of: (a) Any Senator from the department (preferably subject area expert but not necessarily from DRC) can be nominated as Chairman SRC. Any senator preferably subject area expert either from the department or outside can be nominated as Chairman, SRC. (b) One expert in the field from the department/centre. (c) One institute faculty expert, preferably in the concerned area, from outside the department/ centre to which the student belongs. (d) Supervisor(s). Proforma Ph.D-1, given in Appendix-A, is to be filled for the appointment of SRC of the candidate. Note 1: Names for 4(b) and 4(c) shall be proposed by the supervisor(s) and nominated by the Chairman, DRC and Head of the Department/Centre. Note 2: Once approved, the member of SRC can be changed only under exceptional circumstances on recommendations from the department by competent
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	R.1.3 Joining the Departments/Centres and constitution of SRC a) All new entrants in a PhD programme should submit a joining report in the office of Head of the respective department/centre. The departments/centres will send the list of PhD candidates who have joined in the departments/centres in a semester along with the name of supervisor to the Dean Academic Affairs. b) The thesis supervisor shall propose suitable names to constitute the Student Research Committee (SRC) which shall comprise of one internal expert member from within the Department/Centre, one external expert member from outside the Department/Centre, supervisor(s) and one senator as the Chairperson SRC. Member outside the department can also be from outside the institute preferably from CFTI or Institute having equivalent status in Research. Once SRC has been constituted by the Head of the Departments/Centres, the SRC will recommend to Dean Academic Affairs for approval of the courses which the student shall register for, taking into consideration the proposed area of research and the academic background				

<i>Minutes (Page No.06) dt 28.12.2017)</i>		Eligibility criteria for submission of thesis regarding minimum duration of submission and number of papers to be published shall be as per the Ph.D. Ordinances & Regulations in force at the time of admission.	which the registration shall automatically stand cancelled. If the candidate has converted his/her status from full-time to part-time before the expiry of five years, the maximum duration for thesis submission shall be seven years.
SUPERVISOR(S) <i>(Item No. 60.23 Appendix 'L' dt 08.07.2015)</i>	R.3	1. Supervisor(s) can be any full-time faculty member/scientific officer of the Institute with a Ph.D. degree.	Not Commented
		2. Supervisor has to be decided at the time of selection of candidates depending on the candidate's area of interest and the choice for the supervisors. The choices for the supervisors shall be taken by Chairman, selection committee, prior to the interview.	Covered in Admission Process section XX.YY
		3. The competent authority on the recommendations of the SRC, may appoint one or more Supervisor(s) not exceeding a total of three to supervise the research student/candidate. These may be from inside or outside the Institute and there should not be more than two supervisors from within the Institute and not more than one supervisor from outside Institute. However, Emeritus Fellows are allowed to supervise a student only jointly as co-supervisors. Addition/ deletion of Supervisor(s) would not be made after the lapse of 12 months from the date of admission to candidacy. In such cases, the minimum association period of new supervisor shall not be less than one and a half year. In case of Joint Supervision, not more than two supervisors from the same department will be allowed to supervise the thesis jointly.	R.3.1 Supervision The supervisor can be: i) Any full time faculty member holding PhD degree. ii) Faculty retiring or Scientific Officer holding PhD degree can supervise jointly with regular faculty. Retiring faculty shall have minimum Two years left at the time of taking a research student as Joint supervisor. iii) Faculty who is not on regular roles of the institute cannot be a supervisor in any capacity. iv) Joint supervision can be done with supervisor from outside the institute if the proposed joint supervisor is from Institute of Eminence (research organisation) in India or outside India and is working at a level at par with IIT system. v) There can be utmost THREE supervisors with maximum one from outside the institute. vi) In case of addition of a supervisor, the minimum association period of new supervisor shall not be
<i>(Item No. 68.32 Minutes (Page No.15) dt 02.03.2017)</i>			
<i>(Item No. 72.4 Agenda (Page No.09)</i>			

Minutes (Page No.04) dt 22.03.2018)	4. ~~The maximum number of Scholars supervised by a faculty member at any time at IIT Roorkee shall not be more than 12 jointly or singly or a combination of both with a maximum of 06 MHRD supported scholars.~~ There will not be any limit on the total number of research scholars which can be supervised by a faculty subject to the condition that the research scholars with Institute Assistantship can be maximum 08 (eight) per faculty, singly or jointly or a combination of both. However, this number may be changed by the Senate from time to time.		less than one and a half year before submission of the thesis. Retained
(Item No. 71.16 Agenda (Page No.227) Minutes (Page No.06) dt 28.12.2017)	5. Requirement of Co-supervisor in case of Part-time candidate: a) If the research scholar is registered as full time candidate and later on converted to part time after completing 3 years, co-supervisor will not be required. b) If the research scholar is registered as full time candidate and after completing candidacy joined an organization within 100 km from Roorkee and status is converted to part time, co-supervisor from host organization will not be required. c) If the research scholar is teacher trainee (sponsored faculty) from an institute having MoU with institute, co-supervisor may not be required if there is no possibility of co-supervisor at that institute. However, the candidate has to complete residential requirement for completing the course work and for candidacy and they will have to be present at IIT Roorkee during all vacations for interaction with the supervisor(s).	R.3.2 Change of Registration from Full-time to Part-time Programme A PhD student may be allowed by the Dean Academic Affairs on the recommendations of the DRC/SRC to change his/her status to "Part-time Student" if: • He/she has completed all requirements for candidacy, • The DRC approves the organization of employment for continuing the PhD work Retain amended clause as approved by the Senate R.3.3 Change of Registration from Part-time to Full-time Programme The part-time PhD student can change to full-time status	

	d) If the research scholar is registered as full time candidate and after completing candidacy joined an organization at a distance of more than 100 km from Roorkee and status is converted to part time, co-supervisor from host organization will required at the time of conversion. An Organization as a whole and not one of its units be considered by DRC while approving change of status from Full-time to Part-time. Further, there shall not be any requirement of obtaining NOC and having a local supervisor will not be mandatory, if the place of job is at distance more than 100 km. from Roorkee. e) ~~If the research scholar/candidate from an organization, at a distance of more than 100 km from Roorkee, is registered as part time candidate in the beginning, co-supervisor will be required from that organization from the beginning.~~ f) ~~In either case of (d) and (e) above, the organization has to give an undertaking that the research scholar will continue to work on project or in area relevant to his/her Ph.D. degree programme.~~	at any time of the programme provided that he/she has secured a sponsorship or study leave from the parent organization for the intended duration of stay, not less than one semester, without any financial support from the institute.
6.	Change of Supervisor(s) and Appointment of Caretaker Supervisor for Ph.D. students: A faculty member appointed as a Ph.D. Supervisor(s) is expected to be available to a research student/candidate in the Institute till the thesis is submitted. However, under unavoidable circumstances, such as: long leave of more than 12 months, resignation, retirement, death or change of the	R.3.4 Change/Addition of a Supervisor/Caretaker Supervisor Addition/change of supervisor will be allowed in the following special cases: a) Death of supervisor: A new supervisor will be appointed b) Supervisor retires/is due to retire/resigns: The supervisor becomes ~~joint~~ co-supervisor and a new

		supervisor, a new Supervisor(s) may be appointed following regulations as under: A. Supervisor proceeding on long leave but less than 12 months a. If he/she is the only supervisor for a research student/candidate, a caretaker supervisor may be appointed to look after the administrative interest of the student provided the student has completed the requirement of candidacy. HoD can also act as caretaker supervisor only for administrative purposes and faculty supervisor continues for academic purposes. b. If he/she is the only supervisor for a research student/candidate and the student has yet not completed the requirement of candidacy, a co-supervisor shall be appointed by the SRC. B. Supervisor(s) proceeding on long leave of more than 12 months. a. (i) Where there is more than one Supervisor for a research student/candidate and one of the supervisors is proceeding on long leave for more than 12 months other supervisor(s) shall take care of the candidate. The supervisor proceeding on leave continue to be the supervisor of the candidate, if the candidate has completed the minimum duration of submitting thesis as per clause R.2 (c). (ii) Where only one Supervisor exists for a research student/candidate, another supervisor shall be appointed by the SRC in	supervisor will be appointed c) Supervisor proceeding on leave: A caretaker supervisor will be appointed if the student has been admitted to candidacy, otherwise ~~joint~~ co-supervisor will be appointed. d) A student may request for a ~~joint~~ co-supervisor, if the absence of supervisor is hampering the progress. e) The caretaker supervisor shall be designated as a ~~joint~~ co-supervisor if he/she contributes in carrying out major revision of the thesis during evaluation.
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			cases where SRC has not yet found the research work fit for submission following clause R.8 sub-clause 1d) in the area of his research work. b) (i) If SRC has recommended the research work for submission following clause R.8 sub-clause 1d) before the supervisor proceeds on leave, a caretaker supervisor will be appointed for administrative purpose only. (ii) If the thesis has been submitted before the supervisor proceeds on leave, only a caretaker supervisor will be appointed. (iii) Further, if a major revision becomes necessary, and the supervisor(s) is (are) on leave, he should be asked to specifically state whether he would effectively help the Research Scholar in carrying out the major revisions within a reasonable period. In case the supervisor(s) expresses his/her inability due to one reason or the other, the caretaker supervisor, if he/she provides the required help in carrying out the major revision, will automatically be treated as a <u>co-supervisor</u> of that candidate. c) If a supervisor(s) proceeds on leave for a period less than 12 months initially, but later extends his/her leave beyond 12 months, the above procedure as applicable for leave beyond 12 months, will be followed. The extension granting authority will inform the competent authority accordingly. d) If a new supervisor needs to be appointed in case of supervisor proceeding on long leave,
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		his/her signature is required before granting leave to the faculty. The existing supervisor will continue as co-supervisor only if the candidate has completed the minimum duration of submitting thesis as per clause R.2 (c). e) If the supervisor(s) proceeds on leave for more than 24 months during the Ph.D. registration of a research student/candidate and in the opinion of SRC, he has not contributed significantly to the thesis, he/she will cease to be the supervisor(s).
		C. A Supervisor retiring 1. A faculty member on retirement may continue as a co-supervisor till the completion of work and submission of thesis by the candidate. Another supervisor shall be appointed as in "B" above in similar circumstances. 2. A faculty member who is due to retire within the next two years may be appointed only as co-supervisor and may continue to be the co-supervisor even after his/her retirement provided the SRC is convinced of his availability/continued guidance to the student.
		D. A Supervisor(s) resigning A new supervisor shall be appointed at the time of acceptance of resignation by a supervisor as in "B" above. However, if the supervisor has associated with the student for TWO years after candidacy, he/she shall continue to be co-supervisor otherwise he/she shall cease to be supervisor.

			E. Death of Supervisor(s) A new supervisor(s) shall be appointed on the recommendation of SRC as in "B" above. F. Supervisor(s) declining to supervise Once a supervisor agrees to supervise a student, he/she cannot decline to supervise the student later on. G. Change/drop of Supervisor(s) by the research candidate (a) If the research student has requested for change of supervisor before the admission to candidacy and both the outgoing and incoming supervisors have consented then the change of supervisor will be considered by the competent authority on the recommendation of DRC/CRC. In case, research student wishes to change the area of research with new supervisor, SRC be constituted a fresh. (b) If a research student before admission to candidacy wants to drop one of the supervisors, in case of more than one supervisor, the same will be considered by competent authority on the recommendation of SRC and the HoD. However, a supervisor cannot be dropped by the student after the candidacy. (c) If the candidacy has already taken place	R.3.5 Request for change of supervisor by a research student A PhD student can request the DRC/CRC through SRC for a change of supervisor. The student has to get consent from both parties, namely, the current supervisor and the proposed supervisor, without which the request for change of supervisor cannot be considered by DRC/CRC. In case the DRC/CRC fails to resolve the issue, the Head should convene a meeting of the DFC/CFC to resolve the impasse and send the recommendation to the Dean Academic Affairs. Every effort should be made to salvage the academic programme of the student while protecting the academic rights/intellectual property of the supervisor.
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			and student has requested for change of supervisor but the supervisor is not willing to give NOC, the matter shall be sorted out first in the DRC and then in the DFC at the department level. If the department is unable to resolve the issue then the student has to continue with the same supervisor or leave the Ph.D. programme. H. (a) If a new SRC has been constituted due to change of supervisor and the research area, the new SRC may ask the research student to do more courses related to new research area provided candidacy has not taken place. (b) If the candidacy has already taken place but the research area has changed, the SRC may ask the candidate to appear for written examination, oral examination before going for candidacy again.		
COURSE CREDIT REQUIREMENTS <i>(Item No. 60.23 Appendix 'L' dt 08.07.2015)</i>	R.4	1.	Each research student shall satisfy the credit requirements as given in Table-1 by crediting courses as advised by course supervisor and recommended by SRC. The minimum CGPA requirement for pre-Ph.D. courses will be 7.00 calculated taking all courses recommended by SRC including seminar. Waiving off of course work requirement for the candidates is subject to the following conditions: (a) Candidates with M. Tech./M.Arch./MURP from IITs	R.4 Course Credit Requirements R.4.1 Minimum CGPA and Probation If SRC has recommended courses to be taken as credit or audit, then credit courses will be considered towards calculating CGPA and student should earn AP grade in audit courses. Technical Communication, Communication skills, Language course and Project shall be treated as additional courses to be completed by a candidate if so	

(Item No. 72.13 Agenda (Page No.26) Minutes (Page No.05) dt 22.03.2018)	or IISc and M.Sc. from IISERs, MBA from IIMs and having CGPA 8.5 or more. (b) These candidates shall start their PhD within TWO years from the completion of M.Tech./M.Arch./MURP/ M.Sc./MBA. (c) These candidates may be required to do additional course if the SRC recommends to do so. (d) The waiver will be applicable if admission is sought within the relevant stream or discipline with respect to the post-graduate degree based on recommendation of SRC.	felt by SRC. The student should earn a minimum of 7.00 CGPA in course credits to continue for candidacy. ~~A student may be permitted to repeat or substitute ANY TWO courses in which he/she has obtained D, E or F grades ONCE in entire programme. A student who could not achieve 7.0 CGPA shall be given one chance to take up more courses in next semester. The SRC may recommend for repeat or substitution of a such courses to the Dean Academic Affairs as soon as possible. The CGPA will be calculated using credits of courses in which the student was awarded best grades, complying with the minimum credits recommended by the SRC. This may be treated as one-time probation. This shall not have any effect on the maximum duration for completing candidacy requirements.~~ R.4.2 Reduction in Course Credit Requirement The SRC shall carefully examine any case of reduction in course credits and recommend such cases to the Dean Academic Affairs, giving appropriate justification in terms of any relevant post B.Tech./M.Sc./M.A. or equivalent qualification or proven capacity for independent research. In no case shall the reduced credits requirements be less than 14 credits (including 2 credits earned through seminar). Candidates having B. Tech./Int. M.Sc. degree with Honours courses – ALREDY DECIDED BY SENATE Candidates having M. Tech. Degree from IIT Roorkee –
	2. If any subject-class is having more than 80% research scholars/students, absolute grading be carried out. Proforma Ph.D-II, given in Appendix-A, is to be filled for the approval of courses to be registered by Dean of Academic Affairs.	
	3. Each research student has to do all the courses recommended by the SRC in the beginning. If the student could not get the passing grade in any course or the CGPA as calculated in clause R.4.1 is less than 7.00, the student has to leave the programme.	
	4. SRC may recommend additional course(s) as Audit course(s), if required, in a particular case. A research student is deemed to have fulfilled the requirement of additional course(s) as Audit Course(s) if he/she obtains 'Audit Pass' for successfully completing each of such course(s).	
	5. The pre-Ph.D. courses including Audit course are to be completed successfully in first 1 to 2 semesters by research students having masters degree and in 2 to 3 semesters by research students having bachelor's degree. These semesters are counted from the date of initial registration and this clause is applicable both for	

		full time/part time research students. GIVE AMENDMENT RELATED WAIVER TO STUDENTS WITH HONOURS COURSES	ALREADY DECIDED BY SENATE Candidates with professional/industrial experience of more than 10 years and/or having substantial publication record in peer reviewed international journals may be given exemption in credit requirements based on recommendation of SRC, but have to complete minimum 14 credits (including seminar). Residency may not be mandatory for such candidates.
6.	The courses offered other than minimum theory courses for the Ph.D. programmes may be Laboratory Courses, Design Courses and Project.		R.4.3 Course Credit Transfer A PhD student who has completed the two year M.Tech / IDD / M.Sc. / M.Arch. / MURP / MBA programme at this institute can transfer a maximum of 9 postgraduate course credits earned during those programmes (other than project, dissertation and labs) towards fulfilment of his/her course requirement for the PhD programme on the recommendation of the SRC and approval of the Dean Academic Affairs, provided these credits were in excess of the minimum requirement for earning the said degree. Self-study course is considered in Table.
7.	No self-study course shall be offered as part of the requirement of minimum theory courses. However, extra courses may be offered as self-study courses. A. Self-study Courses shall satisfy the following conditions: a) A self-study course should be preferably outside the courses listed in the Courses of Study and offered to a research student/candidate following sub-clause d) below. b) A course listed in Courses of Study but not offered in a semester due to lack of sufficient number of students registering for it, may be offered as a self-study course in that semester with the prior approval of Dean of Academic Affairs. c) A course already running in a semester shall not be offered as a self-study course. d) The SRC shall examine proposals for self-study courses, not listed in the course of study, along with the course contents, textbooks, mode of		

			assessment and name(s) of the instructor(s) and shall recommend the proposal and the credit to be assigned to Dean of Academic Affairs for his approval. e) All self-study courses shall carry a maximum of four credits. f) A student shall not take more than one self-study course during the entire Ph.D. programme. g) If the supervisor/SRC feels that a course is essential for the student which is not available, the same may be designed by SRC and recommended by the DRC under the code and title "XX-999: Special Topics" and approved by competent authority. B. Seminars shall satisfy the following conditions: a) Seminar in a semester shall be of two credits and every research student must deliver a seminar as a part of course requirement and beyond the minimum limit of credits for course requirement. b) Seminar shall be treated as additional course for the purpose of registration and evaluation. c) Supervisor shall act as seminar coordinator and decide the topic of seminar in accordance with the area of research. Supervisor shall arrange the seminar and forward the grade awarded by the SRC to the competent authority by the end of the semester. d) A student shall not get credits for more than one Seminar during the entire Ph.D. programme. e) All research scholar/students are required to be	Not Commented
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			adjudged for proficiency in English while delivering seminar which is mandatory for everyone. The SRC will give its recommendation alongwith the result of seminar whether the candidate has qualified examination for proficiency in English or not. In case, the candidate's proficiency in English is not found satisfactory, the candidate is required to do a course on Communication Skills. (f) A proforma-III_S is to be filled to send the seminar grade and proficiency in English.																					
			<table><tr><th colspan="4">Table 1 COURSE CREDIT REQUIREMENTS</th></tr><tr><th>S. No.</th><th>Candidate Having</th><th>Range of Credit Requirements</th><th>Remarks</th></tr><tr><td>1.</td><td>M.Tech, M.Arch./MURP, MCA or M.Tech. (Integrated/ IDD) or Equivalent Degree</td><td> - minimum 3 theory courses or minimum of 9 credits theory courses - should earn 2 more credits by delivering seminar </td><td>Course From the existing M.Tech and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.</td></tr><tr><td>2.</td><td>M.Sc/M.A./M.B. A. or equivalent admitted to Science/ HSS/ Management department</td><td> 12-15 credits theory courses. - should earn 2 more credits by delivering seminar </td><td>Course From the existing PG level and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.</td></tr><tr><td>3.</td><td>B.Tech. or equivalent, M.Sc. or equivalent, admitted to anyone of the Engg.</td><td> 34-38 credits equivalent to credits earned by M.Tech. students - should earn 2 </td><td>Course From the existing PG level and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.</td></tr></table>	Table 1 COURSE CREDIT REQUIREMENTS				S. No.	Candidate Having	Range of Credit Requirements	Remarks	1.	M.Tech, M.Arch./MURP, MCA or M.Tech. (Integrated/ IDD) or Equivalent Degree	- minimum 3 theory courses or minimum of 9 credits theory courses - should earn 2 more credits by delivering seminar	Course From the existing M.Tech and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.	2.	M.Sc/M.A./M.B. A. or equivalent admitted to Science/ HSS/ Management department	12-15 credits theory courses. - should earn 2 more credits by delivering seminar	Course From the existing PG level and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.	3.	B.Tech. or equivalent, M.Sc. or equivalent, admitted to anyone of the Engg.	34-38 credits equivalent to credits earned by M.Tech. students - should earn 2	Course From the existing PG level and/or pre-Ph.D. courses offered by own Deptt./ other Deptts.	
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			R.4.4 Course Credit Requirements Course credit requirements, which a candidate needs to complete, are given in Table below: <table><tr><th>S No</th><th>Qualification</th><th>Credit requirements</th><th>Remarks</th></tr><tr><td>1</td><td>M.Tech, M.Arch./MURP, or equivalent</td><td>Minimum 12 credits of P.G. level theory courses and 2 credits of seminar in area of research</td><td>Student can take at most ONE self-study theory course.</td></tr><tr><td>2</td><td>M.Sc/M.A./M. B.A./M.Phil. or equivalent, admitted to Science/ HSS/</td><td>Minimum 16 credits of which minimum 12 credits of P.G.</td><td>Student can take at most ONE self-study theory course.</td></tr></table>	S No	Qualification	Credit requirements	Remarks	1	M.Tech, M.Arch./MURP, or equivalent	Minimum 12 credits of P.G. level theory courses and 2 credits of seminar in area of research	Student can take at most ONE self-study theory course.	2	M.Sc/M.A./M. B.A./M.Phil. or equivalent, admitted to Science/ HSS/	Minimum 16 credits of which minimum 12 credits of P.G.	Student can take at most ONE self-study theory course.									
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(Item No. 69.12 Agenda (Page No.25) Minutes (Page No.08) dt 28.07.2017)		Comprehensive examination shall be conducted by the SRC of the research student appointed under clause R.1 sub-clause 4. The comprehensive examination method has to be governed by DRC. The student having Masters degree or Bachelors degree has to present the research proposal within the stipulated time frame of 45 18 months or 20 24 months respectively from the date of initial registration. It is applicable to both Full Time and Part Time research scholar. The syllabus for comprehensive written and oral examination is to be defined by SRC including the courses student has completed as pre-PhD courses and approved by Chairman, DRC. 2. On the basis of the performance of student in the comprehensive examination, SRC will make one of the following recommendations under each of a), b) and c), to the Dean of Academic Affairs: a) Written comprehensive examination (i) passed (ii) to reappear in the written comprehensive examination after a certain period of time specified by the SRC and/or after taking additional courses recommended by it, if any. (iii) failed b) Oral comprehensive examination (i) passed (ii) to reappear in the oral comprehensive examination after a certain period of time specified by the SRC. (iii) failed	recommend the student's admission to the candidacy if the research proposal is acceptable. The student will be given two chances to clear the comprehensive examination. The syllabus for comprehensive examination is to be defined by SRC. Progress report of PhD scholar for the candidacy will be submitted by SRC through prescribed proforma along with comprehensive examination report for the approval of Dean Academic Affairs. The student having M.Tech., M. Arch/MURP, MCA or M Tech (Integrated/IDD) or equivalent degree or M.Sc./M.A./M.B.A. or equivalent admitted to Science/HSS/Management department has to complete the requirements of candidacy within the stipulated time frame of 18 months from the date of initial registration. The student having B.Tech. or equivalent degree or M.Sc. or equivalent admitted to anyone of the Engg. Disciplines has to complete the requirements of candidacy within the stipulated time frame of 24 months from the date of initial registration. It is applicable to both full time and part time.
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(Item No. 63.15 Minutes (Page No. 12) dt 11.01.2016)		c) Research plan and its oral presentation (i) approved (ii) not approved	
	3.	Oral examination shall be conducted only after successful completion of written examination i.e., the student has secured at least 'B' grade (or 64% marks) in written examination. The minimum passing grade in Comprehensive Written Examination shall be 'C+' (64 ≤ C+ ≤ 72). It was also decided that in Comprehensive Oral Examination, no grade be awarded.	
	4.	Research proposal shall be presented before the SRC only if the student has successfully cleared the oral examination, i.e., the student has been declared passed.	
	5.	Notifications for different components of comprehensive examination shall be issued separately through proforma Ph.D-V, given in Appendix-A, and only after the successful completion of previous component(s).	
	6.	Report on Comprehensive Examination - written and oral and Candidacy for Ph.D. Degree will be submitted by SRC through proforma Ph.D-VI, given in Appendix-A.	
	7.	Progress report of Ph.D scholar for the candidacy will be submitted by SRC through proforma Ph.D-VII, given in Appendix-A, alongwith comprehensive examination report for the approval of Dean of Academic Affairs.	
	8.	At the time of presentation of research proposal, SRC/DRRC may identify the ISI/Scopus indexed journals of his/her proposed area where publication is required.	

		NOT E: A student will be provided a maximum of two attempts to qualify in each segment of the comprehensive examination, to obtain the SRC recommendation of 2.a(i), 2.b(i) and 2.c(i). However, two failures in any of the comprehensive examinations will require a student to leave the programme.	
ELIGIBILITY FOR THE CANDIDACY (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.6	1. The Dean of Academic Affairs will approve admission of a research student to candidacy on the recommendation of SRC which will satisfy that a research student has fulfilled the following: a) completed the required course work; b) passed the written and oral comprehensive examinations; c) submitted a research plan and defended it to the satisfaction of SRC. Thereafter, the research student will be admitted to candidacy from the date on which SRC recommended and be called a research candidate. 2. If a research student fails to get admission to candidacy as below then his/ her registration for the Ph.D. Programme will be terminated. (a). For Ph.D. students with M.Tech./M.Arch./ MURP/ MCA/ M.Tech. (Integrated/IDD) or equivalence degree and M.Sc. /MA/ MBA or equivalent admitted to Science /HSS/ Management department: 18 months. (b). For Ph.D. students with B.Tech. or equivalent or M.Sc. degree or equivalent admitted to Engineering discipline: 24 months.	ALREADY DISCUSSED IN R.5

	RESEARCH PERFORMANCE MONITORING (Item No. 60.23 Appendix 'L' dt 08.07.2015)	With a rider that last six months shall be devoted to non-course related activities of Ph.D. programme such as comprehensive exam (Written/Oral) and research proposal for candidacy.	R.6 Performance Monitoring The student should deliver an annual progress seminar in the month of July-August each year and submit a report to the SRC. The report should include the work done so far and should specify the progress made in the intervening period. The SRC shall submit its report on the continuation of the student in PhD programme and continuation of assistantship in a prescribed proforma to the Dean Academic Affairs at the earliest. ~~Half-Yearly report will be sent by SRC without conducting a presentation. Two consecutive unsatisfactory reports will result in the termination of the programme.~~
	R.7	1. The research progress of each research candidate in each semester will be monitored by the supervisor(s), who will assess the performance to be 'satisfactory' or 'unsatisfactory' at the end of each semester. For this purpose, each research candidate will be asked to submit a progress report to the supervisor(s) by the dates stipulated in R11.6. 2. In addition, the candidate shall have to give seminar once in an academic year before the SRC for progress evaluation. If the candidate has been admitted in July, the seminar presentation has to be completed by July 15 of the next year and if the candidate has been admitted in January, the seminar presentation has to be completed by December 31 of the same year. 3. The supervisor(s)/SRC shall forward the recommendation regarding the performance of the research candidate to the Chairman, DRC/CRC before the beginning of the next semester. The Chairman, DRC/CRC will forward the recommendation to the competent authority for necessary action. 4. The progress of a research candidate in each semester is evaluated as 'satisfactory' or 'unsatisfactory' by the supervisor(s)/SRC and forwarded to competent authority through Chairman DRC and Head of the Department/Centre. 5. If the progress is evaluated as 'unsatisfactory' by the supervisor(s) for the first time, a warning will be issued to the Research Candidate by the competent authority.	

		6.	If the performance is evaluated unsatisfactory in two consecutive semesters to a research candidate, his/her registration for Ph.D. programme will stand terminated. A special meeting of SRC may be called by the supervisor(s) at any time during the entire period of Ph.D. for the following: - Any type of change of topic or research area. - Addition or deletion of supervisor. - To consider the request of student for doing work in industry or in some other institute for a short period. - To consider the extension of period - To consider the enhancement of fellowship or change of status from JRF to SRF. Proforma Ph.D-VIII need to be filled every time by the SRC for the approval of Dean of Academic Affairs.	
		7.	R.7 Special SRC Meeting A special meeting of SRC may be convened for considering the following cases: - Any change in topic or research area; - Addition or deletion of supervisor; - Change of status/category; - Short term leave to take up studies outside the institute; - Extension of PhD duration and institute assistantship The SRC recommendations in the prescribed proforma should be sent to Dean Academic Affairs for the approval.	
THESIS SUBMISSION (Item No. 60.23 Appendix 'L' dt 08.07.2015) (Item No. 71.15 Agenda (Page No.226) Minutes (Page No.06)	R.8	1.	a) A candidate is required to publish at least two papers or accepted for publication in refereed journal(s) of repute (preferably journals included in SCI) as decided by the SRC at the time of presentation of research proposal or at least one patent filed. Eligibility criteria for submission of thesis regarding minimum duration of submission and number of papers to be published shall be as per the	R.8 Submission of Thesis When the supervisor and the PhD candidate are of the opinion that the research work as planned in the research proposal has been completed then the supervisor should arrange for a meeting of SRC. At this stage, it is expected that the PhD student has already published (or, accepted for publication) at least TWO papers out of which ONE paper should be in a refereed journal. Papers can be in a conference of repute as endorsed by the SRC. The PhD

dt 28.12.2017)	Ordinances & Regulations in force at the time of admission. b) When the supervisor is of the opinion that the research work as planned in the research proposal has been completed and the quality of work is up to the mark for submission of Ph.D., he/she will ask the research candidate to prepare a draft copy of the thesis and submit to the Chairman, SRC with the request to convene the meeting of SRC. c) The candidate shall submit & 2 soft bound copies and one soft copy of the synopsis after the SRC recommends submission of synopsis. d) The research candidate will deliver a seminar on his/her research work and the seminar shall be adequately notified by the Chairman, SRC, so as to enable interested staff members and students to attend it. If the SRC is satisfied about the quality of the work and considers it fit for submission as a Ph.D. thesis, it will send its recommendation to competent authority along with five soft bound copies and one soft copy of the synopsis and the proposed panel of examiners. Proforma Ph.D-IX, given in Appendix-A, is to be filled by the supervisor(s) to be sent for the approval of Dean of Academic Affairs. e) At the time of delivery of seminar for pre-submission, student has to present the rough draft of the thesis to the SRC. f) If candidate feels that supervisor is not allowing him/her to submit thesis, the student can approach Chairman SRC or HoD and request to convene the special meeting of SRC to consider the work done	student shall submit a draft copy of the thesis to the SRC members at least 15 days prior to the scheduled meeting. The PhD student will present his/her research work to the SRC and if the SRC is convinced and considers it fit for submission as a Ph.D. thesis, it will send its recommendation to Dean Academic Affairs in a prescribed form. The supervisor may verify the availability of potential examiners for evaluating the thesis before recommending the names for panel of examiners. ~~The panel of examiners shall have names of researchers / faculty from eminent organisations spanning all over the world. Ten examiners may be suggested by the SRC.~~ The PhD student should submit the thesis within four months of SRC recommendation for submission of thesis. ~~One time extension upto four months may be granted by the Dean Academic Affairs, on the recommendations of the SRC.~~ The thesis, synopsis and the panel of examiners should be submitted as PDF files.
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		by him/her. The candidate may or may not be allowed to submit thesis by the SRC. The research candidate shall be required to submit his thesis within 04 months of SRC recommendation for submission of thesis. However, in case a candidate fails to submit his/her thesis within the stipulated time and has suitable justification for the same, the competent authority may, on recommendations made by the SRC and DRC and on individual merits of each case, grant him/her extension in time beyond more than four more months, i.e. the candidate may be allowed to submit his/her thesis within a period not exceeding 08 months from the date of SRC meeting recommending submission. No further extension will be given beyond 08 months for the submission of thesis.	
	2.	Panel of Examiners A panel of at least ten experts in the area of the Ph.D. thesis would be suggested by the supervisor(s) and recommended by the SRC while forwarding its recommendation for submission of thesis. The panel so recommended would include at least 50% of the examiners from outside India and be out of the bibliography list of references as submitted by the candidate with synopsis with one reference of each expert in cited journal. Any person working in the laboratory(ies)/ Institution(s) where the research candidate or supervisor(s) from outside the institution, if any, is employed, cannot, however, appear in the panel of examiners. Any person related to the candidate or supervisor(s) should not appear in the panel of examiners.	

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No.08)
dt 11.08.2016)

	3.	Board of Examiners On receipt of the recommendation of SRC for submission of thesis along with synopsis and panel of examiners, the Dean of Academic Affairs will seek consent of the examiners and appoint the Board of Examiners for each research candidate. The Board will consist of internal examiners - ~~the Supervisor(s)~~, and three external examiners – two from within India and the other from abroad, who shall be experts in the subject of the thesis except for cases covered under clause R.8.2 (b). These external examiners shall be chosen from the panel of examiners recommended by the SRC. The supervisor has already gone through the thesis submitted by his/her student and approved the submission, the supervisor will not be asked to evaluate the thesis again. The thesis shall be evaluated only by the Indian and Foreign Examiners as per existing rules.	
	4.	Submission of Thesis (i) The thesis shall be written in English in the specific format available in the office of Dean of Academic Affairs / Department. The specifications of the thesis are given in Proforma Ph.D-X, given in Appendix-A. (ii) The thesis shall contain a critical account of the candidate's research. It should be characterized by discovery of facts or fresh approach towards interpretation of facts and theories or significant contribution to knowledge or development of innovative products and technologies or a combination of these. It should bear evidence of the candidate's capacity for analysis and	

			judgment as well as his ability to carry out independent investigation, design or development. (iii) The Ph.D. thesis must contain the following copyright certificate in the beginning of the thesis, on a separate page on the left side: © INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE, 200.. ALL RIGHTS RESERVED (iv) The research candidate shall submit initially n+4 copies of the thesis in a spiral bound form with a soft cover, where 'n' is the number of supervisor(s), and also a soft copy (pdf file) on a CD. One copy each is for office record, for foreign examiner, for Indian examiner and for supervisor(s). (v) The candidates declaration page will have signature of only the student and supervisor(s). The format of the declaration page will have the format as given in proforma Ph.D- XI-A, given in Appendix-A. (vi) The candidate will have to fill proforma Ph.D- XII, given in Appendix-A, for the submission of thesis.	
THESIS EVALUATION (Item No. 60.23 Appendix 'L' dt 08.07.2015) (Item No. 71.15 Agenda (Page	R.9	1.	The thesis will be sent to the examiners by the office of the Dean of Academic Affairs with the request for a detailed assessment report and his/her recommendations on the prescribed proforma within a period of six weeks of the date of receiving the thesis. Criteria to be adopted for evaluation of thesis shall be as	

No. 226) Minutes (Page No. 06) dt 28.12.2017) (Item No. 68.13 Appendix 'D' Minutes (Pg No. 23- 26) dt 02.03.2017)	per the Ph.D. Ordinances & Regulations in force at the time of submission of the thesis. 2. a) Examiners will examine the thesis individually with a view to judge that the thesis is a piece of research work characterized by; i) The discovery of facts, or ii) A fresh approach towards interpretation and application of facts or theories, or iii) Development of innovative products and technologies b) Each examiner will send detailed comments on the research work along with a clear recommendation stating one of the following: (i) The thesis is satisfactory and recommended for the award of Ph.D. degree, or (ii) The thesis is recommended for the award of Ph.D. Degree subject to the candidate giving satisfactory answers to queries specifically mentioned in the report at the time of oral defence, or (iii) The thesis is recommended for the award of Ph.D. Degree subject to the candidate revise the thesis as per suggestions made and presents during oral defence, or (iv) The candidate is required to resubmit the thesis in the revised form, as per suggestions made and the thesis be sent for re-evaluation. (v) The thesis is rejected. 3. The Dean of Academic Affairs will, on the basis of the recommendations of the examiners will take one of the following actions:	
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			i) If all the examiners recommend acceptance of the thesis, their recommendations shall be accepted. ii) ~~If out of three external examiners, two external examiners (Foreign and one of the Indian) have sent the report in time and recommend the acceptance of the thesis and all internal examiners also recommend acceptance of the thesis, their recommendation may be accepted. However, the academic section shall wait till the last date of sending the reports by all external examiners from the date of dispatch of Ph.D. thesis (i.e., 6 weeks as given in R.9.1 above) and after that give at least one reminder to examiner to send the report in next 4 weeks.~~ If out of three external examiners, two external examiners (Foreign and one of the Indian) have sent the report in time and recommend the acceptance of the thesis, their recommendation may be accepted. However, the academic section shall wait till the last date of sending the reports by all external examiners from the date of dispatch of Ph.D. thesis (i.e., 08 weeks) and after that give at least one reminder to examiner to send the report in next 4 weeks. iii) ~~If the report of one out of two external examiners (received till last date) is negative, the report of third examiner is must.~~ iv) ~~In case reports have come from both the Indian examiners, any one of them may be included in the examination board for viva-voce examination. In case reports have come from both the Indian Examiners and both have given the same recommendations, any one of them may be~~
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			included in the examination. However, if the recommendations of Indian examiners are different, the one who has raised the queries or asked to revise the thesis as per suggestions made by him/her and presents during oral defence shall be included in the examination board. v) ~~If majority of the external examiners recommend rejection, their decisions would be accepted. The candidate may, however, be allowed to resubmit the thesis at least after one year, provided the title of the thesis remains unchanged. Normal procedure will be followed for the evaluation of the resubmitted thesis. In case of resubmission of the thesis, a fresh fee for the examination shall be paid by the candidate. No candidate shall be allowed to resubmit the same thesis for more than once.~~ If any of the examiners recommends rejection, his/her decision would be accepted. The candidate may, however, be allowed to resubmit the thesis at least after one year, provided the title of the thesis remains unchanged. Normal procedure will be followed for the evaluation of the resubmitted thesis. In case of resubmission of the thesis, a fresh fee for the examination shall be paid by the candidate. No candidate shall be allowed to resubmit the same thesis more than once. vi) ~~If more than one examiner recommends rejection, the candidate's replies to the comments made by the examiners shall be sent to these examiners and their clear verdict sought. The examiners may then recommend acceptance, rejection or revision~~
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			of the thesis. ~~In case the thesis is accepted, sub-clause 3(i) above will be applicable. In case of recommendation for revision, sub-clause 3(vii) below will apply. However, if these examiners still recommends rejection, alternate examiners would be appointed from the panel of the examiners recommended by SRC by the Dean of Academic Affairs. In such cases sub-clause 4(viii) will apply.~~ If one or more examiners recommend rejection, the candidate's replies to the comments made by the examiners shall be sent to these examiners and their clear verdict sought. The examiners may then recommend acceptance, rejection or revision of the thesis. In case the thesis is accepted, sub-clause 3(i) above will be applicable. In case of recommendation for revision, sub-clause 3(vii) below will apply. However, if these examiners still recommends rejection, alternate examiners would be appointed from the panel of the examiners recommended by SRC by the Dean of Academic Affairs. In such cases sub-clause 4(viii) will apply. vii) In case some examiners recommend revision of the thesis, the thesis would be revised normally within one year, if the candidate so desires. The revised version of the thesis with new date of submission on thesis would be sent to all the examiners for their recommendations. If the candidate does not agree for revision, he may ask for appointment of another examiner(s) under sub-clause 4(viii) below.
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			~~viii) A new examiner, if appointed, shall be Indian or Foreign depending on whether the thesis was rejected/to be revised on the recommendation by an Indian or a Foreign examiner in the first instance. The reports of all the examiners will be sent to the new examiner without revealing the identity of the previous examiners, along with the response of the candidate, if any, to the grounds for such recommendation as given in the detailed comments. The thesis shall be deemed to be acceptable if majority of the examiners including the new examiner recommend acceptance.~~ ~~If the newly appointed examiner recommends revision, the thesis would be suitably revised and resubmitted at least after 3 months and sent for examination to all the examiners except the ones in whose place the new examiner was appointed.~~ ~~In case the newly appointed examiners recommend rejection or their recommendations for revision is not accepted by the candidate, the thesis would be rejected. The candidate may then avail the benefit of sub-clause 3(v) above.~~ A new examiner, if appointed, shall be Indian or Foreign depending on whether the thesis was rejected/to be revised on the recommendation by an Indian or a Foreign examiner in the first instance. The reports of all the examiners will be sent to the new examiner without revealing the identity of the previous examiners, along with the response of the candidate, if any, to the grounds for such recommendation as given in the detailed comments. The thesis shall be deemed to be acceptable if all the examiners including the new
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			examiner recommend acceptance. If the newly appointed examiner recommends revision, the thesis would be suitably revised and resubmitted at least after 3 months and sent for examination to all the examiners except the ones in whose place the new examiner was appointed. In case the newly appointed examiners recommend rejection or their recommendations for revision is not accepted by the candidate, the thesis would be rejected. The candidate may then avail the benefit of sub-clause 3(v) above. ix) ~~If the majority of examiners recommend revision of the thesis, the candidate may revise the thesis accordingly and resubmit it within a period of one year for the evaluation by the same set of examiners.~~ x) ~~If there is no clear majority opinion and there are recommendations for rejection by some examiners and also, revision of the thesis by some other examiners, the candidates may revise the thesis and resubmit it within a period of one year, for evaluation by the same set of examiners.~~ If there are recommendations for rejection by some and also, revision of the thesis by some others, the candidates shall revise the thesis and resubmit it within a period of one year, for evaluation by the same set of examiners. xi) Any doubt arising out of following the procedure laid down in clause R.9.3 shall be referred to the Director for a decision.
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ORAL DEFENCE OF THESIS (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.10	1.	xii) In case of ambiguous recommendations by the examiner(s), Dean of Academic Affairs will approach the examiner(s) for a clear recommendation. In case clear recommendation is not forthcoming, the matter may be referred to the Director for his decision. ~~xiii) In case any examiner gives comments to be incorporated in the thesis and also states that the revised thesis need not be sent again to him / her, the revised thesis will not be sent to the examiner. The supervisor(s) shall certify that the comments have been incorporated, before the viva-voce examination. (in view of clause R.9.2 (b) (iii) included in the revise rules.)~~	
		2.	If the thesis is recommended for the award of Ph.D. degree, the candidate shall be required to defend his / her work / thesis orally (Oral Defence) before a duly constituted committee hereinafter referred to as the Oral Defence Committee (ODC). The Dean of Academic Affairs shall request the thesis supervisor and Chairman, SRC to arrange the conduct of oral thesis defence. The copies of the report of the thesis examiners shall be sent to the supervisor with the request to provide them to the candidate so that he/she may prepare to answer the queries raised in the report during oral defence. The oral thesis defence shall be adequately notified so as to enable interested staff members and students to attend it. (i) The ODC shall be chaired by the Head of the department / centre or his nominee and shall consist of Chairman SRC, supervisor(s) and one Indian external examiner. The Chairman, SRC and	R.9 Evaluation and Defence of Thesis The thesis shall be sent to three examiners for evaluation and the student will be asked to defend his/her thesis in front of the Oral Defence Committee (ODC), if any two of the three examiners recommend acceptance of the thesis. The ODC shall consist of the Head of Department (or, nominee), Chairperson SRC ~~DRC (or, nominee), the external examiner, and SRC members.~~ Once the ODC is satisfied with the defence of PhD student, it will record its recommendations in the prescribed form and communicate it to the Dean Academic Affairs. The PhD student has to incorporate all the suggestions given by the examiners in the thesis and present a compliance report of the same. A revised thesis incorporating all suggestions should be submitted

		the supervisor(s) in the capacity of internal examiner(s) shall arrange for the oral defence of the candidate and the Head of the department/centre will notify it. The oral defence of the thesis of the candidate shall be arranged as early as possible and normally within two months from the date of receipt of communication from the Dean of Academic Affairs for holding the viva-voce examination. (ii) The Dean of Academic Affairs will decide that out of two Indian external examiner who should be included in the panel of examiners for ODC. (iii) In case of the inability of the supervisor to arrange the conduct of the oral defence of the thesis due to any reason whatsoever, the Dean of Academic Affairs may appoint Chairman, SRC or internal expert, as recommended by Head of the Department/Centre concerned, another Internal Examiner for oral defence of the thesis. In such cases also, the Ph.D. work will be deemed to have been carried out under the guidance of the supervisor only.	along with the report of the ODC. Thesis shall be signed by Student and the Supervisor.
	3.	a) In case of non-availability of the Indian External Examiner in conducting the viva-voce examination, the Dean of Academic Affairs may appoint another examiner to conduct the oral defence of the thesis from the panel of Indian examiners recommended by SRC. If need be, the SRC may suggest a fresh panel of examiners. b) The examiners in Oral Defence Committee (ODC) shall be provided with the comments made by the	

			examiners before the oral defence. c) If there is a difference of opinion among the viva-voce examiners in Oral Defence Committee (ODC), the recommendations of the ODC will be put up to the Director for a decision who may either direct that a fresh oral defence be held with a new ODC or recommend acceptance or otherwise to the Senate. d) On the completion of the oral defence, the Oral Defence Committee shall recommend to the Dean of Academic Affairs, one of the following courses of action: (i) that the degree be awarded; (ii) that the candidate be re-examined at a later specified time in a specified manner; The Oral Defence Committee shall also provide to the research candidate a list of all corrections and modifications in the thesis (if required) including suggestions made by the examiners during the thesis evaluation. The second oral defence may be held in case of (ii) normally after a period of 3 months. Any other matter not explicitly provided herein or of an exceptional nature, may be referred to the Director for his decision. e) After the successful completion of oral defence, the candidate is required to make all the changes suggested by the examiners or members of viva defence committee. (i) The final submission of thesis shall be in hard bound form incorporating all the changes in the
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			thesis after successful completion of oral defence. The candidate declaration page will have the format as given in proforma-XI-B, given in Appendix-A. (ii) The candidate's declaration page in the final thesis will have the signature of the candidate, supervisor(s), Indian examiners and Chairman, SRC. The supervisor will take the signature of all the members of Oral Defence Committee on required number of sheets at the time of viva-voce examination to be placed in the final thesis. (iii) Before signing the thesis in the hard bound form, the supervisor(s) will certify that the candidate has made all the changes as suggested by the examiner(s). (iv) The research candidate shall prepare n+2 copies of the final thesis in hard bound, where 'n' is the number of supervisor(s), after successful completion of Oral Examination. One copy each is for Central Library, Departmental Library and for supervisor(s). (v) One copy of the thesis shall be given to each supervisor(s) by the candidate. (vi) One copy of thesis shall be submitted in Departmental Library by the candidate to get 'No Dues' from the Departmental Library. (vii) The candidate shall submit one copy of thesis meant for Central Library, synopsis of the thesis, additional one page synopsis for Hindi translation, 'No Dues' certificate and a soft copy (pdf file) on a CD to supervisor(s) for sending to Academic Section. (viii) Supervisor will send the above alongwith
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			Report of the thesis to Academic Section for approval of the competent authority.	
AWARD OF Ph.D. DEGREE (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.11	1.	The Degree of Ph.D. shall be awarded by the Senate, provided that: - The Oral Defence Committee so recommends; - The candidate produces a 'No dues Certificate' in the prescribed form. - The candidate has submitted one soft and two hard cover copies of the thesis; one for the Library of the Department/Centre and the other for the Central Library. The thesis should incorporate all necessary/ corrections/modifications listed by the Oral Defence Committee (ODC).	
FINANCIAL ASSISTANCE (Institutional Assistantship) (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.12	1.	- Those students who are admitted on full-time basis are considered for the award of Institutional MHRD Assistantship of the amount as decided by the Government of India from time to time, under specified terms and conditions. - The students getting Institute MHRD Assistantship will provide 8-10 hours of assistance per week in teaching, laboratory development, and research. - The total number of MHRD assistantships in a department will be as decided by the institute from time to time.	Assistantships are awarded on a semester-to-semester basis for a period of up to five years for PhD students. A student is expected to devote up to eight to ten hours per week towards job(s) assigned to him/her. The renewal of assistantship is contingent on the student's satisfactory performance in the academic programme and in the discharge of assistantship duties. Project fellows may be offered institute assistantship after the expiry of project funding for a maximum cumulative period of five years (project funding + institute assistantship) in PhD programme. These assistantships will be over and above any limit/quota of institute assistantships for Departments/Centres. Financial assistance will not be available from the institute to candidates who are recipients of the fellowship awards

(Item No. 69.32 Agenda (Pg No. 139-140) Minutes (Pg No. 12) dt 28.07.2017)	2.	The maximum duration for which assistantship can be awarded to any Ph.D. research student is 4 years for MHRD and UGC/CSIR fellows or till the end of the semester in which the thesis is submitted, whichever is earlier. Continuation of the fellowship is contingent on satisfactory academic and research performance and satisfactory performance in the discharge of responsibilities for assistance assigned under the scheme. IITR Assistantship to research scholars may be extended up to the viva-voce Examination on the recommendation of supervisor. This is subject to their registration in those semester(s). However, in any case, the assistantship cannot be given beyond five years as per the guidelines of MHRD. MHRD or UGC/CSIR fellowship can be given to the students in the 5th year provided the SRC or the three member assessment committee respectively strongly recommends with a justification for fellowship after the candidate delivers a seminar before the committee, to show progress. The committee has to specify the date beyond 4th year upto which fellowship can be given. It is to be noted that admission to the Programmes and award of assistantship are not linked. Admission to any programme does not guarantee the award of fellowship/ assistantship. Those who are not awarded assistantship can continue with the programmes as a self financing student.	~~from~~ UGC/CSIR/IDST/ICMR/DBT, etc. ALREADY TALKED IN PART-I
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TUITION FEE WAIVER TO Ph.D. STUDENTS <i>(Item No. 60.23 Appendix 'L', dt 08.07.2015)</i>	R.13	Tuition Fee Waivers is given to research students/ candidates following the policy of the Government of India, Ministry of Human Resource Department.	Tuition fee waiver as per Government of India guidelines.
LEAVE AND ATTENDANCE <i>(Item No. 60.23 Appendix 'L', dt 08.07.2015)</i>	R.14	A research student/candidate will be entitled to avail leave as approved by the Head of the department/centre following Leave Rules/Attendance Rules formulated and amended from time to time by the Senate. Presently these are as under: Leave Rules 1. A full-time research student/candidate, during his/her stay at the Institute will be entitled a total of ~~30 days leave per academic year, in addition to Public Holidays including leave on medical grounds;~~ for 8 days casual leave and 15 days vacation leave including leave on medical grounds in an academic year. He/she will not be entitled to mid-semester breaks, summer and winter vacation. The leave due can be carried over to the next year and accumulated up to ~~90~~ 60 days. Leave beyond ~~30~~ 15 days in an academic year may be granted to a Research student/ candidate in exceptional circumstances, on the recommendation of the supervisor, by the Head of the Department/Centre concerned, subject to the following conditions: a) The leave beyond ~~30~~ days due leave will be	R.10 Leave, Attendance and Withdrawal R.10.1 Leave Rules A full-time PhD student, during his/her stay at the Institute, is entitled for 8 days casual and 15 days vacation leave and 15 days leave on medical grounds in an academic year. He/she will not be entitled to mid-semester breaks, summer and winter vacation. The vacation ~~and medical leave~~ due can be carried over to the next year and both can be accumulated up to 60 days. An extension of leave beyond available leave up to additional 15 days will be granted only once during the programme by the Head of the Departments/Centres under exceptional conditions. Proper attendance record shall be maintained in the department. A PhD student is allowed to draw Assistantship/ Scholarship/ Fellowship during the sanctioned leave period. This is also applicable to: • Maternity leave to a woman PhD student for a period not exceeding ~~125~~ 180 days, once during the period of PhD programme; • Paternity leave for a male PhD student for period not exceeding 15 days once during the period of

(Notification No. Acd./1814/UG-15 dated 20.11.2015)	without Assistantship/ Scholarship/ Fellowship. b) An extension of leave up to additional 30 15 days will be granted only once during the programme of the scholar. c) A proper leave account of each research student/candidate shall be maintained by the Department/ Centre concerned. d) Women scholars are entitled for maternity leave with full fellowship/assistantship as applicable, for a period not exceeding 180 days, once during the tenure of their award. The application for maternity leave should be supported by medical certificate. e) Male Scholars are entitled for 15 days paternity leave once during the tenure of their award. The application for paternity leave should be supported by medical certificate. f) Special leave may be granted with the permission of Dean of Academic Affairs to attend Seminars/Conferences in India /abroad and present paper. However, permission of Dean of Academic Affairs, is required to attend Seminars/ Conferences in abroad and present paper. g) Field trips, attending Seminars/Conferences/Workshops will be considered on duty. h) Research student/candidate supported by a Government/ semi-Government agencies may be governed by their own rules as applicable.	PhD programme. The application for maternity/paternity leave shall be made well in advance and should be supported by medical certificate. Special leave may be granted by Head of the Department/Centre for field trips, working in other research laboratory and to attend Seminars/ Conferences/ Workshops and present paper. The PhD student may continue to draw his/her assistantship/fellowship during these visits outside the institute and shall be considered on-duty if he/she is not availing any financial support from the host institute. Such period of absence for field trips/working in other research laboratories shall not be more than one semester.
2.	Attendance A research student/candidate irrespective of the	R.10.2 Attendance

			source of support including self financing, while pursuing course work, must have at least 75% attendance in each course in which he/she is registered. A research student falling short of 75% attendance in a course shall not be permitted to appear in the examination of that course and asked to leave the programme. A research student/candidate after having completed the course work must attend to his/her research work on all the working days and mark attendance except when he/she is away from the campus on duty/sanctioned leave. The requirement of 75% attendance will apply as above on daily attendance on monthly basis except in the cases where longer leave have been duly sanctioned within the leave entitlement of the research student/candidate. In case the attendance of a research student/candidate falls below 75% during a month, he/she will not be paid his assistantship/support, if applicable, for that month. Further, if his/her attendance again falls short of 75% in any subsequent months in the same semester his/her studentship/candidacy and support will be terminated. For the above purpose, if 75% works out to be a number which is not a whole number, the immediate lower whole number will be treated as the required 75% attendance.	During the course credit period, the minimum attendance requirement shall be as mandated by the institute regulations. A PhD student after having completed the coursework must attend to his/her research work on all the working days and mark attendance except when he/she is away from the campus on duty/sanctioned leave. The assistantship/fellowship shall be released on the recommendation of the supervisor in each month.
WITHDRAWAL FROM SEMESTER/COURSES	R.15	1.	A research student/candidate may be permitted by the Dean of Academic Affairs to withdraw from all the courses registered by her/him in the entire semester, on medical grounds supported by a medical certificate	R.10.3 Withdrawal from Semester A PhD student can seek withdrawal from a semester on medical grounds, supported by medical documents

(Item No. 60.23 Appendix 'L' dt 08.07.2015)		from the Institute Medical Officer. The medical certificate issued by a registered Medical Practitioner will also be acceptable in those cases where the research student/candidate has valid reasons for his/her absence from the Institute. Withdrawal may also be granted by the Dean of Academic Affairs provided he/she is convinced that the research student/candidate cannot pursue his/her studies for the reasons beyond his/her control.	issued by institute hospital or issued by a certified medical practitioner and verified by institute chief medical officer. Permission is to be taken from Dean Academic Affairs. The medical certificate should be submitted (if not submitted earlier) within two days of his/her resuming duties at the Institute. Partial withdrawal from some of the courses registered in a semester is not admissible on medical grounds. The period of authorized absence in the semester should not be less than three weeks in a semester, for which withdrawal is to be granted. In case a student wishes to temporarily withdraw from his/her PhD Programme, he/she may do so only after candidacy with the permission of the Dean Academic Affairs on the recommendation of SRC. Temporary withdrawal may be granted for up to one year (two semesters) initially. Extension of the duration of withdrawal beyond the period of one year would normally not be encouraged, and could be granted by the Dean Academic Affairs, only under exceptional circumstances. The period of temporary withdrawal will not be counted, when counting the number of semesters of Ph.D. registration already completed by the student. R.10.4 Withdrawal from a Course A student may drop courses for which he/she may have registered if the academic load for the given semester is found to be too heavy. The last date for dropping a course by the student will be two weeks after the mid-
	2.	Research Student/Candidate should present the medical certificate in support of his/her absence for health reasons within two days of his/her rejoining the Institute, if not produced already. Under no circumstances a request for semester withdrawal from a research student/candidate will be entertained after the major tests in courses have begun. Withdrawal will	

			Bachelors' Degree both for full time/part time student from initial registration following provisions of clause R.4. f) If he/she does not clear the comprehensive examination as stipulated in clauses R.5.2 and R.6.2. g) If he/she is found involved in an act of misconduct and/or indiscipline and termination has been recommended by a competent authority.	If he/she is found involved in an act of misconduct and/or indiscipline and termination has been recommended by the competent authority. R.12 Exit from Ph.D. Programme If a PhD student in may exit from the programme with an M.S. (Research) degree provided: • The PhD student has qualified for the candidacy; • A request to this effect is made at least six months before the exit but not before the student has completed two-and-half years (excluding the period of sanctioned leave, if any) in the programme; The request is approved by the Senate on the recommendations of DRC and IRC.
TO TAKE UP JOBS/ASSIGNMENTS (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.17		The Full time research student/candidate cannot take up any regular job/assignment during Ph.D. programme. If he/she takes up a job / assignment, his/her status will be converted from Full-time to Part-time student in accordance with clause A.2.3. Conversion of status from Full-time to Part-time is admissible only after the candidacy.	
GENERAL (Item No. 60.23 Appendix 'L' dt 08.07.2015)	R.18	1.	Notwithstanding anything contained in these Ordinances & Regulations, all categories of the research students/candidates shall be governed by the regulations, guidelines and procedures framed by the Senate in this regard, and in force from time to time.	

		2.	Unfair means and Plagiarism a) In case a research student/candidate is found adopting or suspected of adopting unfair means before, during and after the examination or lifting of some other's work(s) and inserting it in his/her project, seminar and dissertation, etc. without proper acknowledgment, credit and reference or plagiarizing the dissertation/project report etc., such penal action shall be taken by the Institute as may be necessary to uphold the sanctity and integrity of the examination system and the credibility of the Institute. b) All such cases may be taken suo-moto cognizance of by the Institute Standing Committee (ISC) appointed by the Senate for this purpose. Such cases may also be reported by examiners/invigilators/ supervisor(s)/ Chairman, DRC/CRC or any person to Dean of Academic Affairs and or the Institute Standing Committee for consideration. After giving an opportunity to the concerned research student(s) /candidate(s) to explain the conduct/defend against the charge, the Chairman, Senate on the recommendation of Institute Standing Committee shall take action to impose on the concerned research student(s)/candidate(s) appropriate penalty including termination of registration or award of F Grade in the concerned course(s) etc.	
INTERPRETATION (Item No. 60.23 Appendix 'L')	R.19	1.	Any doubt or dispute about the interpretation of these Ordinances and Regulations shall be referred to the Chairman, Senate whose decisions shall be final.	

dt 08.07.2015)	2.	Eligibility for admission to Ph.D. programmes in different disciplines is summarized in Annexure-I. This may be reviewed from time to time by the concerned department/centre and approved by the Senate. Note: The recommendations of SRC in respect of a research student are to be made on prescribed proforma available in the office of concerned department / centre as well as Institute website.	
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Additional Suggestions of Manish Shrikhande Committee which are not met in the existing Ph.D. Ordinances & Regulations

Suggestions from Faculty Colleagues

- Admission Process

- Prof. Prateek Jha: "JRFs under projects who register for PhD are eligible for 2 year institute assistantship after completion of the project. Is GATE qualification a mandatory criteria for availing that assistantship for engineering students not from CFTIs." -- Eligibility for PhD admission is well defined and is independent of the source of financial support. The institute assistantship will be available if the candidate has been admitted to PhD programme.

- Prof. R.S. Mulik: "The requirement of 5 years of experience in case of sponsored candidates is too high. It is really difficult to cope with the course work after 5 years of gap. Request to cut it down to 2 years." The committee is in favour of retaining 5 years of experience for bringing in adequate industrial experience to research programme. The IRC may deliberate further.

- Supervisor Allocation

Prof. Vipul Rastogi suggested that the allocation of supervisor at the time of admission is working well for the Physics department and should be continued.

Item No. 76.17: To consider merging of Oral Comprehensive examination with Research Proposal presentation as a part of candidacy for Ph.D. Programme.

A proposal was received from Department of Metallurgical and Materials Engg. regarding possibility of merging Oral Comprehensive examination with Research Proposal presentation, which at present are conducted separately as a part of Candidacy for Ph.D. programme.

The IRC in its 21st Meeting held on July 16, 2018 recommended to merge the two presentations. The presentation may be evaluated as 'Accepted' or 'To be revised'.

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

Item No. 76.18: To consider Models for Collaborative Doctoral Programmes with Foreign Universities.

IIT Roorkee is looking forward for the collaborative research with different universities abroad. A generalized model has been created regarding Joint Ph.D. Supervision and Dual Degree Ph.D. supervision.
(Appendix 'A')

The IRC in its 25th emergent meeting held on 19.12.2018 discussed the Models and recommended the same with minor corrections.

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

The following institutes have proposed to have collaborative degree programmes with IIT Roorkee

- 1) Lulea university of technology, Sweden
- 2) University of Strasbourg, France
- 3) Swinburne University, Australia
- 4) University of Alberta, Canada
- 5) The French network of doctoral schools (REDOC-SPI)

It is proposed that we shall start with the doctoral programmes with the models suggested below. The MoUs with the interested institutes shall be signed with additional clauses decided on case-by-case basis by IRC.

Models for Collaborative Doctoral Programmes with Foreign Universities

A. Joint Degree

1. Students must meet the admission requirements and need to complete the degree requirements of their home institution.
2. They will receive the degree only from their home institution with a remark that the program has been completed jointly with the host institution.

B. Dual Award Degree

1. Students must meet the admission requirements **and** complete the degree requirements of **both** institutions.
2. They receive a degree from each institution.

Conditions common for both of the above models.

1. Students must have a supervisor at each institution.
2. They must spend minimum 6 months over the entire duration of the program at the host institution.
3. They shall pay tuition fee at the home institution only.

Item No. 76.19: To consider the proposal of renaming the Alternate Hydro Energy Centre as Hydro and Renewable Energy Department.

Alternate Hydro Energy Centre (AHEC) was established in the year 1982 with the objective to carry out research & development, training, education and to provide advisory services to promote development of renewable energy potential. During the initial phase, the thrust was on hydropower, conservation of water bodies and other natural resources. Over time, the scenario has changed and activities of the centre have become wider, ranging from renewable energy to new emerging areas of environmental sustainability. Currently, AHEC has laboratories equipped with the state of art equipments and faculty capable of undertaking R&D and attracting national & international students & professionals for higher education, training and research. The process for recruitment of new faculty to broaden the activities of AHEC is also on. In this regard, a proposal received from AHEC is placed at **Appendix 'A'**.

The proposal to rename the 'Alternate Hydro Energy Centre' to 'Hydro and Renewable Energy Department' is placed before the Senate for consideration and recommendation to the Board.

Proposal to consider the change of name of “Alternate Hydro Energy Centre (AHEC)” to new name ‘Hydro and Renewable Energy Department’

Keeping in view of the fast developing energy and environment scenario, a Hydro and Renewable Energy Department is proposed by renaming and widening activities of the Alternate Hydro Energy Centre at Indian Institute of Technology Roorkee with the aim to provide world-class education, training, research, development and advisory services in the field of hydropower, other energy sources and environment management through multidisciplinary approach combining technology, management, economics and policy.

The prime objective of the department is to generate knowledge and evolve practical solutions that enable sustainable generation and utilization of energy along with protection of the environment from energy-related anthropogenic change as well as environment management of rivers and lakes.

1 The need

With the passage of time, continuous development and change in life-styles, there is a growing need of energy. This fast-pace of development and growing energy needs poses significant pressure to the natural resources and our environment. The challenges of energy sector and environmental sustainability are intrinsically interlinked. Sourcing, generating and utilizing energy in an environmentally sustainable manner needs comprehensive understanding of interlinks and interdependency of energy and environmental issues and their management. Thus there is a need to tackle these challenges in a comprehensive and holistic manner.

IITs are at the forefront of technical institutions of excellence in India. The problems of contemporary world, especially those of energy, environment and development are increasingly becoming interdisciplinary in nature. These problems lie at the confluence of science, technology, management, economics and policy. To solve such problems, the solutions have to be interdisciplinary and comprehensive at these fronts. Thus in the field of energy and environmental sustainability, there is a need for IITs to expand

beyond technical excellence to enable and foster an inter-disciplinary environment for knowledge creation, management and dissemination.

Alternate Hydro Energy Centre was established in the year 1982. That time alternate hydro was considered as an alternate energy to the conventional dam based hydro power. The scenario has been changed over the time and focus is being shifted towards development of renewable energy sources. In line with these needs, it is proposed to rename AHEC as Hydro and Renewable Energy Department at IIT Roorkee, for undertaking interdisciplinary and collaborative research as well as teaching in IITs and simultaneously address issues which are society relevant in the field of hydro and renewable energy as well as environmental management.

2 Vision

The department envisions to lead and provide world class education, training, research and advisory services in the interdisciplinary field of hydropower, renewable energy and environmental sustainability.

3 Objectives

Inline to above vision, department has following objectives:

- To become a leading international hub for teaching, research, development and knowledge dissemination in the field of hydro and renewable energy and environmental management studies
- To enhance collaboration among industry, government, academia, NGOs, and the public to address the interrelationships between energy and the environment across technological, economic, and social aspects of sustainable hydro and renewable energy development and use.
- To develop, nurture and maintain an environment conducive for collaborative research and teaching in the field of energy and environmental sustainability by providing appropriate facilities
- To develop highly competent hydro and renewable energy and environmental management professionals, catering to the rising national and international needs.

4 International and National Practices

4.1 International Scenario

Globally, increasing number of major universities/institutions are focusing on energy, environment and sustainability issues not only through their research and education within conventionally established departments but also by creating specific departments focusing primarily on energy and environmental sustainability issues. This is mainly because these issues are complex and interdisciplinary in nature, and require unique approach to develop and disseminate knowledge in these areas. Some of the well-established and internationally recognized hubs which are doing exceedingly well in this areas are The Energy and Resource Group (ERG) at University of California Berkley and MIT Energy Initiative (MITEI) at MIT, Cambridge.

ERG is an intellectual hub for research on clean energy, climate science, ecosystems and biodiversity, energy systems, international development, technology and society, and water policy.

At MIT, the MIT Energy Initiative (MITEI) is an integrated framework which includes research, education, campus energy management and outreach programs that cover all areas of energy supply and demand, security, and environmental impact. The Laboratory for Energy and the Environment (LFEE), an integral part of the MITEI, fosters collaboration among industry, government, academia, nongovernmental organizations, and the public to address not only the complex interrelationships between energy and the environment, but also the technological, economic, and social aspects of sustainable energy development and use.

Environmental Change Institute (ECI) at University of Oxford is another leading organization with international recognition for research in climate, ecosystems and energy. The ECI is responding to the challenges in these areas through an interdisciplinary and integrated programme of understanding processes of change; exploring sustainable solutions; and influencing change through education and partnership.

The Energy Policy Institute at Chicago (EPIC) is an interdisciplinary research and training institute of the University of Chicago's Booth School of Business and Harris

School of Public Policy focused on the economic and social consequences of energy policies.

Apart from these departments and other similar hubs across various leading international universities, there are various departments and institutes focusing on some of the specific areas within energy and environmental studies.

4.2 National scenario

It is evident that at international level there is increasing recognition of both interlinks and overlaps between energy and environmental issues and as well interdisciplinary approach required to tackle these challenges. However, the current research and education approach of most of the leading institutes in India have been either focusing on environmental issues or energy issues in a standalone manner. Interdisciplinary research approach has also been very limited. Some of the departments working on energy and environmental management issues include Department of Energy Science & Engineering, IIT Bombay. It aims to develop sustainable energy systems and solutions for the future.

Centre for Energy Studies, IIT Delhi, though primarily focusing on energy, is looking at energy and environmental issues simultaneously. It believes that energy supply and environmental protection are an inseparable unit and an energy engineer will have to take cognizance of the same.

Centre for Environmental Science & Engineering at IIT Kanpur is carrying out research, leading to technology development and competency building in various areas related to environmental problems, thereby providing solutions to Indian industry, medical professionals and policy makers.

School of Energy Science and Engineering at IIT Kharagpur runs M.Tech programme and carryout research in the field of Bioenergy, solar energy, wind energy and smart grid and renewable integration.

Renewable energy sources department at University of Petroleum and Energy Studies (UPES) is particularly focusing on energy sector with certain interests in transportation and infrastructure sector specifically to petroleum matter. The university is relatively new and in the process of establishing its research and education base across different areas of energy sector.

In all, it is evident that in order to keep pace with latest developments and to maintain the leading position of IITRoorkee, there is a strong need to develop a world-class department of excellence in the field of energy and environment which can lead the research, knowledge management, education and advisory services in hydro and renewable energy and environmental sustainability domain through an interdisciplinary approach.

5. AHEC Background

Alternate Hydro Energy Centre (AHEC) was established in the year 1982 with initial support of the Ministry of Non-Conventional Energy Sources. The mandate of AHEC was to promote power generation through development of small hydropower projects (SHP) in hilly as well as plain areas. Development of decentralised integrated energy systems in conjunction with other renewable energy sources e.g. biomass, solar, wind etc. were also undertaken.

AHEC has been an academic centre of the Institute with an initial financial support from the MNRE, Govt. of India upto March 1989 and thereafter from UP Govt. on net deficit basis. Since 2003, after conversion of the University of Roorkee in to IIT Roorkee, AHEC has been fully integrated like any other academic department of the institute through MHRD funds.

AHEC has the vision as “An Academic Department of Excellence for carrying out education, research, development, training and advisory services to provide key inputs for full realisation of renewable energy potential with thrust on Hydropower and conservation of water bodies and other natural resources.”

AHEC has been recognised by the Indian Parliamentary committee on Energy and some of extracts of their recommendations are as follows:

16th report of standing committee on energy of LokSabha and Rajya Sabha on 18th March 2011 recommended that: *AHEC, IIT Roorkee work as a premier institution in the development of small hydro technology in the country paving the way for economic and efficient development of the technology and be a torch bearer for other technological institutes.*

13th Report of the Standing Committee on Energy of LokSabha and Rajya Sabha on 14th March 2016 recommended that: *The Committee feel that AHEC, IIT Roorkee, is a premier*

institution in the development of small hydro technology in the country paving the way for economic and efficient development of the technology and it should be made a guiding star for the sector with sufficient technical, financial and functional support and autonomy.

5.1 Academic Programmes at AHEC

Looking at the large energy potential available in small hydro, solar, biomass, wind resources, the creation of trained human resources in renewable energy sources, especially in developing countries, has been the need of the hour. In order to accelerate the development of Renewable Energy, AHEC has started offering Master of Technology (M.Tech.) programme in “Alternate Hydro Energy Systems” covering renewable energy sources with emphasis on Small Hydro power development in the year 1997.

In view of carrying out the conservation and management of a large number of important lakes and rivers under national programme, AHEC also started M.Tech. programme in “Environmental Management of Rivers and Lakes” to meet the growing need of trained human resource in the area of conservation and restoration of rivers, lakes and other water bodies with initial support from Ministry of Environment and Forests, Govt. of India.

In both M.Tech. programmes, foreign candidates under ITEC programme of Ministry of External affairs are also admitted every year since 2010.

Considering the requirement of under graduate students exposing in the field of energy, two elective subjects on (i) small hydropower development and (ii) Renewable Energy Technology” are offered to B.Tech students as Institute Electives in the both the semesters like other academic department. Ph.D. programme is also offered by AHEC.

5.2 Research and Extension

In addition to the academic activities, AHEC has undertaken research and technical extension projects in the field of small hydropower, biomass and solar energy systems. It carries out the environment and energy auditing of process and allied industries and CEIA of hydro projects. The Centre has also worked for several projects related to the conservation and management of water bodies including developing guidelines.

The centre has various laboratories viz., Instrumentation, Hydro-mechanical Systems, Biomass and Eco-systems, Control Systems, GIS, CFD for teaching and to undertake specific research studies. Data bank, for small hydro projects is the unique facility created at AHEC to cater the speedy development of small hydropower. A digital real time hydropower simulator has been established for training and design with the support from MNES and UNDP under CCFII. Recently an International-level hydro turbine R&D laboratory has been commissioned and inaugurated in the Centre. The laboratory has been accredited by National Accreditation Board for Testing and Calibration (NABL) for fluid flow testing as well as calibration. To study and mitigate the hydro-abrasive issues in Himalayan region, a Sediment Monitoring and Abrasion Testing Laboratory having state of the art instrumentation is also established at the AHEC. With the modern instruments and equipment expertise has been developed for field performance evaluation of small hydro plants.

AHEC has developed two new designs of water mills for grinding of grains and for generation of mechanical/electrical energy in the hilly regions of the country. These designs have been recognized and patents have been awarded for both the designs. Several small scale manufacturers have adopted these designs for manufacturing.

AHEC has been imparting education and training to the field engineers and technologists through M Tech programmes and short-term courses to create trained human resource including of neighboring and developing countries in the field of small hydropower and other sources of renewable energy. Through different International short term training programmes (2 weeks duration) during last 18 years about 900 participants from 68 countries have been trained on various aspects of SHP development. Through national short-term training courses (1 to 2 week duration) for professional/field engineers during last 21 years, over 3400 participants from all over country have been trained.

Standards, manuals and guidelines for various aspects of small hydropower development for the use of different stakeholders have been prepared by AHEC through consultative process. For conservation and management plan for rivers and lakes different guidelines for preparation of reports for MOEFCC and NMCG have been also prepared for the use by different state agencies.

Faculty of AHEC drawn from multidisciplinary fields of Civil, mechanical, electrical engineering and Environment have gained excellent expertise in the entire gamut of activities related to hydropower, renewable energy and the environment.

The faculty in AHEC (5 nos – Professors (3), Associate Professor (1) and SSO (1)) have responsibilities of teaching, research and development similar to any other academic department of the institute.

5.3 Functioning of AHEC

From above, it may be seen that AHEC is functioning as any other academic department of IITR as it offers:

- M.Tech programme in Alternate Hydro Energy Systems
- M.Tech programme in Environmental Management of Rivers & Lakes
- Two nos. institute elective courses for B.Tech students every semester.
- Ph.D. programme
- Short term training programmes
- Sponsored Research projects
- Industrial Consultancy Projects

As per Institute Statutes 'Department' means an academic department established to impart instructions and for carrying out research activities leading to bachelor's and / or Master's and Ph.D. degrees.

Education, research, advisory support and large number of training programmes for Indian and foreign students / participants by AHEC have been like any other Department of the Institute. AHEC exposes regularly its students to designing and implementing actual projects, trained a large number of technical personnel in designing, operating and maintaining complex systems and generated considerable revenue for the IIT.

Academic Activities by AHEC during Last Five Years

M.Tech

Academic Session	No. of registered Students						Total
	AHES			EMRL			
	GATE qualified	Sponsored / QIP	ITEC / ICCR / Foreign	GATE Qualified	Sponsored / QIP	ITEC/ ICCR/ Foreign	
2014-15	27	03	11	11	-	01	53
2015-16	30	02	07	11	-	01	51
2016-17	22	-	09	08	-	01	40
2017-18	14	02	07	10	-	01	34
2018-19	19	01	03	09	01	04	37
	112	8	37	49	01	8	215

Annual average of last five years - 43 students per year.

Ph.D.

Academic Session	Registered	No. of Awardees
2014-15	06	02
2015-16	04	03
2016-17	08	08
2017-18	07	07
2018-19	06	09
	31	29

Annual average admission of last five years - 6 students per year.

Sponsored research/consultancy projects/facility outlay during the period 1991 – 2018 has been 117 crores with sponsorship from MNRE 33%, MOEF&CC 4%, state government organisations 41%, International institutions 1% and Private sector 21%.

Research Papers:

Year	No. of Faculty/ Scientist	Research Publications			
		Research Papers			Books/ Guidelines
		Journal	Conf.	Total	
2013-14	07	43	31	74	27
2014-15	07	59	27	86	2
2015-16	07	51	33	84	-
2016-17	06	49	29	78	-
2017-18	06	36	25	61	02
Patent Granted: 2 nos. (230527 and 231697) during 2008-09					

6. Proposal of Renaming AHEC as Department

The word "Alternate Hydro" was given in 1982 as small hydro and other renewable energy sources were being considered as alternate to the conventional dam based hydro power at that time. For some time, it has been observed by the faculty of AHEC and others that "Alternate Hydro" word conveys a very limited sense of the range of activities of the Centre while in reality the activities are far wider and does not reflect truly to the students and academic community of the role that the Centre plays. It is, therefore, proposed to consider the renaming the "Alternate Hydro Energy Centre" as **Hydro and Renewable Energy Department**. This department has laboratories equipped with the state of art equipment and has faculty capable of undertaking and guiding R&D and attract students for higher education, training and Research

6.1 Areas of expertise of department

The department plans to have a comprehensive coverage of all the major well established areas as well as the new emerging areas within energy and environmental sustainability. Following are the major areas which would be in focus at the department.

Hydro and Renewable Energy –Hydro, wind, solar thermal and solar PV, Biomass and Geothermal, integrated renewable energy systems

Off-grid applications – decentralized rural electrification, micro-grids, efficient cook stoves, smart grid, distributed generation

Energy Conservation – Energy Efficiency in industrial systems, building management systems, embodied energy in buildings, energy system modelling and analysis

Other Emerging Areas in Energy-Behavioural studies for environmental sustainability, hydrogen as fuel, waste to energy, biofuel

Environmental Assessment -Environmental Impact assessments, Cumulative Impact assessments, Life cycle assessments, carbon foot-print evaluations, carrying capacity assessment, GHG emissions assessment and measurements

Waste Management -Solid Waste management, Waste as resource, Recycling/Reuse of treated waste

Sustainable Water Management -Water Sensitive urban Design, Sustainable Urban Drainage System

Climate Change -Mitigation endeavours, Adaptation to change, Risks and Impacts,

System Studies - Resource Nexus – Water, Food, Land & Energy, Industrial Ecology/Circular Economy, Ecosystem Services, Regulatory, Grid integration of renewable energy

In these and other related areas, the department will focus on providing a truly interdisciplinary environment to research, educate, train and provide advisory services covering Technology, R&D, Knowledge Management, Policy Analysis, Policy Advocacy, Economics / Market analysis and Social Sciences.

7. Recruitment of New Faculty

The process for recruitment of new faculty in AHEC is going on and focus is on recruiting new faculty in different areas of energy and environment to broaden the activities of AHEC. For recruitment of new faculty, rigorous efforts are being made by contacting faculty of different IITs and other institutes / university of excellence working in the related areas and also by contacting potential candidates directly. All the modern and state of art equipment and facilities available are uploaded on AHEC webpage. A new faculty working in the area of renewable energy, Solar photovoltaic systems, and grid integration is joining AHEC soon.

Presently, AHEC is offering two M.Tech programmes in Alternate Hydro Energy Systems and Environmental Management of Rivers and Lakes. Based on the present and future needs and availability of the faculty, these programmes will be restructured and new programmes in the emerging areas as outlined above will be developed.

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



सीनेट की छिहत्तरवीं बैठक हेतु अनुपूरक कार्य सूची
SUPPLEMENTARY AGENDA FOR THE
76th MEETING OF THE SENATE

बैठक सं०	: छिहत्तरवीं
MEETING NO.	: 76th
स्थान	: सीनेट हॉल, भा० प्रौ० सं० रुड़की
VENUE	: Senate Hall, IIT Roorkee
दिनांक	: 2 जनवरी 2019
DATE	: 2nd January 2019
समय	: 4.00 बजे अपरान्ह
TIME	: 4.00 P.M.

भारतीय प्रौद्योगिकी संस्थान रुड़की
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
रुड़की 247 667
ROORKEE – 247 667



अनुपूरक कार्यसूची / SUPPLEMENTARY AGENDA

मुद्दा सं०/ Item No.	विवरण / Particulars	पृष्ठ / Page(s)
76.20	आटम सेमेस्टर (2018-19) में एक पाठ्यक्रम के दो छात्रों की गुम हुई ईटीई उत्तर पुस्तिकाओं के मामले पर विचार करना। To consider the case of missing ETE answer scripts of two students of a course in Autumn Semester (2018-19).	146
76.21	न्यूनतम अर्जित क्रेडिट आवश्यकता को पूरा नहीं करने के बावजूद भी निम्नलिखित छात्रों द्वारा कार्यक्रम जारी रखने की प्रार्थनाओं/अपीलों पर विचार करना: 1. श्री भठला साई सुजीत (अनुक्रमांक सं० 17119011) बी.टेक. (पीआई)। 2. श्री भुक्य भार्गव (अनुक्रमांक सं० 17115027) बी.टेक. (ईई)। To consider the requests/appeals from following students regarding continuation of programme in spite of not fulfilling the minimum earned credit requirement. 1. Mr. Bhethala Sai Sujith (Enr No. 17119011), B.Tech. (PI) 2. Mr. Bhukya Bhargav (Enr No. 17115027), B.Tech. (EE)	147
76.22	श्री दीपांशु चौधरी (अनुक्रमांक सं० 10113034) बी.टेक. सिविल अभियांत्रिकी की डिग्री की आवश्यकता को पूरा करने के लिए बैलेंस क्रेडिट को पूरा करने के लिए पुनः नामांकन और पंजीकरण अनुकम्पा याचिका पर विचार करना। To consider the mercy petition of Mr. Dipanshu Chaudhry (Enr. No. 10113034), B.Tech. Civil Engg. for re-enrolment and registration for balance credits to complete the degree requirement.	148

76.23	न्यूनतम अर्जित क्रेडिट के मानदंडों को पूरा नहीं करने के बावजूद भी अध्ययन जारी रखने के सम्बन्ध में छात्रों की दया याचिका पर विचार करना। To consider the mercy appeal of students regarding continuation of studies in spite of not meeting the criteria of minimum earned credits.	149
76.24	न्यूनतम एसपीजीए पूरा नहीं करने बावजूद भी कार्यक्रम जारी रखने के बारे में एम.टेक/एम.एससी प्रथम वर्ष के छात्रों के अनुरोधों पर विचार करना। To consider the requests of 1 st year M.Tech./M.Sc. students regarding continuation of programme in spite of not fulfilling minimum SGPA.	150-152
76.25	सत्र 2019-20 के लिए पीजी (एमटेक/एमआर्क/एमयूआरपी) में प्रवेश के लिए सीट मैट्रिक्स पर विचार करना। To consider the seat matrix for PG (M.Tech./M.Arch./MURP) admission for the session 2019-20.	153-154
76.26	डॉक्टोरल रिसर्च अवार्ड्स में उत्कृष्टता के प्रस्ताव पर विचार करना। To consider the proposal for Excellence in Doctoral Research Awards.	155-156
76.27	बागची स्वर्ण पदक को बागची एमसीएम में परिवर्तित करने के प्रस्ताव पर विचार करना। To consider a proposal for converting Bagchi Gold Medal into Bagchi MCM.	157
76.28	वर्षिक दीक्षांत समारोह-2018 के लिए स्वर्ण पदक के प्रस्ताव पर विचार करना। To consider a proposal for Gold Medal for the Annual Convocation 2018.	158
76.29	अध्यक्ष सीनेट द्वारा अनुमोदित छात्रवृत्तियों को रिपोर्ट करना। To report approvals accorded by the Chairman Senate on scholarships etc.	159-160
76.30	अध्यक्ष सीनेट द्वारा अनुमोदनों को रिपोर्ट करना। To report approvals accorded by the Chairman Senate.	161
76.31	उन छात्रों को अनंतिम पी0एच0डी0 उपाधि प्रदान करने की पुष्टि किया जाना, जिन्होंने विभिन्न पाठ्यक्रमों में 01 अक्टूबर 2018 से अब तक उपाधि प्राप्त किए जाने की अर्हता प्राप्त की है। To ratify the award of provisional Ph.D. Degrees certificate to the students who have completed the requirements for the award of Ph.D. Degree in various disciplines w.e.f. 01.10.2018 to date.	162-164

Item No. 76.20: To consider the case of missing ETE answer scripts of two students of a course in Autumn Semester (2018-19).

The answer scripts of two out of seventy five students, who appeared in the end term examination of a course in the Department of Electrical Engineering went missing. A departmental level committee to enquire about the matter had been formed by the Head. The IAPC in its 67th meeting held on December 11, 2018 considered the recommendations of the committee and recommended the following:-

- (a) In the interest of students, the result of the other 73 students may be declared.
- (b) A second examination for the two students, whose answer scripts are missing may be conducted with no restriction on their grades.

The recommendation is submitted for the consideration of the Senate.

Item No. 76.21: To consider the requests/appeals from following students regarding continuation of programme in spite of not fulfilling the minimum earned credit requirement.

- 1. Mr. Bhethala Sai Sujith (Enr No. 17119011),
B.Tech. (PI)**
- 2. Mr. Bhukya Bhargav (Enr No. 17115027),
B.Tech. (EE)**

The minimum earned credit requirement to continue the programme at the end of 1st year is 22 excluding the credits of NCC/NSO/NSS.

The student at S. No. 1 earned 11 credits with SGPA 2.571. He has requested continuation of his programme citing health issues for his performance.

The student at S. No. 2 earned 7 credits with SGPA 1.429. His request for continuation was also considered earlier in 74th meeting of Senate but was not accepted as there was no supporting document. Now the student has provided documents in support of his medical condition and has again made a request for continuation of the programme.

The IAPC in its 65th Meeting held on Sep. 27, 2018, considered the requests of the above students and did not recommend the requests.

The above is submitted for the consideration of the Senate.

Item No. 76.22: To consider the mercy petition of Mr. Dipanshu Chaudhry (Enr. No. 10113034), B.Tech. Civil Engg. for re-enrolment and registration for balance credits to complete the degree requirement.

The name of Mr. Dipanshu Chaudhry was struck-off the Institute rolls in the year 2015 as he did not register for the programme. At that time he had 3 credits left to complete his degree. He has now requested for re-enrolment and registration for balance credits to complete the degree requirement. As per his request, he could not continue studies due to financial crisis and was interested in pursuing music as career. The degree is required to pursue further masters in music and build up his career.

The IAPC in its 66th meeting (emergent) held on Nov. 05, 2018 did not recommend the request as the student had discontinued in 2015 and is in ninth year from the year of registration.

The above is submitted for the consideration of the Senate.

Item No. 76.23: To consider the mercy appeal of following students regarding continuation of studies in spite of not meeting the criteria of minimum earned credits:

S.No.	Name	Enr No.	Programme	Year
1.	Nitish Kumar	16115079	B.Tech. (EE)	III
2.	Mamta Meena	14115069	B Tech. (EE)	IV
3.	Vedang Patidar	14118107	B.Tech. (MT)	IV
4.	Jaikant Niwariya	16116024	B.Tech. (ECE)	III
5.	Bhargab Das	14411006	B.Tech. (MT)	IV
6.	Bathula Hemanth	14118021	B.Tech. (MT)	IV
7.	Harshit Choudhary	16116022	B.Tech. (ECE)	III
8.	Rishi Kant Kala	16115096	B Tech. (EE)	III
9.	Bheemsen Saran	15113032	B Tech. (CE)	IV

The IAPC in its 66th meeting (emergent) held on Nov. 05, 2018 considered the requests regarding continuation of programme in spite of not meeting the criteria of minimum earned credits. These students registered for the Autumn semester 2018-19 as the striking-off of their names could only be notified when the semester had already begun.

The IAPC recommended the requests of the following students considering that very few credits are required to continue:

1. Mr. Nitish Kumar (16115079). B.Tech. (EE) III year
4. Mr. JaikantNiwariya (16116024). B.Tech. (ECE) III year
5. Mr. Bhargab Das (14411006). B.Tech. (MT) IV year
9. Mr. Bheemsen Saran (15113032). B Tech. (CE) IV year

The IAPC did not recommend the requests of the following students because of large number of credits are required to continue:

2. Ms. Mamta Meena (14115069), B Tech. (EE) IV year
3. Mr. Vedang Patidar (14118107). B.Tech. (MM) IV year
6. Mr. Bathula Hemanth (14118021). B.Tech. (MT) IV year
7. Mr. Harshit Choudhary (16116022), B Tech. (ECE) III year
8. Mr. Rishi Kant Kala (16115096), B Tech. (EE) III year

The Chairman, Senate allowed all the above mentioned students to provisionally appear in the End Term Examinations (Autumn Semester, 2018-19) as these cases were due for consideration in Senate. However, the result of these students has not been declared.

The above is submitted for the consideration of the Senate.

Item No. 76.24: To consider the requests of 1st year M.Tech./M.Sc. students regarding continuation of programme in spite of not fulfilling minimum SGPA.

The following students requested continuation of the programme in spite of not fulfilling minimum SGPA citing the reasons listed in **Appendix 'A'**.

1. Mr. Myat Sithu Lwin (Enr. No. 18541014), M.Tech. (ME), I Year
2. Mr. Chalachew Dagne Yehuala (Enr. No. 18538011), M.Tech. (ME), I Year
3. Mr. Chan Aye Aung (Enr No. 18530019), M.Tech. (EE), I Year
4. Mr. Kishan Mushar (Enr No. 18530012), M.Tech. (EE), I Year
5. Mr. Rahul Tripathi (Enr No. 18512016), M.Tech. (AH), I Year
6. Mr. Kundan Kumar (Enr No. 18616016), M.Sc. (MA), I Year
7. Mr. Anil Gautam (Enr No. 18519001), M.Tech. (CE), I Year
8. Mr. Farhad Khiabani (Enr. No. 18519004), M.Tech. (CE), I Year
9. Mr. Ismail Ahmed Aden (Enr. No. 18548034), M.Tech. (WR), I Year

The IAPC in its 67th meeting held on Dec. 11, 2018 and 68th meeting (emergent) held on Dec. 27, 2018 recommended the requests of all the students except the one at S.No. 6 (Mr. Kundan Kumar) regarding continuation of programme in spite of not fulfilling minimum SGPA.

The above is submitted for the consideration of the Senate.

Appendix 'A'
Item No. Senate/76.24

DETAILS OF STUDENTS' REQUESTS/ APPEALS

(Continuation of Programme In Spite of not fulfilling minimum SGPA)

S. No.	Name	Details	Recommendations	Supporting Documents
1.	Myat Sithu Lwin (Enr No 18541014) M.Tech (ME) (International Student)	-Language problem -SGPA: 4.4	-Recommended by the Department - Recommended by IAPC	Nil
2.	Chalachew Dagne Yehuala (Enr No 18538011) M.Tech (ME) (International Student)	- Language problem (accent) -Health issue (Depression, Psychological problem) -SGPA: 3.6	-Forwarded by the Department - Recommended by IAPC	Medical documents
3.	Chan Aye Aung (Enr No 18530019) M.Tech (EE) (International Student)	-Language problem -SGPA: 4.6	-Forwarded by the Department - Recommended by IAPC	Nil
4.	Mushar Kishan Lakhabhai (Enr No 18530012) M.Tech (EE) (Indian Student)	-Family problem (Heart attack to father) -SGPA: 4.6	-Recommended by the Department - Recommended by IAPC	Medical documents of father
5.	Rahul Tripathi (Enr No 18512016) M.Tech (AH) (Indian Student)	-Unavoidable circumstances -SGPA: 4.4	-Recommended by Head - Recommended by IAPC	Nil
6.	Kundan Kumar (Enr No. 18616016) M.Sc. (MA) (Indian Student)	-Language problem -SGPA: 0.5	-Recommended by Head -Not Recommended by IAPC	Nil

7.	Anil Gautam (Enr No. 18519001) M.Tech. (CE) (Indian Student)	-Family problem -SGPA: 4.762	-Recommended by Head - Recommended by IAPC	Nil
8.	FarhadKhiabani (Enr No 18519004) M.Tech (CE) (International Student)	-SGPA: 4.571 -Family problem (paralysis attack to father)	-Forwarded by Head	Medical documents of father
9.	Ismail Ahmed Aden (Enr No 18548034) M.Tech (WR) (International Student)	-SGPA: 4.8	-Recommended by Head	Nil

Item No. 76.25: To consider the seat matrix for PG (M.Tech./M.Arch./MURP) admission for the session 2019-20.

IAPC in its 63rd meeting recommended increase in the number of seats in M.Tech. (Water Resources Development), M.Tech. (Irrigation Water Management), M.Tech. (Surface Water Hydrology), M.Tech. (Watershed Management) and M.Tech. (Groundwater Hydrology) as per the following details:

S. No.	Programme	Existing seats	Recommended seats
1.	M.Tech. (Water Resources Development)	04	07
2.	M.Tech. (Irrigation Water Management)	04	07
3.	M.Tech. (Surface Water Hydrology)	04	07
4.	M.Tech. (Watershed Management)	09	12
5.	M.Tech. (Groundwater Hydrology)	05	08

Also, IAPC in its 67th meeting recommended closing down of M.Tech. (Advanced Method of Chemical Analysis). Accordingly, the seat matrix for PG admission for the session 2019-20 has been modified (**Appendix 'A'**).

The above is submitted for the consideration of the Senate.

Proposed Seat PG Admission 2019-20

Proposed Seat PG Admission 2019-20																	Appendix	
S.No	Academic Department/ Centre & (Code)	Academic Programmes		Main Gate Discipline(s)					Other Gate Discipline(s)					Total Intake	Total Existing Seats			
		Name	Code	Discipline	GEN	OBC	SC	ST	Discipline	GEN	OBC	SC	ST					
1	Architecture and Planning (ARD)	M Arch	10	AR(12)	6	3	2	1						23	12			
		M U R P	11	AR(9)	5	2	1	1	CE(2)	1	1	0	0		11			
2	Alternate Hydro Energy Centre (AHC)	M Tech Alternate Hydro Energy Systems	12	CE(2)	1	1	0	0	AG/CH/EE/EC/ME/PI/XE (13)	6	4	2	1	25	15			
		M Tech Environmental Management of Rivers and Lakes	13	CE(3)	1	1	1	0	AG/CH/EE/ME/PI/XE/AR/CY/BI/PH/MA/XL/EY(7)	3	2	1	1		10			
3	Chemical Engineering (CHD)	M Tech Chemical Engineering	14	CH(20)	10	5	3	2						20	20			
4	Civil Engineering (CED)	M Tech Environmental Engg	16	CE(9)	5	2	1	1	CH(2)	1	1	0	0	86	11			
		M Tech Geomatics Engg	17	CE(7)	3	2	1	1	AR/CS/EC/EE/AG/MN(7)	4	2	1	0		14			
		M Tech Geotechnical Engg	18	CE(13)	7	3	2	1	MN (2)	1	1				15			
		M Tech Hydraulic Engg	19	CE(11)	5	3	2	1							11			
		M Tech Structural Engg	20	CE(21)	10	6	3	2							21			
		M Tech Transportation Engg	21	CE(14)	7	4	2	1							14			
5	Earthquake Engineering (EQD)	M Tech Soil Dynamics	22	CE(11)	5	3	2	1						39	11			
		M Tech Structural Dynamics	23	CE(18)	9	5	3	1							18			
		M Tech Seismic Vulnerability and Risk Assessment	24	CE(10)	5	3	1	1							10			
6	Electrical Engineering (EED)	M Tech Electric Drives & Power Electronics	25	EE(15)	8	4	2	1						58	15			
		M Tech Instrumentation and Signal Processing	26	EE(9)	5	2	1	1	EC/IN(5)	3	1	1	0		14			
		M Tech Power System Engg	27	EE(15)	8	4	2	1							15			
		M Tech Systems and Control	28	EE(11)	5	3	2	1	EC/IN(3)	1	1	1			14			
7	Electronics and Communication Engineering (ECD)	M Tech Communication Systems	29	EC(12)	6	3	2	1						31	12			
		M Tech R.F. & Microwave Engg	30	EC(9)	5	2	1	1							9			
		M Tech Microelectronics and VLSI	31	EC(10)	5	3	1	1							10			
8	Computer Science and Engineering (CSD)	M Tech Computer Science & Engg	32	CS(30)	16	8	4	2					30	30				
9	Hydrology (HYD)	M Tech Hydrology	33	CE/AG(18)	9	5	3	1	GG/XE/PH/ EY(3)	1	1	0	1	21	21			
10	Mechanical and Industrial Engineering (MED)	M Tech CAD, CAM & Robotics	34	ME/PI(10)	5	3	1	1						56	10			
		M Tech Machine Design Engg	35	ME/PI(12)	6	3	2	1							12			
		M Tech Production & Industrial Systems Engg	36	ME/PI(12)	6	3	2	1							12			
		M Tech Thermal Engg	37	ME/PI(11)	5	3	2	1							11			
		M Tech Welding Engg	38	ME/PI(11)	5	3	2	1							11			
11	Metallurgical and Materials Engineering (MTD)	M Tech Industrial Metallurgy	39	MT(4)	2	1	1	0	ME/PI/XE (7)	3	2	1	1	22	11			
		M Tech Materials Engg	40	MT(4)	2	1	1	0	PH/ME/PI/CY/XE (7)	3	2	1	1		11			
12	Paper Technology Saharanpur Campus (PPD)	M Tech Pulp & Paper	41	CH(8)	4	2	1	1	ME/BI/TF/EY (4)	2	1	1	0	24	12			
		M Tech Packaging Technology	42	CH(7)	3	2	1	1	BT/CY/ME/TF (5)	3	1	1	0		12			
13	Water Resources Development and Management (WRD)	M Tech Irrigation Water Management	43	CE/AG(8)	4	2	1	1						20	8			
		M Tech Water Resources Development	44	CE/EE/ME (12)	6	3	2	1							12			
14	Chemistry (CYD)	M Tech Advanced Methods of Chemical Analysis	45						dropped									
15	Physics (PHD)	M Tech Solid State Electronic Materials	46	PH(7)	3	2	1	1	EE/EC/MT (3)	1	1	1	0	20	10			
		M Tech Photonics	47	PH(7)	3	2	1	1	EE/EC/MT/IN (3)	1	1	1	0		10			
16	Nanotechnology (NTC)	M Tech Nanotechnology	48	MT/ME/EC/CH/BI/CE (5)	3	1	1	0	CY/PH/XL (5)	2	1	1	1	10	10			
17	Disaster Mitigation and Management (DMC)	M Tech Disaster Mitigation and Management	49	CE(5)	2	1	1	1	ME/PI/CS/CH/AR/G/PH/MA/XL/XE/EY/BI (5)	3	1	1	0	10	10			
18	Transportation Systems (TSC)	M Tech Infrastructure Systems	50	CE(2)	1	1	0	0	ME/PI/CH/EE/EC/CS/AR (8)	4	2	1	1	10	10			
19	Biotechnology (BTD)	M Tech Bioprocess Engineering	51	CH (5)	3	1	1	0	BT/AG/XE/TF (5)	2	1	1	1	10	10			
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															515			

Item No.76.26: To consider the proposal for Excellence in Doctoral Research awards.

During the annual convocation of the Institute, several medals and awards are given to UG and Masters' students. Some of these are for Institute level achievements while others are for department level achievements. However, there is no award/medal/prize for Ph.D. students. It is proposed to initiate "**Excellence in Doctoral Research**" awards. Maximum five awards can be given in a year. The awards will be in the following two categories:

- (a) Fundamental Research
- (b) Applied Research

Eligibility: Students getting Ph.D. degree in the convocation will be eligible for this award. For applying, a student should get either all three "A" or "2A + 1B" from the three examiners of the thesis.

(1) Application Deadline: Students can apply for this award through a web portal after getting all the reports of the thesis examiners. The last date of application will be the same as the last date for conducting viva-voce examination before the annual convocation, as decided by the Academic Office.

(2) Screening of applications: Three different committees will be constituted to screen the applications. Screening will be done on the basis of quality and number of papers published in top ranking journals, patents filed/granted, research grant received in the candidate's group on the basis of his/her doctoral research, international travel support received for attending conferences etc. The three committees will be for the following groups of departments/centres:

- (a) All engineering departments, AHEC, CoEDMM and CTRANS
- (b) All science departments, IIC, Centre for Nano Technology
- (c) MS, HSS, A&P

(3) Interview: Shortlisted students will be required to make a presentation to a common committee. This committee will be formed from the three committees made for the screening of applications.

The committee will assess the overall suitability of the student for the award on the basis of novelty of the work, contribution of the student, potential for industrial application, scope of entrepreneurship etc.

Shortlisted candidates who will not be available in the campus can make their presentation using video-conferencing.

(4) Approval: Recommendations of the interview committee will be presented to the Senate for approval.

(5) Award: The award will carry a citation and a cash prize of Rs. 50,000/-.

The above proposal is placed before the Senate for consideration and approval.

Item No.76.27: To consider a proposal for converting Bagchi Gold Medal into Bagchi MCM.

Due to discontinuation of MCM, Bagchi MCM scholarship was converted into Bagchi Gold Medal for the topper of B.Tech. (MME). Since MCM has been reinstated by Senate resolution 72.9, the donor has desired to have Bagchi MCM scholarship for an UG student of MME who is at the first position in the list of MCM awardees.

The above proposal is placed before the Senate for consideration and approval.

Item No.76.28: To consider a proposal for Gold Medal for the Annual Convocation 2018.

No Gold Medal was awarded to any student of B.Tech. of MME during the last convocation. This happened as no student had a CGPA of more than 9.0. Later, it has been pointed out that Somesh Mohapatra (Enrl. No. 14118098), who had completed his degree in 3.5 years, had a CGPA of 9.409 and so he can be considered for the Gold Medal of the MME batch which graduated in 2018.

The above proposal is placed before the Senate for consideration and approval.

Item No. 76.29: To report approvals accorded by the Chairman Senate on scholarships etc.:

(1) **Shri D.K. Gupta Scholarship:** Mr. Vijay Kumar Gupta has created a corpus to support one MCM scholarship of Rs.10,000/- per year. It will be given to the student with the best rank in JEE in the list of MCM scholarship awardees of B.Tech. Ist Year Civil Engg.

(2) **Mrs.& Mr. Balwant Singh Scholarship:** Mr. Avtar Singh has created a corpus to support one MCM scholarship of Rs.10,000/- per year. It will be given to the student with the best rank in JEE in the list of MCM scholarship awardees of B.Tech. Ist Year Mechanical Engg.

(3) **Shri K.K. Puri Memorial Scholarship:** Puri Oil Mills Ltd. has created a corpus to support two MCM scholarships of Rs. 10,000/- each per year. It will be given to the two students with the best ranks in JEE in the list of MCM scholarship awardees of B.Tech.Ist Year P&I Engg.

(4) **92 Batch Student Scholarship:** Alumni of 1992 Batch have created a corpus to support five MCM scholarships of Rs. 10,000/- each per year. They will be given to five students of B.Tech. II Year (one each in ECE, EE, ME, P&I and CE) who are at the first position in the list of MCM scholarship awardees of their respective classes.

(5) **Bhagwan Devatma Memorial Award for Excellence in Social Service:** Satya Dharam Bodh Mission, Roorkee has created a corpus to honour a UG student of third year for excellence in social service. The award carries a cash prize of Rs. 20,000/-, a certificate and a gold plated medal. The selection process will be as follows:

- (i) Applications will be invited by individual students.
- (ii) A committee consisting of two IITR representatives and one donor representative will shortlist the applications. This committee will be proposed by SCSP and approved by Chairman, Senate.
- (iii) Shortlisted candidates will make presentations to the committee and the committee's recommendation will be submitted to the Senate for final approval.

(6) **Singhal's Tech. for Society Award:** Mr. Sanjay Singhal has created a corpus to create an award for final year B.Tech. student(s) for B.Tech. Project. The projects will be evaluated on their relevance, innovativeness, impact and

commercially viability. The award will be given during the annual convocation of the Institute.

The award carries a cash prize of Rs. 50,000/- alongwith a certificate. The selection process will be as follows:

- (i) A committee proposed by SCSP and approved by Chairman, Senate will shortlist the applications.
- (ii) Shortlisted candidates will make presentations to the committee and the committee's recommendation will be submitted to the Senate for approval.

Item No.76.30: To report approvals accorded by the Chairman Senate on the following items:

- (i) Two candidates with INSPIRE Fellowship had applied against advertisement issued for regular Ph.D. admissions in Spring Semester 2018-19. Both the students have been recommended for admission by their departments. The fellowship of these students was lapsing on December 19, 2018.

The IRC considered the matter in its meeting held on December 10, 2018 and recommended that they be allowed to register by December 19, 2018. On the recommendation of IRC, the Chairman Senate approved the same.

- (ii) The IRC considered the notification issued and displayed by the Department of Electronics & Communication Engineering wherein IIT graduates were called directly for interviews and rest of the candidates were screened based on a written test before being shortlisted for interview. The department prepared the merit list of candidates based on interview marks only.

The IRC considered the matter in its meeting held on December 10, 2018 and recommended that the list be released for admission. On the recommendation of IRC, the Chairman Senate approved the same.

The above is reported to the Senate.

Item No.76.31: To ratify the award of provisional Ph.D. Degree certificates to the students who have completed the requirements for the award of Ph.D. Degree in various disciplines w.e.f. 01.10.2018 to date.

The list is presented in **Appendix 'A'**.

I Senate Approved 2019 PDC List:

S. No.	Name	Deptt.	Topic	Supervisor	Examiner (For./Ind.)	PDC Date
1	Mr. Amit Kumar	ASE	MANGANESE BASED CARBONATES AND OXIDES AS ELECTRODE MATERIALS FOR ENERGY STORAGE DEVICES	Dr. Yogesh Kumar	Prof. V. Thangadurai, Canada Prof. A. Chandra, IIT Kharagpur Prof. Sagar Mitra, IIT Bombay	18.12.18
2	Mr. Tamoghna Ghosh	BT	MOLECULAR INVESTIGATIONS AND APPLICATIONS OF SELECTED GRAS MOLECULES FOR ANTIBACTERIAL AND ANTICANCER EFFECTS	Dr. N. K. Navani	Prof. Salam A. Ibrahim, USA Prof. Bishwajit Kundu, IIT Delhi Prof. R. K. Sharma, DFRL Mysore	06.12.18
3	Mr. Navdeep Raghuvanshi	BT	BIOGENIC NANOPARTICLES: SYNTHESIS, CHARACTERIZATION AND ITS APPLICATIONS	Dr. Vikas Pruthi	Prof. Jagat R. Kanwar, Australia Prof. Kanchan Kohli, JH Delhi	30.11.18
4	Mr. Madhusudhanarao Katiki	BT	STRUCTURAL AND BIOCHEMICAL CHARACTERIZATION OF PROTEIN DRUG TARGETS FROM HUMAN PATHOGENS	Dr. Pravindra Kumar	Prof. D. Golemi-Kotra, Canada Prof. S. Gourinath, JNU Delhi Dr. R. K. Dhaked, DRDO Gwalior	19.12.18
5	Mr. Swapna K. Srivastava	BT	PRODUCTION OF POLYHYDROXYALKANOATES BY HALOPHILIC BACTERIA	Dr. Bijan Choudhury	Prof. S. Chanprateep Napathorn, Thailand Prof. N. Mallick, IIT Kharagpur	27.12.18
6	Mr. Lovjeet Singh	CH	TREATMENT OF NITROGENOUS AROMATIC COMPOUNDS CONTAMINATED WATER BY CATALYTIC WET PEROXIDE OXIDATION	Dr. Shri Chand	Prof. J. Garcia, Spain Prof. Anurag Garg, IIT Bombay	30.11.18
7	Mr. Hitesh Upreti	CE	MODELLING SOIL MOISTURE DYNAMICS IN CROPPED AREA FOR IRRIGATION SCHEDULING	Dr. C. S. P. Ojha	Prof. Suat Irmak, USA Prof. M.S. Mohan K., IISc Bangalore	30.11.18
8	Ms. Astha Verma	CE	WIND PRESSURE DISTRIBUTION ON LOW-RISE BUILDINGS WITH VARYING ROOF FORMS	Dr. P. K. Gupta Dr. A. K. Ahuja	Prof. Partha P. Sarkar, USA Dr. Rajeev K. Garg, CSIR Delhi Prof. Sudip Talukdar, IIT Guwahati	13.11.18
9	Ms. Sapna	CY	COMPUTATIONAL STUDIES OF OPTICAL PROPERTIES OF SOME SILICON NANOSTRUCTURES	Dr. P. P. Thankachan Dr. Pallavi Debnath	Prof. Aristides D. Zdzetsis, Greece Prof. Biswarup Pathak, IIT Indore	27.12.18
10	Ms. Ruchi Lamba	CTS	SOLID PHASE HETEROGENEOUS CATALYTIC ESTERIFICATION OF DECANOIC ACID WITH ALCOHOLS	Dr. Sudipta Sarkar Dr. Surendra Kumar	Prof. Merv Fingas, Canada Prof. Avinash K. Agarwal, IIT Kanpur	27.12.18
11	Ms. Rajni Devi	ES	GEOELECTRIC AND GEOTECHNICAL SITE INVESTIGATIONS FOR SOIL LIQUEFACTION STUDIES	Dr. R. G. Sastry Dr. N. K. Samadhiya	Prof. Phan Huy Giao, Thailand Prof. D. Choudhary, IIT Bombay Prof. G.L. Sivakumar, IISc Bangalore	30.11.18
12	Ms. Smita Kaloni	EQ	OUTPUT-ONLY SYSTEM IDENTIFICATION USING BLIND SOURCE SEPARATION	Dr. Manish Shrikhande	Prof. Ahmed Ghojarah, Canada Prof. C. S. Manohar, IISc Bangalore Prof. S. R. Chaudhuri, IIT Kanpur	15.10.18
13	Mr. Hanwate Sandeep Devrao	EE	APPROACHES OF PID CONTROLLER DESIGN WITH APPLICATIONS AND EXPERIMENTAL VALIDATION	Dr. Yogesh Vijay Hote	Prof. Matthew Joordens, Australia Prof. Somnath Pan, IIT Dhanbad	30.11.18

14	Mr. Yogesh Kumar Manibhai Makwana	EE	PROTECTION OF DISTRIBUTION SYSTEMS DURING DISTRIBUTED GENERATORS ENVIRONMENT	Dr. Bhavesh R. Bhalja	Prof. Tarlochan S. Sidhu, Canada Prof. K. Shanti Swarup, IIT Madras Prof. A. K. Pradhan, IIT Kharagpur	01.11.18
15	Mr. Guruswamy K. P.	EE	ANALYSIS AND CONTROL OF BIDIRECTIONAL DC-DC CONVERTERS	Dr. S. P. Singh	Prof. Ashoka K.S. Bhat, Canada Prof. Bhim Singh, IIT Delhi	10.12.18
16	Mr. Pankaj K. Gupta	HY	MULTI-SCALE FATE AND TRANSPORT OF LNAPL UNDER VARYING SUBSURFACE FLOW CONDITIONS	Dr. Brijesh K. Yadav	Prof. Chittaranjan Ray, USA Prof. Shashi Mathur, IIT Delhi	30.11.18
17	Mr. Arvind Kumar	IIC	SYNTHESIS OF NANOSTRUCTURED THIN FILMS FOR GAS SENSING APPLICATIONS	Dr. Ramesh Chandra	Prof. Chintalapalle V. Ramana, USA Dr. Bodh Raj Mehta, IIT Delhi Prof. Sujeet Chaudhary, IIT Delhi	16.11.18
18	Ms. Soshal	MA	FOURIER SERIES APPROXIMATION OF FUNCTIONS IN $L_p(p \geq 1)$ SPACES	Dr. Uday Singh	Prof. Billy E. Rhoades, USA Prof. A. Prasad, IIT Dhanbad Prof. H. H. Khan, Aligarh	15.11.18
19	Mr. Amit Sharma	MA	A STUDY OF SKEW CODES AND QUANTUM CODES OVER SOME FINITE RINGS	Dr. Maheshanand	Prof. Nuh Aydin, USA Prof. Anuradha Sharma, IIT Delhi	01.11.18
20	Mr. Vikram Singh	MA	EXISTENCE AND CONTROLLABILITY RESULTS TO SOME FUNCTIONAL DIFFERENTIAL SYSTEMS	Dr. D. N. Pandey	Prof. N. Mahmudov, Turkey Prof. Shruti Dubey, IIT Madras Prof. D. Bahuguna, IIT Kanpur	18.12.18
21	Mr. Teekam Singh	MA	SPATIAL ASPECTS OF SOME TUMOR-IMMUNE AND ECOLOGICAL MODELS	Dr. Sudip Banerjee	Prof. Ezio Venturino, Italy Prof. Malay Banerjee, IIT Kanpur Prof. S.P. Chakrabarty, IIT Guwahati	20.12.18
22	Mr. Kalu Ram Meena	MA	SOME PROBLEMS ON ESTIMATION AFTER SELECTION	Dr. Aditi Gangopadhyay	Prof. Nutan T. Mishra, USA Prof. Somesh Kumar, IIT Kharagpur Prof. Neerak Misra, IIT Kanpur	17.10.18
23	Mr. Lokesh Kumar	MIE	MODELING OF CARBON COMPLIANT SUPPLY CHAIN NETWORK FOR TYRE REMANUFACTURING INDUSTRY	Dr. P. K. Jain Dr. A. K. Sharma	Prof. Yoshiro Fukuda, Japan Prof. Manoj K. Tiwari, IIT Kharagpur Prof. U. Shanker Dixit, IIT Guwahati	12.12.18
24	Dr. Rituraj Singh	MIE	IMPROVED MLPG METHOD FOR LARGE SCALE HEAT TRANSFER PROBLEM	Dr. K. M. Singh	Prof. Satya N. Atluri, USA Prof. Sandeep Kumar, IIT Varanasi	18.12.18
25	Mr. Guru Prakash	MME	SURFACE MODIFICATION OF MARTENSITIC STAINLESS STEELS FOR HYDROTURBINE BLADES	Dr. S. K. Nath	Prof. Chandan Mahato, USA Prof. Bikramjit Basu, IISc Bangalore Prof. Sunil Mohan, IIT Varanasi	27.12.18
26	Ms. Priti	PH	ELECTRON SCATTERING FROM ATOMS (IONS) AND PLASMA MODELING	Dr. Rajesh Srivastava	Prof. Yuri Ralchenko, USA Prof. P. C. Deshmukh, IIT Tirupati	30.11.18
27	Ms. Archana	PPE	EVALUATION OF CADAVER GOAT-DERMIS AS SCAFFOLD FOR SKIN TISSUE ENGINEERING	Dr. S. C. Sharma	Prof. Rajagopala Sridaran, USA Dr. Dheer Singh, NDRI Karnal Prof. Rakesh K. Tyagi, JNU Delhi	06.12.18
28	Mr. Testamariam Abreha Bahita	WRDM	WATER QUALITY ASSESSMENT AND POLLUTION STATUS OF UPPER GANGA CANAL	Dr. Ashish Pandey Dr. P. K. Jha	Prof. Nicola Fohrer, Germany Prof. K. N. Tiwari, IIT Kharagpur Prof. P. K. Khan, IIT Dhanbad	18.12.18