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To,  
The Controller of Examination  
Central University of South Bihar,  
Panchanpur, Gaya

Subject: structure and syllabus of PhD Chemistry approved by BOS for further perusal

Respected Madam,

We organised third board of study meeting on 27/07/2019 to approve the course work of Ph.D. in Chemistry. Here, I request you to find the original copy of minutes of the meeting, approved structure and syllabus of course work and ordinance for further perusal.

Thanks with warm regard.

Girish Chandra  
29/8/2019

Dr. Girish Chandra  
Head (I/C), Chemistry

S.O. A. 27/8/19  
S. O. A. 02/08/2019

Sr. Jitesh K. Singh / Manish  
21/10/19



Minutes of the meeting

27<sup>th</sup> July 2019

The third meeting of Board of Studies of the Department of Chemistry was held on July 27, 2019 at 10 a.m. in the SEBES building, CUSB, Gaya to design the structure and syllabus of the course-work for PhD programme in chemistry to be Implemented from academic session 2019-2020,

Following members were present:

- |  |                 |
|--|-----------------|
| 1. Prof. Ramendra Kumar Singh<br>Professor, Department of Chemistry<br>Faculty of Science<br>University of Allahabad<br>Allahabad -211002<br>Uttar Pradesh                 | External Expert |
| 2. Prof. Shital Chattopadhyay<br>Professor, Department of Chemistry<br>University of Kalyani<br>Kalyani, Nadiya- 741235, West Bengal                                       | External Expert |
| 3. Dr. Akhilananda Kumar<br>Asstt. Professor, Department of Physics<br>School of Physical and Chemical Sciences<br>Central University of South Bihar, Gaya                 | Cognate Member  |
| 4. Dr. Girish Chandra<br>Assistant Professor, Head (I/c)<br>Department of Chemistry<br>School of Physical and Chemical Sciences<br>Central University of South Bihar, Gaya | Convener        |
| 5. Dr. Amiya Priyam<br>Assistant Professor, Dept. of Chemistry<br>Central University of South Bihar, Gaya  | Member          |
| 6. Dr. Sudip Mohapatra<br>Assistant Professor, Dept. of Chemistry<br>Central University of South Bihar, Gaya   | Member          |
| 7. Dr. Saurabh Kumar<br>Assistant Professor, Dept. of Chemistry<br>Central University of South Bihar, Gaya   | Member          |

The members of the Board of Studies discussed the Ordinance, the structure and the syllabus of PhD course-work in Chemistry, which is to be implemented in this academic session 2019-2020.

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Following decisions were taken unanimously.

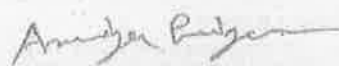
1. The course structure, course content and books were discussed, finalized and incorporated in the final version of the syllabus for PhD Course-work. (Copy attached).
2. The members also approved the Ordinance framed for governing the Ph.D. Chemistry programme (Copy attached)
3. The syllabus will be applicable from the session 2019-2020.
4. The student will have flexibility in their choosing the type of courses relevant to their doctoral projects. A student must complete 12-credit coursework and obtain a minimum of 55% marks as per the UGC-regulations.
5. The distribution of credits will depend on the choice of the student.
6. The software for graphical analysis, Origin, and the softwares for structural analysis, Chem-Office were discussed and the members felt the need of these softwares for MSc and PhD programmes.

The meeting ended with the thanks to the chair.

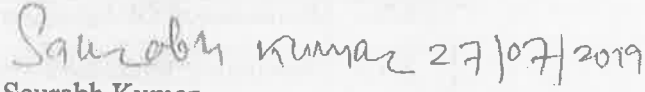
  
Prof. Ramendra Kumar Singh

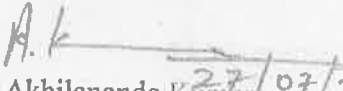
  
Prof. Shital Chattopadhyay

  
Dr. Girish Chandra 27/7/2019

  
Dr. Amiya Priyam

  
Dr. Sudip Mohapatra 27-07-2019

  
Dr. Saurabh Kumar 27/07/2019

  
Dr. Akhilananda Kumar 27/07/2019

Ordinances Relating to the  
Award of Degree of Doctor of Philosophy

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I. TITLE & COMMENCEMENT	
1.1	These Ordinances shall be called the 'Ordinances Relating to the Award of Degree of Doctor of Philosophy'. These ordinances shall come into effect from the academic session 2016-17.
1.2	The degree of Doctor of Philosophy (herein after referred to as the Ph.D. degree) of the Central University of South Bihar shall be conferred on the candidate who fulfills the requirements as specified in these ordinances.
II. DEFINITIONS	
1.	<b>University</b> means a University defined under Section 2 (f) of the University Grants Commission Act 1956.
2.	<b>CUSB</b> means Central University of South Bihar
3.	<b>Board of Studies</b> means the Board of the Studies of the Department/Centre of Studies.
4.	<b>URC</b> means University Research Committee
5.	<b>DRDC</b> means Departmental Research Committee
6.	<b>CRDC</b> means Centre Research Committee
7.	<b>Supervisor</b> means the main research guide of a Ph. D. student
8.	<b>Co-Supervisor</b> means an additional research guide of a Ph.D. student
9.	<b>MoU</b> means Memorandum of Understanding
10.	<b>Residency Period</b> means a prescribed period for which a Ph. D. Scholar shall be required to be present as full-time research scholar in the University.
III. APPLICATION FOR ADMISSION	
III.1	There shall be two terms of six months each in a year for the Ph.D. Programme: one beginning from August and another from February.
III.2	A candidate may be admitted to the Ph. D. programme at the beginning of any semester provided the result of the qualifying examination is declared before the commencement of counseling for admission to the semester and he/she fulfills the eligibility criteria laid down in these Ordinances.
III.3	The admission to the Ph. D. programme shall be either through Entrance Test or through direct admission as per Clause V.1(b) of these Ordinances. The application form shall be the same for both these types of candidates (Annexure-A-1).

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III.4	The candidates shall submit the duly filled in application form to the Controller of Examinations on or before the last date announced by the University. The details shall be notified well in advance on the institutional website and through advertisement in at least two (2) national newspapers, of which at least one (1) shall be in the regional language, the number of seats for admission, subject/discipline wise distribution of available seats, criteria for admission, procedure for admission, examination centre(s) where entrance test(s) shall be conducted and all other relevant information for the benefit of the candidates.
III.5	All applications of the candidates belonging to the categories of the Clauses V.1 (b) (iii) to (xi) shall be routed through proper channel.
<b>IV. Eligibility Criteria for Admission to Ph.D. Programme</b>	
IV.1	Eligibility criteria for admission to Ph.D. Programme:
a)	Candidates for admission to the Ph. D. Programme shall have a Master's degree or a professional degree declared equivalent to the Master's degree by the corresponding statutory regulatory body, with at least 55% marks in aggregate (Annexure-A) or its equivalent grade 'B' in the UGC 7-point scale (or an equivalent grade in a point scale wherever grading system is followed) or an equivalent degree from a foreign educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions.
b)	A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled and other categories of candidates as per the decision of the Commission from time to time, or for those who had obtained their Master's degree prior to 19th September, 1991. The eligibility marks of 55% (or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned above are permissible based only on the qualifying marks without including the grace mark procedures.
IV.2	Subject to the conditions stipulated in these Regulations, the following persons are eligible to seek admission to the Ph.D. programme:
a)	Master's Degree holders satisfying the criteria stipulated under Clause IV.1. a and b above.
b)	Candidates possessing a Degree considered equivalent to M.Phil. Degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions, shall be eligible for admission to Ph.D. programme.

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V. MODE OF ADMISSION

V.I	A candidate who has passed the qualifying examination with requisite percentage of marks as prescribed in Clause IV of these Ordinances is eligible for admission to the Ph. D. Programme through one of the following modes:
	<p>a) Admission through Entrance Test:</p> <p>(i) A candidate qualified in Entrance Test as per the details given in Clause VIII.1 (a) shall be considered for admission to the Ph. D. Programme depending on the number of seats available in a Department/ Centre/ School.</p> <p>(ii) The prospective number of seats available in Departments/Centres shall be as notified in advertisement. The number of candidates to be called for counseling will depend upon the number of seats in the Department/Centre.</p> <p>(iii) The Controller of Examinations shall conduct Entrance Test once in a year the results of which shall remain valid for one academic year only.</p>
	<p>b) Direct Admission:</p> <p>A candidate who fulfills one of the following requirements may be considered for direct admission to the Ph. D. Programme without appearing in the Entrance Test:</p> <p>i) A candidate who is qualified in a national level test such as National Eligibility Test (NET-JRF), NET-LS (without fellowship), Graduate Aptitude Test for Engineering (GATE), State Level Eligibility Test (SLET) accredited by UGC/Central or State Government.</p> <p>Note: However, a research scholar earlier admitted under Entrance Test - exempted category (NET-LS/GATE) could be extended CUSB research fellowship, subject to fulfillment of following conditions, without any break in continuity of his/her research work done as an Entrance Test exempted enrollee:</p> <p>1) He/she is not getting any financial support/ fellowship from any other source;</p> <p>2) He/she publishes at least one research paper in peer refereed journals after his/her enrollment as Ph.D. scholar in the University (out of the research work generated as a Ph.D. scholar);</p> <p style="text-align: center;">OR</p> <p>He/ she is short-listed in the Entrance Test conducted by the University</p> <p>3) The award of fellowship shall be only for the remaining period (to be calculated based on the CUSB Research Fellowship Scheme), and shall commence from the month following the one in which either of the aforesaid conditions [V(b)] is fulfilled by the scholar</p>

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	ii)	A candidate who is a recipient of National Doctoral Fellowship or other fellowships from government/semi-government organizations (through All-India selection procedure conducted by the agencies/organizations for award of research fellowships) such as Council of Scientific and Industrial Research (CSIR), University Grants Commission (UGC), All India Council for Technical Education (AICTE), Department of Science and Technology (DST), Defense Research and Development Organization (DRDO), Department of Atomic Energy (DAE), Department of Biotechnology (DBT), Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research, and similar National Level Organizations.
	iii)	A candidate who is selected under Quality Improvement Program (QIP) of AICTE or Faculty Development Programme of a State Government/UGC.
	iv)	An employee of any other university/ institution/ college/ government department/ public sector undertaking/ R & D organization/ private industry, who is sponsored as a full-time candidate by the said organization, with at least 2 years of experience and who is relieved on study leave for a period of not less than three years for pursuing Ph. D. Programme in a Department/Centre/School of the University.
	v)	A foreign national who is a recipient of fellowship by Indian Council for Cultural Relations (ICCR), Government of India and who is sponsored by his/her government.
	vi)	A self-financing foreign national who is admitted through the Embassy/High commission of his/her country or admitted under a MoU with due clearance from the Indian Missions abroad. As per revised guidelines/ instructions of the Department of Higher Education, MHRD, GOI on grant of research visa, the foreigners who desire to undertake research in India, should therefore, apply to the concerned Indian Missions abroad with the brief synopsis of the research project to be undertaken in India, the details of places to be visited, previous visits, whether the scholar has secured admission into a recognized or reputed institution and evidence of financial resources.
	Note:	
	1)	The equivalence of the degree possessed by the foreign candidates belonging to the Clauses V.I (b) (v) and (vi), shall be settled by the Equivalence Committee of the CUSB before their admission. They shall be admitted to the Ph. D. Programme only if the degree possessed by them entitles them for enrolment as Ph. D. scholars in the universities of their own countries.
	2)	The supernumerary quota for self-financing foreign nationals shall be restricted to a maximum of 10% of the total available seats in a Department/Centre/School.

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vii)	A candidate who is already registered as a Ph. D. scholar in some other university and whose supervisor joins this University. In this case, the candidate has to fulfill the terms & condition laid down in CUSB Ph.D. Ordinances.
viii)	A candidate [employee or a research scholar {qualifying the criteria laid at para V.1 (b) (i) or (ii) above}] of any non-Ph.D. degree awarding institution/ government department/ public sector undertaking/ R & D organization/ private industry who is either sponsored as a full-time candidate by the said organization or having fellowship, with at least 2 years of experience, who shall work for his/her Ph. D. in his/her parent organization fulfilling the residency period requirement prescribed in Clauses IX.3 (c) and (d) of these Ordinances. The candidate is required to submit a sponsorship and work experience certificate from the parent organization. The non-degree awarding institutions, government departments, public sector undertakings, R & D organizations and the private industries are only those, which are recognized and approved as Centers of Research by the Academic Council of the Central University of South Bihar.
ix)	A candidate, working in an externally funded research project in the University as a research personnel, may be allowed to register for Ph.D. in the University provided he/she publishes at least one research paper in a peer refereed journal after joining the project (out of the research work generated in the project) or he/ she is short-listed in Entrance Test conducted by the University. Provided further that in such cases, the consents of the PI and the supervisor (in case PI is not the supervisor) are available to the effect that the research work of the Project and that of the Ph.D. are overlapping and/or working simultaneously will not hamper the interest of either.
x)	A teacher of the University holding substantive post provided he/she meets the eligibility requirements and is recommended by the concerned DRDC / CRDC. (xi) A non-teaching employee of the University holding substantive post provided he/she meets the eligibility requirements and is recommended by the Registrar and accepted the concerned DRDC / CRDC.
xi)	A Non-teaching employee of the University holding substantive post provided he/she meets the eligibility requirements and is recommended by the Registrar and accepted by the concerned DRDC/CRDC.
xii)	"A teaching or a non-teaching employee of Central University of South Bihar, Gaya holding substantive position and recommended by the Head & Dean of the School in case of teachers and by the Registrar in case of non-teaching employee and accepted by the concerned DRDC/CRDC."

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VI. CLASSIFICATION OF THE CANDIDATES			
VI.1.	A candidate admitted to the Ph.D. Programme in a Department/ Centre/School shall be classified under any one of the following categories:		
	a)	<b>Full-time Research Scholar</b>	
		A candidate who has been admitted to the Ph. D. Programme through Entrance Test, or by direct admission based on the eligibility criteria mentioned in Clauses V.1 (b) (i) to (vii) and (ix) shall be referred to as a full-time research scholar.	
	b)	<b>Part-time Research Scholar</b>	
		A candidate who has been admitted directly to the Ph. D. Programme based on the eligibility criteria mentioned in Clauses V.1 (b) (viii), (x), (xi) and (xii) shall be referred to as part-time research scholar.	
VII. RESEARCH COMMITTEES			
VII.1	Subject to the general superintendence of the Academic Council, the following Committees shall deal with all matters connected with the Ph.D. Programme of the University in accordance with these Ordinances:		
	1)	The University Research Degree Committee (URDC), as per University Ordinance-33	
	2)	The Departmental/Centre Research Degree Committee (DRDC/CRDC)	
	3)	The Research Advisory Committee (RAC)	
VII.2	The DRDC/CRDC shall consist of the followings:		
	1)	Head of Department/Centre	Chairman
	2)	All Professors of the Department/ Centre	Member
	3)	One Associate Professor + One Assistant Professor of the Department/ Centre, according to seniority, by rotation in every two year.	Member
	4)	Supervisor and Co-Supervisor (if any) of the concerned Ph.D. Scholar.	Member
	5)	Emeritus Scientists/ Emeritus Professors (if any) in the concerned School as	Special Invitee

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Where there are five or less than five teachers in the Department/ Centre, the DRDC / CRDC shall consist of the followings:		
1)	Dean of the concerned School	Chairman
2)	All teachers of the Department/ Centre	Member
3)	A senior teacher of a sister Department/Centre/School nominated by the Dean in consultation with the Head of Department/Centre of the School	Member
4)	Supervisor and Co-Supervisor (if any) of the concerned Ph.D. Scholar	Member
The DRDC / CRDC shall appoint one of its members as Member-Secretary. The DRDC / CRDC shall have powers to co-opt such members of the teaching staff of the concerned/sister Department/Centre/School as may be helpful to them in their deliberations. In the case of Schools consisting of a single department, a senior teacher of a sister School recommended by the Dean of the concerned School shall also be a member of the DRDC / CRDC.		
<b>Functions of DRDC/CRDC</b>		
1)	Allotment of Supervisor, Co-Supervisor, recording reasons for not admitting a candidate.	
2)	Recommendation for extension of time for submission of thesis	
3)	Recommendation to peruse a part of research outside the University	
4)	Approval of the Course Work	
5)	Assessment and Grading in Course Work	
6)	Monitoring the research progress of the candidate	
7)	Approval of Research plan proposal/language	
8)	Sanction of duty leave to the Ph.D. candidate	
9)	Assessment of Ph.D. work through pre-submission seminar	
10)	Maintaining the record of research paper publications of the candidate	
11)	Recommendation of panel of experts for thesis evaluation	
12)	Assessment of revised thesis for satisfactory compliance, if any	
13)	Arrangement of Viva-voce in the absence of the supervisor	
14)	Recommendation to waive the Viva-voce	

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VII.3	<p><b>The RAC and its Functions:</b></p> <p>There shall be a Research Advisory Committee, or an equivalent body for similar purpose as defined in the Statutes/Ordinances of the Institution concerned, for each Ph.D. scholar.</p>																					
	<p><b>The RAC shall consist of the followings:</b></p> <table border="1"> <tr> <td data-bbox="438 537 494 604">1.</td> <td data-bbox="494 537 1236 604">Supervisor</td> <td data-bbox="1236 537 1444 604">Convener</td> </tr> <tr> <td data-bbox="438 604 494 672">2.</td> <td data-bbox="494 604 1236 672">One nominee of the Dean</td> <td data-bbox="1236 604 1444 672">Member</td> </tr> <tr> <td data-bbox="438 672 494 739">3.</td> <td data-bbox="494 672 1236 739">One nominee of the Head</td> <td data-bbox="1236 672 1444 739">Member</td> </tr> </table> <p>a) This Committee shall have the following responsibilities:</p> <table border="1"> <tr> <td data-bbox="438 806 494 940">1.</td> <td colspan="2" data-bbox="494 806 1444 940">To recommend for the appointment of Co-supervisor, as per the terms and conditions of eligibility, if required due to interdisciplinary nature of the topic and the need of supplementing with expertise;</td> </tr> <tr> <td data-bbox="438 940 494 1008">2.</td> <td colspan="2" data-bbox="494 940 1444 1008">To review the research proposal and finalize the topic of research;</td> </tr> <tr> <td data-bbox="438 1008 494 1120">3.</td> <td colspan="2" data-bbox="494 1008 1444 1120">To guide the research scholar to develop the study design and methodology of research and identify the course(s) that he/she may have to do; and</td> </tr> <tr> <td data-bbox="438 1120 494 1220">4.</td> <td colspan="2" data-bbox="494 1120 1444 1220">To periodically review and assist in the progress of the research work of the research scholar.</td> </tr> </table> <p>b) A research scholar shall appear before the Research Advisory Committee once in six months to make a presentation of the progress of his/her work for evaluation and further guidance. The six monthly progress reports shall be submitted by the Research Advisory Committee to the Institution/College with a copy to the research scholar</p> <p>c) In case the progress of the research scholar is unsatisfactory, the Research Advisory Committee shall record the reasons for the same and suggest corrective measures. If the research scholar fails to implement these corrective measures, the Research Advisory Committee may recommend to the Institution/College with specific reasons for cancellation of the registration of the research scholar.</p>	1.	Supervisor	Convener	2.	One nominee of the Dean	Member	3.	One nominee of the Head	Member	1.	To recommend for the appointment of Co-supervisor, as per the terms and conditions of eligibility, if required due to interdisciplinary nature of the topic and the need of supplementing with expertise;		2.	To review the research proposal and finalize the topic of research;		3.	To guide the research scholar to develop the study design and methodology of research and identify the course(s) that he/she may have to do; and		4.	To periodically review and assist in the progress of the research work of the research scholar.	
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VII.4	<p>A teacher who is not eligible to guide a Ph. D. scholar as per Clause X.1 (d) of these Ordinances can become a member of any of the research committees mentioned above, if he/she is holding a position of Dean/Head.</p>																					
VII.5	<p>The DRDC / CRDC shall not make any recommendation that is not in conformity with these Ordinances and/or such other directives as may be issued by the URC and/or the Academic Council in regard to the Ph. D. programme from time to time.</p>																					

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VIII. PROCEDURE OF ADMISSION	
	<b>Eligibility for Entrance Test:</b>
VIII.1	<p>a) A candidate possessing the minimum qualifications with the requisite percentage of marks as prescribed in Clauses IV.1 and 2 of these Ordinances shall be eligible to appear in the Entrance Test.</p> <p>b) If a candidate is an applicant and also eligible for admission to Ph. D. programme in a School different from the one in which he/she has obtained the qualifying degree, he/she shall appear in the Entrance Test conducted by the School corresponding to the subject in which the candidate possesses the qualifying degree.</p> <p>c) The Entrance Test shall be conducted by the Controller of Examinations normally in the month of May/June every academic year, the results of which shall be declared within two weeks.</p>
VIII.2	<b>Procedure for Admission to Ph.D. Programme through Entrance Test</b>
	<p>a) All admissions to Ph.D. programmes in the University will be through national level Entrance Test. In order to identify the candidate's capabilities and aptitude for research there shall be a two level test as below:</p> <p>a) Test A: Test to assess reasoning, quantitative ability, general knowledge, language skills and subject knowledge</p> <p>b) Test B: Research Proposal and Personal Interview to test aptitude for research by DRDC / CRDC</p> <p>b) The Test A shall be held as per procedure adopted by the University at multiple centres across the country. The Test B shall be held at CUSB in the concerned Department/Centre by DRDC/CRDC.</p> <p>c) Certain categories of candidates, as defined in the relevant Ph.D. Ordinances [Clause V.1.(b)], are exempt from appearing at Test A (Direct Admission category), but would be required to qualify at Test B to be eligible for consideration for registration for Ph.D. in the given discipline. The Direct Admission categories of applicants are also required to submit application in the prescribed form separately as and when the applications are invited by the University for Entrance Test.</p> <p>d) Entrance Test shall be conducted once in a year. Qualified candidates in Test A and Test B shall be admitted against vacant seats as per merit in July/August. However, candidates failing to get admitted in August due to non-availability of vacancy shall under Clause V.1(b).(i) have another opportunity to apply for Ph.D. admission in the February term subject to the notification regarding availability of vacancy.</p> <p>e) The University shall maintain the list of all the Ph.D. registered students on its website on year-wise basis. The list shall include the name of the registered candidate, topic of his/her research, name of his/her supervisor / co-supervisor, date of enrolment/registration.</p>

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VIII.3	<b>Test Design of Entrance Test</b>
VIII.3.1	<b>Test A: Assessment of Reasoning, Analytical Ability and Subject Knowledge:</b>
a)	The syllabus of the Entrance Test shall consist of 50% of research methodology and 50% shall be subject specific. This written test is aimed to assess the reasoning, quantitative ability, general knowledge, language skill and subject knowledge of PG level.
b)	This test and admission shall be regulated as per the rules and regulations decided by UATEC from time to time.
	<b>Test B: Assessment of Research Aptitude through Research Proposal and Personal Interview:</b>
	The interview/viva voce shall be of 100 marks consisting of the following aspects, viz. whether:
a)	the write up submitted is satisfactorily defended by the candidate- 30%
b)	the candidate possesses the competence for the proposed research- 40%
c)	the proposed area of research can contribute to new/additional knowledge- 30%
d)	the research work can be suitably undertaken at the Institution
VIII.3.2	The qualifying marks for Test A shall be 50%. However, the cut off marks to be eligible for Test B shall be determined in accordance with the number of vacancy available in the concerned discipline in that academic session. The ratio of vacancy and number of candidates shall be 1:5.
VIII.4	<b>Admission:</b>
VIII.4.1	a) Merit orders of Entrance Test and Entrance Test -exempt candidates will be 4.1 prepared by the Interview Board for the discipline.
	b) Final merit order of Entrance Test and Entrance Test -exempt candidates shall be prepared on the basis of Test B. Entrance Test is a qualifying examination.
	c) The candidate must secure a minimum of 60% marks in Test B to be eligible for Ph.D. registration in the discipline. However, meeting the said minimum requirement will not guarantee registration for Ph.D. as it is dependent upon availability of vacant seats.

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VIII.4.2	<b>Admission Process:</b>
VIII.4.2.1	<b>Declaration of Results after Test B.1</b>
	Names of as many Entrance Test and Entrance Test -exempt candidates as the number of vacancies given in the Information Bulletin will be announced on the basis of Final Merit Order after Test B for admission to Ph.D. in the discipline. An equal number of wait-listed candidates (in order of merit) will also be prepared for consideration in case seats fall vacant in future for consideration in February
VIII.4.2.2	<b>Allotment of Ph.D. Supervisor</b>
a)	The Head of the Department/Centre will provide a list of teachers together with their research areas to the Entrance Test and Entrance Test -exempt selected candidates and advise them to interact with teachers, identify their supervisor in the discipline and submit the letter of consent of the identified Supervisor to the DRDC / CRDC within two weeks.
b)	As many finally qualified candidates after the Test B can be admitted to Ph.D. Programme in the discipline if Supervisors are available/ agreeable and the maximum number will ordinarily be restricted to the number of vacancies announced in the Entrance Test bulletin.
c)	If required, DRDC/CRDC should help in identifying a suitable "match" between the selected candidate and his/her Ph.D. supervisor (and CoSupervisor/s, if required).
d)	The DRDC/CRDC would formally allot a Ph.D. supervisor (and Co-Supervisor, if required) for the selected candidates keeping in view the mutual consent and the facilities available with the Supervisor including his/her specialization for undertaking the proposed research topic. The DRDC/CRDC would record reasons for not admitting a candidate who ranks higher in the merit order than some others who may have been selected for registration for Ph.D.
e)	Candidates under the Entrance Test -exempt category, who could not be admitted in August term, may be considered along with those who apply in response to the notification for admission in the February term and shall be again evaluated through Test B along with the fresh applicants under Entrance Test -exempt category and admitted, if selected, as above.
VIII.4.2.3	<b>Admission and payment of Fees</b>
	The candidates will submit the registration form (Annexure-A-1) and pay the required fees after their Supervisor (and Co-Supervisor, if required) has/have been allotted by the concerned DRDC/CRDC. The process of admission completes only when a selected candidate has deposited the prescribed fees for Ph.D. registration within the date prescribed for payment of fee failing which shall lead to cancellation of right to admission, and the vacant seat thus created may be given to the next candidate in order of merit.

VIII.5	After the payment of fees, the candidate shall submit an application to the Head of the Department/Centre giving the proposed topic of research. The part-time candidate [as defined in Clause V.1b (viii)] is required to submit the consent of the proposed external supervisor/co-supervisor along with the above application.
VIII.6	The Head of the Department/ Centre shall send a complete list of the admitted candidates along with the necessary details to the CoE with a copy to the Dean of the School within a week from the date of admission.
VIII.7	The records of the merit list of both the Entrance Test qualified candidates and those eligible for direct admission along with their application forms shall be maintained in the Department/ Centre.
VIII.8	Every candidate shall be registered only at the beginning of the term which will continue till the submission of the Ph. D. thesis.
VIII.9	During the period of research no full-time Ph. D. scholar shall accept any paid assignment apart from Research Fellowship, Research Assistantship/ externally funded research project assignments etc.

**IX. DURATION OF THE PROGRAMME**

<b>IX.1</b>	<b>Minimum Period of Research Work required for the Submission of Thesis:</b>
a)	For the full time Ph.D. programme a minimum duration shall be of three years, including course work, from the date of admission and a maximum of six years. Extension beyond the above limits will be governed by the IX.2 clause as stipulated in these Ordinances.
b)	The minimum period of research work before submitting the thesis for all part-time candidates, admitted to the Ph.D. programme any Department/Centre shall be four years.
c)	For the candidates admitted under Clause V.1 (b), the minimum period of research work before the submission of the thesis shall be any one of the following:
i)	Four years out of which at least one year from the date of his/her joining this university, or
ii)	Four years taking into account the period spent earlier in the previous institution, or
iii)	Four years including the period required for completing the course work.

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IX.2	Extension of Duration for the Submission of Thesis:	
	a)	If a candidate fails to submit the thesis at the end of the stipulated period as prescribed in Clause IX.1, the Head of the Department/Centre, with the recommendation of the DRDC/CRDC, may grant an extension of up to two years (one year at a time) for the submission of the thesis.
	b)	If a candidate fails to submit the thesis within the extended period as stipulated in Clause IX.2 (a) due to satisfactory reasons, he/she may be given additional one year of extension for submitting the thesis, by the Dean of the School, on the recommendation of the DRDC/CRDC, but the total period for the submission of the thesis counted from the date of his/her admission does not exceed six years. For the candidates admitted under Clause V.1 (b) (vii), this period of six years is counted taking into account the period spent in the previous institution also.
	c)	The women candidates and Persons with Disability (more than 40% disability) may be allowed a relaxation of two years for Ph.D. in the maximum duration. In addition, the women candidates may be provided Maternity Leave/Child Care Leave once in the entire duration of Ph.D. for up to 240 days.
	d)	In case of relocation of a woman Ph.D. scholar due to marriage or otherwise, research data shall be allowed to be transferred to the University to which the scholar intends to relocate provided a) all other conditions in these regulations are followed and b) the research work does not pertain to a project secured by the parent institution/ supervisor from any funding agency. The scholar will give credit to the parent guide and institution for the part of research already done.
IX.3	Residency Period:	
	a)	A Ph.D. Scholar shall be required to be present in the University for a prescribed period, which is known as the Residency Period.
	b)	For the candidates of all categories, except for the external part-time research scholars, the compulsory residency period shall be the minimum period prescribed for the submission of thesis under clause IX.1(a). The period is extendable as per Clause IX.2 (b), (c) & (d). However, the hostel facility to any research scholar shall not be extended beyond four years period from the date of his/her registration.
	c)	For an external part-time research scholar (except those admitted under provisions of clause V.1(b).(viii)), the residency period shall be the minimum period required for completing the course work of which at least one week per semester shall be essential. Such candidates would be required to deliver at-least two open seminars to evidence the progress of research made by them.
	d)	For an external part-time research scholar [those admitted under provisions of clause V.1(b).(ix)], the residency period shall be of at least one week per semester during the minimum time period for submission of thesis. Such candidates would be required to deliver at-least two open seminars to evidence the progress of research made by them.

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IX.4	The DRDC/CRDC may recommend a full-time Ph.D. scholar to pursue a part of his/her research work at a place outside the University. The Dean of the concerned School may approve the recommendations of DRDC which are for a period of six months or less. However, if such recommendations are for a period beyond six months, the recommendations of the DRDC shall be placed before the URDC, which may permit a full-time Ph. D. scholar to pursue a part of his/her research work at a place outside the University for a period of one year without exceeding the maximum time limit for the submission of the thesis laid down in these Ordinances.
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**X. SUPERVISOR AND CO-SUPERVISOR**

X.	<b>Appointment of Supervisor and Co-Supervisor:</b>
a)	Every candidate, prior to admission to the Ph.D. programme (i.e. before payment of Fee), shall be assigned a Research Supervisor by the DRDC / CRDC of, the concerned Department/ Centre in the manner laid at Clause VIII.2.2 of these Ordinances. The DRDC / CRDC may, if necessary, assign a Co-Supervisor, in the same manner.
b)	The allocation of Research Supervisor for a selected research scholar shall be decided by the Department concerned depending on the number of scholars per Research Supervisor, the available specialization among the Supervisors and research interests of the scholars as indicated by them at the time of interview/viva voce.
c)	In case of topics which are of inter-disciplinary nature where the Department concerned feels that the expertise in the Department has to be supplemented from outside, the Department may appoint a Research Supervisor from the Department itself, who shall be known as the Research Supervisor, and a Co-Supervisor from outside the Department/ Faculty/College/Institution on such terms and conditions as may be specified and agreed upon by the consenting Institutions/Colleges.
d)	The external part-time research scholar shall normally have one Supervisor from the University and another from the parent organization (Co-Supervisor), where he/she will be carrying out the research work (such candidate will submit a certificate from the Co-Supervisor to the effect that he/she did work under the Co-Supervisor during the period). The Supervisor and /Co-Supervisors shall consult each other in all matters pertaining to the progress of the work of the candidate.
e)	In case a candidate is permitted to do a part of his/her research work at a place outside the University for a period of one semester or more, the person who will be looking after the research work of the candidate at the outside organization shall be appointed as an Co- Supervisor by the concerned DRDC / CRDC.
f)	Any regular Professor of the University/Institution Deemed to be a University/College with at least five research publications in refereed journals and any regular Associate/Assistant Professor of the university/institution deemed to be a university/college with a Ph.D. degree and at least two research publications in refereed journals may be recognized as Research Supervisor.

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	<p>Provided that in areas/disciplines where there is no or only a limited number of refereed journals, the Institution may relax the above condition for recognition of a person as Research Supervisor with reasons recorded in writing.</p>
g)	<p>Only a full time regular teacher of the concerned University/Institution Deemed to be a University/College can act as a supervisor. The external supervisors are not allowed. However, Co- Supervisor can be allowed in inter-disciplinary areas from other departments of the same institute or from other related institutions with the approval of the Research Advisory Committee.</p>
h)	<p>Scientist/Scientific Officer/Research Officer/UGC-Faculty Recharge faculty, who is appointed for a period of not less than 5 years in the University and who holds Ph. D. degree shall also be eligible to guide Ph. D. scholars provided he/she still has two years of service period for the University from the date of the registration of the scholar. The teachers of the University, who are appointed against the above post are also eligible to guide Ph. D. scholars provided they hold lien on their substantive posts and are otherwise qualified to guide Ph. D. scholars as per these Ordinances.</p>
i)	<p>Emeritus Professor/Scientist/Fellow, appointed by the University or any national organization, shall be eligible to guide Ph. D. scholar, provided after retirement he/she consents to continue to supervise the candidate subject to the recommendation of the DRDC/CRDC and the approval of the URDC.</p>
j)	<p>A faculty member who is to retire within the next two years shall not be appointed as a supervisor but can continue to be the supervisor even after his/her retirement provided the DRDC/CRDC is convinced of his/her availability for continued guidance to the candidate already registered with him/her.</p>
k)	<p>A teacher who has retired/ resigned from the University service may continue to be the supervisor, if his/her research scholar has fulfilled the minimum period requirement for the submission of the thesis as per Clause IX.1 and the scholar so desires.</p>
l)	<p>In case where the supervisor of the candidate is appointed in a sister Department/Centre of the University, provision for transfer of candidates pursuing research under his/her supervision in the earlier Department/Centre shall be available provided the candidate opts for it and the DRDC/CRDC of the concerned Department/Centre agrees to the proposed transfer. However, the research scholar, subsequent upon transfer, shall be governed by the Ordinances of the Department/Centre to which he/she is transferred.</p>
<b>X.2</b>	<b>Quota of Ph. D. Supervisors</b>
a)	<p>The Ph.D. ordinance related to quota of Ph.D. Supervisors shall be in consonance with the provision laid down in Clause 6.5 of UGC Ph.D. Regulation-2016 which is an under:</p> <p>"A Research Supervisor/Co-supervisor who is a Professor, at any given point of time, cannot guide more than three (3) M.Phil. and Eight (8) Ph.D. scholars. An Associate Professor as Research Supervisor can guide up to a maximum of two (2) M.Phil and Six (6) Ph.D. scholars and an Assistant Professor as Research Supervisor can guide up to a maximum of one (1) M.Phil and four (4) Ph.D. scholars."</p>

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	b)	In case a Co-supervisor is also appointed, the candidate shall be counted towards the quota of both the Supervisor and the co-supervisor.
	c)	All research scholars including the teachers registered for Ph. D. except those referred in clause X.2 (b) be counted within this quota. Vacancy under any Supervisor shall be created only after the submission of the thesis by the researcher.
X.3	a)	If the supervisor of a candidate proceeds on leave for a period of more than 12 months, or he/she proceeds on leave for a period of less than 12 months, but later extends his/her leave beyond 12 months, then, he/she shall cease to be the supervisor. However, if the candidate submits the abstract of the thesis or the thesis itself before the supervisor proceeds on leave, then the existing supervisor shall continue to be the supervisor.
	b)	If the supervisor of a candidate expires or is terminated from the University service, he/she shall cease to be the supervisor.
	c)	If the supervisor of a candidate is under suspension, he/she shall cease to be the supervisor during the entire period of his/her suspension.
	d)	If a teacher, except for the one governed by the Clauses X.1 (h), (i) and (j), retires/resigns from the University service, he/she shall cease to be the supervisor.
	e)	In all cases, where the existing supervisor of a candidate ceases to be the supervisor, the DRDC/CRDC shall appoint the co-supervisor, if any, as the supervisor of the candidate, provided the co-supervisor is from the same discipline. If there is no co-supervisor for the concerned candidate or the co-supervisor is from a different discipline, then the DRDC/CRDC shall appoint a new supervisor from an allied department.
	f)	In the event of conflict or for some personal reasons between Supervisor and Ph.D. Scholar, transfer of Supervisor with mutual consent can be approved by the concerned DRDC / CRDC, provided a Supervisor with vacancy gives consent to accept the scholar.
X.4	<b>Department/Eligibility :</b>	
		The departments having less than two teaching faculty with Ph.D., shall not be eligible to run Ph.D. Programme.
<b>XI. COURSE WORK</b>		
XI.1	A candidate, admitted to the Ph.D. Programme in any of the subjects, shall be required to undertake Course Work as approved by the Academic Council during the initial one or two semesters for a minimum period of one semester. However, this period may be extended for another semester as per the requirements of Department/Centre. The candidate shall have to qualify as per the criteria prescribed by the Course Work Ordinances of the concerned Centre/Department. The Course Work shall include a course on Research Methodology (which may contain quantitative methods and computer applications) and Reviewing of Published Research Work in the relevant field.	

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<p>XI.1.a</p>	<p>Candidates already holding M.Phil. Degree and admitted to the Ph.D. Programme, or those who have already completed the Course work in M.Phil. and have been permitted to proceed to the Ph.D. in Integrated Course, may be exempted by the DRDC/CRDC from the Course Work, subject to the fulfillment of the minimum credits requirement prescribed by the Department. Such candidates shall be issued an Exemption Certificate by the University. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. Course work prescribed by the Department.</p>
<p>XI.2</p>	<p>The credit assigned to the Ph.D. course work shall be a minimum of 08 credits and a maximum of 16 credits. A minimum of four credits shall be assigned to one or more courses on Research Methodology which could cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, field work, etc. Other courses shall be advanced level courses preparing the students for Ph.D. degree. The details of the courses, course credits and other related matters shall be determined in accordance with the Ordinances of the concerned Centre/Department. However, a minimum of 75 % attendance shall be required in the Course Work for the research scholars registered on part-time basis.</p> <p>The Department where the scholar pursues his/her research shall prescribe the course(s) to him/her based on the recommendations of the Research Advisory Committee.</p>
<p>XI.3</p>	<p>The courses offered for the Ph. D. Programme may be through lecture, laboratory, field study, design and self-study courses, mini projects and seminars. Each of these courses shall be of doctoral level.</p>
<p>XI.4</p>	<p>Grades in the course work, including research methodology courses shall be finalized after a combined assessment by the Research Advisory Committee and the DRDC/CRDC. A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 7-point scale (or an equivalent grade/CGPA in a point scale wherever grading system is followed) in the course work in order to be eligible to continue in the Programme and submit the thesis.</p>
<p>(i)</p>	<p>The evaluation of the Course Code 901 &amp; 902 shall be done by the concerned faculty-member and the evaluation report is to be sent to the Controller of Examinations office.</p>
<p>(ii)</p>	<p>For all the three courses there shall be only end semester examination of 100 marks. The Grades of these course shall be the same as that of respective PG courses and shall not be placed before the Board of Examiners.</p>
<p>(iii)</p>	<p>Regarding Course Code 903, it was decided that the 100 marks allotted for this will be split in two parts, 75% for research proposal writing and rest 25% for the presentation. This evaluation shall be done jointly by the RAC and the CRDC/DRDC and submitted to the Controller of Examinations.</p>
<p>XI.5</p>	<p>In addition to XI.4, such course work components which are experimental, the satisfactory completion of that would be determined by the DRDC/CRDC through oral presentation by the scholar. The research scholar would be declared to have successfully completed such course work component on the recommendations of the DRDC/CRDC.</p>

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XI.6	The system of giving course work credit to a teacher registered for Ph.D. as a part-time candidate, and credit transfer for candidates working in outside institutions shall be governed as follows:
a)	Such teachers (registered as a part-time research scholars) who have at least 5 years teaching experience and have taught some of the components of the course work shall have the option to either appear in the examination or present a detailed seminar related to the said course work component to the satisfaction of the DRDC/CRDC. If the DRDC/CRDC considers that the teacher has adequate knowledge of the course work component it would be recommended the teacher to have completed the said component of the course work successfully.
b)	In addition to XI.6.1, in case of an experimental course work component, the part-time research scholars will have the option to perform that laboratory work either in CUSB or at their place of work in parent organization laboratory which shall furnish a certificate to the effect that the candidate has been exposed to requisite hours of laboratory work (as per the course curriculum/ credit requirement) and such candidates would be required to demonstrate laboratory skills at the CUSB Campus before the DRDC/CRDC for assessment/ examination.
XI.7	A teaching or a non-teaching employee of Central University of South Bihar, Gaya holding substantive position shall complete his / her course work alongside performing his/her duties.

**XII. PERFORMANCE EVALUATION**

XII.1	<b>Progress Report:</b>
a)	The DRDC/CRDC shall monitor the academic/research progress of each candidate. For this purpose, the candidate shall submit a progress report on a prescribed proforma (Annexure-C) in triplicate, at the end of each semester to the DRDC/CRDC through his/her supervisor and co-supervisor, if any.
b)	The Chairman of the DRDC/CRDC shall forward the progress report with specific recommendations to the CoE with a copy to the Dean of the concerned School.
c)	The progress of a candidate in any semester shall be deemed to be unsatisfactory if the candidate is absent for a period more than that specified in Clause XIII.
d)	The candidate shall submit progress reports for each semester till the submission of the thesis. The last progress report of the candidate shall be submitted to the CoE, in the manner prescribed, along with submission of thesis.
e)	A candidate who is belonging to Clause V.1 (b) (vii) and has been admitted to the Ph.D. Programme, shall submit a certificate from the Head of the Department of earlier institution for the period for which he/she has done the research work in that institution. He/she shall also submit a detailed report of the work he/she has carried out in the earlier institution certified by his/her former Head along with all previous six monthly reports duly forwarded by the parent department/institution. However, for the remaining period of research in this University, he/she shall submit progress reports at the end of every semester till the submission of the thesis.

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XII.2	<p><b>Research Plan Proposal</b></p> <p>a) After the successful completion of the course work, the candidate shall submit to the DRDC/CRDC a duly forwarded (by the supervisor) research plan proposal generally consisting of preamble, definition of the problem, approaches, methodology, results anticipated and references, in about 8 to 10 pages along with his/her second progress report. The proposal shall also indicate the topic of the research, although not necessarily the precise title of the thesis.</p> <p>b) The DRDC/CRDC shall examine the research plan proposal of the candidate and the candidate shall deliver a detailed seminar called "Research Plan Proposal Seminar" before the DRDC/CRDC.</p> <p>c) The DRDC/CRDC, if satisfied with the research proposal and the seminar presentation, shall approve the proposal and the final topic of research, and shall forward its recommendation to the CoE with a copy to the Dean of the concerned School.</p> <p>d) If the DRDC/CRDC is not satisfied with the quality of the research plan proposal and the seminar presentation, the candidate shall submit a fresh proposal and deliver fresh seminar within a time limit specified by the DRDC/CRDC (not exceeding three months in any case), and a fresh evaluation shall be done. If the seminar is unsatisfactory, the candidate shall deliver only the seminar again within one month.</p> <p>e) If the candidate fails to submit the research plan proposal at the end of the second semester or the research plan proposal and/or the research plan proposal seminar of the candidate is/are not approved by the DRDC/CRDC even after complying with Clause XII.2 (d), the candidate's admission shall stand cancelled.</p>
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**XIII. LEAVE AND ATTENDANCE**

XIII.1	<p><b>Leave Rules</b></p> <p>a) A Ph. D. scholar shall be eligible to avail a leave of 30 days in an academic year. He/she shall not be entitled to any inter-semester break, winter and summer vacations. However, he/she is entitled to an additional leave of up to 10 days on medical grounds in an academic year. The aforesaid leave provisions are cumulative. Further, male/female candidates shall be eligible for paternity/maternity leave as per University rules. In case of medical emergency the leave may be extended by the Chairperson, URDC on the recommendations of DRDC/CRDC.</p> <p>b) In addition a Scholar shall be entitled for Duty Leave of maximum six months for field/laboratory work in India or maximum of one year for the same work abroad. This shall be sanctioned by DRDC/CRDC after due recommendations of the Supervisor.</p> <p>c) The leave shall be granted by the Head of the Department /Centre on the application of the candidate duly forwarded by the Supervisor/Co-supervisor.</p>
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XIII.2	<b>Attendance Requirements</b>  a) A candidate is required to sign on all working days of the University in an attendance register to be kept in the concerned Department/Centre except when he/she is on duty/sanctioned leave as per Clause XII.1 (a).  b) A candidate, who is pursuing Course Work as a part of his/her Ph. D. Programme, is expected to have at least 75% attendance in each course. However, 15% of the required attendance may be condoned by the Dean of the concerned School for cogent reasons as per university rules.
XIII.3	The attendance requirements and leave rules shall be applicable to the external part-time research scholars also during their stay in the University
<b>XIV. SUBMISSION OF THE THESIS</b>	
XIV.1	<b>Pre-submission Seminar</b>  a) On completion of the research work for the Ph.D. by a candidate, the supervisor shall organize a pre-submission seminar, in consultation with the Head of the Department/Centre/Dean of the School to apprise the teachers and other research scholars of the Department/Centre/School of the candidate's work and receive suggestions for improvement of the research work. The DRDC/CRDC shall assess the work of the candidate through this seminar. If the DRDC/CRDC is not satisfied with the quality of the work of the candidate, then the candidate shall do further work incorporating the suggested improvements, and deliver a fresh pre-submission seminar after a definite period specified by the DRDC/CRDC.  b) The exact title of the thesis shall be as approved by the DRDC/CRDC after the pre-submission seminar.  c) If the DRDC/CRDC is satisfied with the pre-submission seminar of the candidate, the Chairman of the DRDC/CRDC shall forward the application of the candidate for submission of the thesis along with a certificate about the satisfactory completion of the pre-submission seminar (Annexure – E) and the exact title of the thesis to the CoE with a copy to the Dean of the concerned School. Any extended residency period left beyond the date on which the thesis is forwarded for submission, as aforesaid, shall be deemed to have been terminated on the said date.
XIV.2	<b>Submission of the Thesis</b>  a) The candidate is required to submit the thesis within six months from the date of his/her pre-submission seminar (without exceeding the maximum time limit for the submission of the thesis as laid down in Clause IX.2), failing which he/she shall be required to deliver a fresh pre-submission seminar.  b) The candidate shall submit the thesis to the Controller of Examinations (CoE), duly forwarded by the Head of the Department/Centre. While submitting the thesis the candidate shall submit the followings:

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	i.	Four hard copies and one soft copy (in a CD) of the abstract of the thesis written in about 600 words describing the salient features of his/her investigations/findings.
	ii.	Four hard copies and one soft copy (in a CD) of the thesis in English or any other language approved by the concerned DRDC/CRDC as per the format given in Annexure-B
	iii	A declaration by the candidate as per the format given in Annexure-D along with Annexure- D-1.
	iv	A certificate, of successful completion of the course work and pre-submission seminar shall be issued by the Head of the Department/Centre as per the format given in Annexure – E.
	v.	A copyright transfer certificate as per the format given in Annexure-F.
	c)	The candidate may submit the copies of the abstract (in hard and soft) one month before the submission of the thesis in order to expedite the process of evaluation.
	d)	Ph.D. scholars must publish at least one (1) research paper in refereed journal and make two paper presentations in conferences/seminars before the submission of the dissertation/thesis for adjudication, and produce evidence for the same in the form of presentation certificates and/or reprints. The reprints/pre-prints of the papers shall be incorporated at the end of the thesis and submitted to the DRDC / CRDC for record and further action. The evidence for acceptance of the papers shall be submitted to the office of CoE at the time of submission of thesis.
	e)	The candidate shall also submit one copy thesis and one copy abstract to the supervisor, co-supervisor, external supervisor and external co-supervisor, as the case may be.
	f)	The thesis shall contain a copyright certificate at the beginning of the thesis on a separate page (Annexure-F). A sample copyright format is given below: Copyright (c) Central University of South Bihar, India, 2016. All rights reserved.
	g)	A thesis once submitted cannot be re-submitted except when the examiner recommends for the revision of the thesis.
<b>XV. EXAMINATION</b>		
<b>XV.1</b>	<b>Panel of Examiners</b>	
	a)	The Supervisor shall propose a panel of at least six subject experts at least one from abroad in the area of the Ph. D. thesis for consideration of DRDC/CRDC soon after the pre-submission seminar of the candidate. Out of the six, at least four should be from outside the State of Bihar.
	b)	Complete and current addresses along with e-mail ID, telephone/mobile numbers of all the examiners proposed in the panel shall be provided by the Supervisor in the prescribed format (Annexure- J) .

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XV.2	Appointment of Examiners	
	a)	The panel proposed by the supervisor and approved by the DRDC/CRDC shall be forwarded to the Vice-Chancellor for final approval and appointment of the two examiners for the evaluation of the thesis.
	b)	The Controller of Examinations shall obtain the acceptance on prescribed format (Annexure-I & I-1) of the two appointed examiners before dispatching the thesis and the abstract thereof to them for evaluation. If any examiner declines to evaluate, or does not comply to the communication of the Controller of Examinations in this regard within one month, the Controller of Examinations will take the permission of the Vice-Chancellor for sending the thesis to another examiner out of the panel approved and will send the thesis accordingly (Annexure-J & J-1).
XV.3	Thesis Evaluation	
	a)	The Ph.D. thesis submitted by a research scholar shall be evaluated by his/her Research Supervisor and at least two external examiners, who are not in employment of the Institution/College, of whom one examiner may be from outside the country. The viva-voce examination, based among other things, on the critiques given in the evaluation report, shall be conducted by the Research Supervisor and at least one of the two external examiners, and shall be open to be attended by Members of the Research Advisory Committee, all faculty members of the Department, other research scholars and other interested experts/researchers.

	b)	The public viva-voce of the research scholar to defend the thesis shall be conducted only if the evaluation report(s) of the external examiner(s) on the thesis is/are satisfactory and include a specific recommendation for conducting the viva-voce examination. If the evaluation report of the external examiner of Ph.D. thesis is unsatisfactory and does not recommend viva-voce, the Institution shall send the dissertation/ thesis to another external examiner out of the approved panel of examiners and the viva-voce examination shall be held only if the report of the latest examiner is satisfactory. If the report of the latest examiner is also unsatisfactory, the dissertation/ thesis shall be rejected and the research scholar shall be declared ineligible for the award of the degree.
	c)	The Institutions shall develop appropriate methods so as to complete the entire process of evaluation of Ph.D. thesis within a period of six months from the date of submission of the dissertation/thesis. The Controller of Examinations shall forward the copy of the thesis to the examiners within a week of receipt of their consent and take necessary action to get the report of the examiners expeditiously.
	d)	The examiners shall be requested to submit their individual reports within two months of the receipt of the thesis.
	e)	In case, an examiner does not send his/her report within the above period, a reminder shall be sent to him/her over e-mail. This shall be followed by a subsequent reminder after a fortnight.

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f)	In the event of the report not being received from the examiner within 12 weeks, his/her examiner ship shall be terminated and a new examiner shall be appointed from the panel of experts.
g)	The examiners shall examine the thesis specifically with a view to judge whether the thesis is a piece of research work characterized by:
i.	discovery of new facts, or
ii.	a fresh approach towards interpretation of facts or theories, or
iii.	a distinct advancement in the subject.
h)	The examiner shall be required to give his/her opinion about candidate's ability for critical examination and sound judgment.
<b>XV.4</b>	<b>Examiner's Report</b>
a)	The examiners shall submit the report on a prescribed proforma as given in Annexure - G, and shall make one of the following recommendations:
i.	The thesis be accepted for the award of the Ph. D. degree.
ii.	The thesis, in the present form, cannot be accepted for the award of the Ph.D. degree and the candidate be advised to revise the thesis on certain issues raised in the report and resubmit the thesis. In the case of resubmission, the examiner shall specifically mention whether the resubmitted thesis must be referred back to him/her for re-evaluation or not.
iii.	The thesis be rejected
b)	If both the examiners recommend acceptance of the thesis for the award of the Ph. D. degree, the thesis shall be accepted.
c)	If both the examiners recommend rejection of the thesis, the thesis shall be deemed to be rejected.
d)	If the examiner(s) raise(s) some queries/seek(s) clarifications, the candidate shall be required to give satisfactory answers to the queries at the time of Viva-Voce.
e)	If one or both the examiner(s) recommend(s) revision of the thesis, the candidate shall resubmit the thesis after revision. If a specific examiner asks for the revised thesis to be referred back to him/her, it shall be sent to him/her. Otherwise the revised thesis shall be assessed by the DRDC/CRDC for satisfactory compliance of the desired revision.
f)	If the revised thesis is to be referred back to some other examiner, the examiner shall submit his/her report on a prescribed form as given in Annexure-H. The examiner shall recommend the revised thesis to be either accepted or rejected. Then depending on the recommendation of the other examiner, an appropriate action shall be taken as per Clauses XV 4 (c), (d), (e), (f) or (g).

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	g)	If one examiner recommends rejection of the thesis and the other recommends acceptance, then a third examiner shall be appointed from the panel of already approved examiners. In such cases, Clause XV. 4(i) shall apply.
	h)	The third examiner, if appointed, shall be an Indian or a foreign expert, depends on whether the thesis was rejected by an Indian or a foreign examiner in the first instance. Once the third examiner is appointed, any previous recommendations of the examiner in whose place the third examiner has been appointed shall become null and void for all purposes.
	i)	In case the third examiner recommends acceptance or revision of the thesis or asks for clarifications, then depending on the recommendation of the other examiner (who has not rejected the thesis), an action appropriate to the case mentioned in clauses XV.4 (c), (e) or (f) shall be taken.
	j)	In case the third examiner recommends the rejection of the thesis, his/her recommendation shall be final and the thesis shall be deemed to be rejected.
XV.5		In the case of any ambiguous recommendations by any examiner, the Controller of Examinations shall approach the examiner concerned for a clear recommendation. If a clear recommendation is not forthcoming, the matter shall be referred to the Vice-Chancellor for his/her decision.
XV.6		After the reports from both the examiners are received, the Controller of Examinations shall inform the supervisor and co-supervisor (if any) for appropriate action.
XV.7		<b>Viva-Voce</b>
	a)	If the thesis has been accepted for the award of the degree, the candidate shall be required to defend his/her thesis in a Viva-Voce, before a duly constituted committee hereinafter referred to as Viva-Voce Committee (VVC). The date, time and venue of the Viva-Voce with other necessary details shall be adequately notified by the Head of Department/Centre on the proposal of the supervisor so as to enable other faculty members and students to attend it.
	b)	The supervisor and the co-supervisor (if any), shall arrange for the Viva-Voce of the candidate as early as possible and normally within two months from the date of communication to them from the Controller of Examinations for conducting the Viva-Voce.
	c)	The VVC shall consist of the supervisor and the co-supervisor (if any), the Indian examiner who has evaluated the thesis and the Chairperson of the concerned DRDC/CRDC or his/her nominee. The Head of the Department/Centre shall be the Chairman of the VVC.
	d)	In the case of external candidates, the external supervisor and co-supervisor, if any, may be invited to the Viva-Voce as invited members of the VVC.
	e)	In the case of non-availability of the Indian Examiner for conducting the Viva-Voce, the Vice-Chancellor may appoint another examiner.

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f)	In the case of inability of the Supervisor or Co-Supervisor to conduct the Viva-Voce due to any reason, the nominee of the DRDC/CRDC shall arrange to conduct the Viva-Voce. In such cases, the Ph. D. work shall be deemed to have been carried out under the guidance of the original supervisor/co-supervisor only.
g)	The VVC shall be provided with the reports of all the examiners before the Viva-Voce.
h)	The VVC shall submit a comprehensive report on the performance of the candidate at the Viva-Voce, including the discussions over various points raised. The VVC shall recommend one of the followings:
i.	that the degree be awarded.
ii.	that the candidate be re-examined in a second Viva-Voce.
iii.	that the degree be not awarded and the thesis be rejected.
i)	If the VVC recommends that the degree be awarded, the candidate shall submit two hardbound copies of the thesis incorporating corrections, if any (along with 2 corresponding soft copy versions of the thesis in CDs), one for keeping in the library of the University and the other for the departmental library. The spare copies of the thesis may be returned to the candidate.
j)	If the VVC recommends for a second Viva-Voce, it shall be conducted normally after a period of three months but within six months from the date of the first Viva-Voce.
k)	If a candidate, after the submission of the thesis, has gone abroad (other than SAARC countries) and is not likely to return in near future and the reports of the examiners on the thesis are unanimous without any major critical comments or corrections, the DRDC/CRDC may recommend to waive the Viva-Voce. However, if the examiners' reports need some points to be clarified/corrected by the candidate, these shall be communicated to the candidate for giving suitable reply, which shall be considered by the DRDC/CRDC. If the DRDC/CRDC is satisfied, it shall recommend to the URDC for the waiver of the Viva-Voce.
<b>XV.8</b>	<b>Review of Examiners' Report in case the thesis is rejected</b>
	The Vice-Chancellor shall have the power to constitute an independent three member review panel to investigate the cause of rejection of thesis. The review panel shall examine the research work and the examiners' report thereon and submit their findings to the Vice-Chancellor for necessary action. It may also examine the matter to suggest whether the research scholar can further work on the same topic to rebuild his/her initial work and the correct course of action for achieving that and time frame needed for resubmission of his/her thesis without exceeding the total time period prescribed for submission of thesis in these Ordinances.

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XV.9	<b>Depository with INFLIBNET</b>
	Following the successful completion of the evaluation process and before the announcement of the award of the Ph.D. degree(s), the office of the CoE shall submit an electronic copy of the Ph. D. thesis to the INFLIBNET, for hosting the same so as to make it accessible to all Institutions/Colleges.
XV.10	<b>Award of the Degree</b>
a)	The reports of all the examiners on Annexure H-1 and the VVC shall be placed before the concerned URDC for consideration. In the case of unanimous recommendations, the URDC shall approve the award of the Ph. D. degree provided the candidate produces 'No Dues Certificate' in a prescribed form. In all other cases, the URDC shall take its specific decision based on the reports of the examiners as well as the VVC.
b)	After the approval of thesis by the URDC for the award of the degree, the provisional degree shall be issued to the candidate by the Controller of Examinations to the effect that the Degree has been awarded in accordance with the provisions of the UGC Regulations, 2016. for which the candidate shall apply in a prescribed form by paying the prescribed fee. The candidate concerned may also be given the examiners' reports after the approval of the thesis for which he/she shall apply separately. However, in case of thesis rejected by examiners, the confidentiality of the reports shall be maintained until the final order of the Vice-Chancellor is obtained in this regard.
c)	The year of award of the Ph. D. degree shall be the same as the year of submission of the thesis, if the thesis is accepted without revision. If the thesis is recommended for revision, the year of award of the Ph. D. degree shall be the year of submission of revised thesis.
d)	The Ph. D. degree certificate shall mention the title of the thesis, the discipline of research and the Department/Centre and the School in which the candidate was admitted for the Ph. D. Programme.
e)	After the approval of the thesis for the award of the degree, the abstract shall be published in the "Abstracts of Accepted Theses for the Ph. D. Degree" of the Central University of South Bihar.
f)	Once a thesis has been approved for the award of the Ph. D. degree, the candidate shall, in case of publication of the thesis in full or in part, state on the title page that it was a thesis approved for the award of the Ph. D. degree of the Central University of South Bihar, or based upon that thesis.
<b>XVI. FEES PAYABLE</b>	
XVI.1	Fees payable by a candidate admitted to the Ph. D. Programme shall be as prescribed by the University from time to time.
XVI.2	Full fee, as applicable, shall be payable by the Ph. D. scholars for all the periods for which extension is granted.

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XVI.3	Part-time research scholars shall pay fees as prescribed by the university during their residency period within the university. For the period during which they are carrying out research work in their parent organization, they shall pay the fees as prescribed by the University.
XVI.4	The university employees and the teachers of university, who have been admitted as research scholars, shall pay the fees as prescribed by the university.
XVI.5	If any candidate is already enrolled in the University, irrespective of whether he/she is a part-time or full-time research scholar, he/she shall be exempted from the enrolment fee.
XVI.6	Fees once paid to the University shall not be refunded except the caution money, which shall be refunded to the Ph. D. scholar within one year from the date of award of the Ph. D. degree or cancellation of admission on any ground, subject to the adjustment of any dues payable by him/her. However, if the candidate leaves the Ph. D. Programme or is terminated from the Programme within one year of his/her admission, the caution money shall not be refunded.
XVI.7	A waiver of 50% research and laboratory (if applicable) fees will be admissible for the full time Ph. D. scholars not availing fellowship subject to their satisfactory performance.

**XVII. UNFAIR MEANS AND PLAGIARISM**

XVII.1	In case a Ph.D. candidate is found adopting or suspected of adopting unfair means or copying other's work and inserting it in his/her work without proper acknowledgement, credit and reference, such penal action shall be taken by the University as may be necessary to uphold the sanctity and the integrity of the examination system/research work, and the credibility of the University.
XVII.2	The University Unfair Means Committee appointed by the Academic Council for this purpose may take suo-moto cognizance of all such cases. Such cases may also be reported by any person to the Unfair Means Committee/Head of the Department or Centre/Dean of the School/Vice-Chancellor who will forward the matter to the standing committee for its consideration and recommendation on the basis of which appropriate action shall be taken by the Vice-Chancellor.

**XVIII. FINANCIAL ASSISTANCE**

XVIII.1	Subject to the availability of fellowships, the Ph. D. candidates, who are admitted as full-time research scholars through Entrance Test would be entitled to CUSB Research Fellowship of such amount as may be decided by the Schools/University and/or directed by the UGC/MHRD/Government of India from time to time. This award shall be strictly subject to the fulfilment of all the conditions governing such awards.
XVIII.2	In addition to the CUSB Research Fellowship, such candidates may also be entitled to contingency grant in accordance with the decisions of the University.
XVIII.3	The maximum duration for which the CUSB Research Fellowship can be awarded to any Ph. D. student is three years. The award shall be on year-to-year basis subject to the satisfactory academic and research performance and satisfactory performance in the discharge of responsibilities assigned to him/her under the scheme.
XVIII.4	The Ph.D. scholar getting financial assistance from an external sponsoring agency, such as UGC, CSIR, ICSSR, DBT, DST, DRDO, etc. shall be governed by the rules and regulations of that sponsoring body as well as of CUSB.

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XIX. CANCELLATION OF ADMISSION AND REGISTRATION	
XIX.1	The admission of a Ph. D. candidate shall be cancelled by the Vice-Chancellor on report from the concerned DRDC/CRDC in any one of the following eventualities:
i.	If the candidate is absent for a continuous period of four weeks without prior information/sanction of leave.
ii.	If two consecutive progress reports of the candidate are unsatisfactory.
iii.	If the candidate's research plan proposal/research plan proposal seminar is/are not approved even after the submission of revised proposal/revised seminar.
iv.	If the candidate fails to submit the thesis within the maximum stipulated time as provided in these Ordinances.
v.	If the candidate resigns from the Ph. D. programme and the resignation is duly recommended by the Supervisor.
vi.	If the candidate is found involved in an act of misconduct and/or indiscipline and his/her termination has been recommended by the competent authority.
XX. TEMPORARY WITHDRAWAL FROM THE PROGRAMME	
XX.1	A candidate admitted to the Ph. D. Programme may be permitted by the Dean of the School, on the recommendation of the DRDC/CRDC, to temporarily withdraw from the Programme on some specific reasons, and later allowed to join back to complete the research and submit the thesis, without exceeding the maximum prescribed time limit for the thesis submission as per clause.
XX.2.	This withdrawal may be granted for whole or part of the semesters provided it does not affect the coursework. The temporary withdrawal may be permitted for any one of the following reasons:
(i)	If the candidate is suffering due to prolonged illness, supported by medical certificates.
(ii)	In the event of illness or death of candidate's parents/spouse.
(iii)	If a candidate gets a professional employment, and if such candidate has to undergo course work as part of the Programme, he/she shall be allowed to take up the job only after completing the course work.
(iv)	If a fulltime sponsored candidate after fulfilling the minimum period requirement for the submission of the thesis joins back his/her parent organization.
(v)	Any other event in which the Vice-Chancellor is convinced that the situation faced by the research scholar warrants his/her temporary withdrawal from the Programme without exceeding the maximum time-limit provided in these Ordinances for submission of thesis.

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XX.3	During the period of withdrawal the candidate will be required to pay the prescribed fee, to maintain continuance of his/her Ph.D. registration.
XX.4	The residential requirement of the candidates, who are allowed temporary withdrawal, shall be automatically extended by a period equivalent to the duration of the withdrawal, without exceeding the maximum period laid down in Clause IX.2.
<b>XXI. AMENDMENTS</b>	
	Any amendment, if needed, in the provisions of these Ordinances shall be proposed and executed by observing the required procedure. Amendment proposal shall be initiated through the resolution of the DRDC/CRDC of the concerned subject. The URDC shall consider the proposal on merit and if satisfied, shall entrust the Vice-Chancellor to constitute a committee for the purpose. The recommendation of the committee shall be referred to the Academic Council for approval and onward transmission to the Executive Council for confirmation.
<b>XXII. CONCLUSION</b>	
XXII.1	Notwithstanding anything contained in these Ordinances all categories of the candidates shall be governed by the rules and procedures framed by the Academic Council, and are in force at that point of time.
XXII.2	Any doubt or dispute about the interpretation of these Ordinances shall be referred to the Vice-Chancellor, whose decision; in his/her capacity as the Chairperson, Academic Council, shall be final.
XXII.3	All legal disputes shall be subject to Gaya jurisdiction.
XXII.4	The Vice-Chancellor is authorized:
(a)	order a special procedure for the evaluation of a Ph. D. thesis to protect the work of classified nature involving national security and sovereignty and/or to protect the intellectual property rights of the candidate, the supervisor and the University.
(b)	relax any of the provisions laid in these Ordinances for handling circumstances not covered by these Ordinances.

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**Department of Chemistry**  
**School of Physical and Chemical Sciences**

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**Syllabus of Ph.D. Programme in Chemistry**  
*(Proposed to be implemented from the session 2019-2020)*



**Central University of South Bihar**  
**Gaya-Panchanpur Road, Gaya-824236**

## Department of Chemistry

The Department of Chemistry under the School of Physical and Chemical Sciences forms a key component of the university. The department is composed of dynamic faculty members and research scholars who are actively engaged in knowledge creation and dissemination at the frontiers of the Chemical Sciences. The discipline has an encompassing effect on the biological and physical sciences and therefore considered a central science. Knowledge and skills in chemistry play a crucial role in finding the solutions to most of the challenges (eg. energy, disease, and environment) faced by the mankind today. The department believes in interdisciplinary approach of learning and fosters a culture of excellence. Undergraduate students of chemistry have been nurtured and mentored well to compete at the national and international levels (eg. selection for the summer research fellowships of National Academies of Sciences, award at National Science Film Festival and more...). The postgraduate programme was launched from the last academic session in 2018-19. Going stronger with the research component, Ph.D. programme is being started from this new academic session in 2019-20. The department envisages scaling greater heights with the launch of Ph.D. programmes and producing globally competent chemists who can solve the pressing problems of the nation.

### MSc. in Chemistry

The programme is for the students who have an interest in chemistry and a desire to explore the frontiers of science. This is a unique programme that combines core chemistry (Organic, Inorganic and Physical) with Nano Chemistry and Green Chemistry. Along with thorough grounding in chemistry, it equips the students with the knowledge and skills in the emerging interdisciplinary area of green nanotechnology which has now become a crucial requirement for the sustainable development globally. Computational Chemistry and Medicinal Chemistry have also been incorporated to equip the students better. The programme follows choice-based credit system (CBCS) where students have the liberty to choose courses from the elective baskets of our department or other departments. The students also have the freedom to choose a few online courses through SWAYAM (Study Webs of Active - Learning for Young Aspiring Minds) portal which further enhances learning. The programme envisages creating good bench strength of future scientists who can solve a wide range of issues and contribute to the scientific advancement of the nation. There is ample opportunity and employability of chemists having sound knowledge, analytical skills and hand-on training on the sophisticated instruments. The chemical industry is India's one of the largest manufacturing sectors and plays an integral role in the country's economic development. The Indian chemical sector currently accounts for 13-14% of total exports. In terms of volume of production, it is the twelfth-largest in the world and the third-largest in Asia. Currently, the per capita consumption of products of the Indian chemical industry is one tenth of the world average, which reflects the huge potential for further growth. The "Make in India" scheme has further given a fresh impetus to this sector. For a sustainable, environment friendly growth, the sector is looking for new technologies that incorporate green chemistry and nanotechnology and there lies the exciting and excellent career opportunities for young chemists. Besides chemical industry, the training imparted in the interdisciplinary area of green nanotechnology will also enable the students to diversify and join other sectors such as energy, photovoltaics, photonics, biosensing and healthcare etc. The curriculum has been designed to keep abreast with changing times. In the long run, the programme is likely to produce globally competent chemists with bright innovative ideas. By

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understanding the nuances of chemistry, these young scientists would be creating new tools, products and technologies to address some of the world's biggest challenges such as (just to name a few) clean affordable energy, biomedical devices and drugs for treating diseases, biosensing and environmental remediation etc.

### Ph.D. in Chemistry

The faculty members and students of the department are engaged in cutting edge research at the frontiers of science. The launch of Ph.D. programme in the upcoming academic session in 2019-20 will further strengthen and institutionalize the culture of research and innovation. The department follows an interdisciplinary approach and offers diverse areas of research which include nano-chemistry, materials chemistry, organic synthesis, medicinal chemistry, photochemistry, catalysis etc. To further encourage the interdisciplinary research, the department has established inter-institutional links and collaborations with renowned laboratories and universities. During the programme, students will acquire new skills while working on state-of-the-art instruments in the department. The ultimate aim of the programme is to produce globally competent chemists who can critically think and analyse a problem, and develop innovative scientific solutions. Equipped with sound knowledge and lab skills, the doctoral students would be able to address some of the biggest scientific challenges facing the mankind today such as energy crisis, lighting & displays, sanitation, diagnostics & therapeutics and many more. The successful completion of the Ph.D. programme will ensure enhanced employability and the students are likely to get positions of eminence in leading research and academic institutions in India as well as abroad.

### Laboratory Facilities & Resources

There are two laboratories in the department. Each lab is spacious enough to accommodate 40 students at a time. There are six working platforms (island tables) and four fumehoods fitted with inlet & outlets for water, LPG and nitrogen to perform the experiments. The lab is equipped with the sophisticated instruments, glassware, plasticware, chemicals & other lab peripherals. The sophisticated instruments available in the labs are as follows

- UV-Visible absorption spectrophotometer
- UV-Vis-NIR absorption spectrophotometer
- Digital pH Meter
- Digital Conductivity meter,
- Digital Thermometer
- Ultrasonicator
- Ice-Flaker
- Magnetic Stirrer cum hot plate (ceramic top)
- Incubator & Shaker
- Circulating water bath with temperature control (5°C to 80 °C)

FTIR and Luminescence spectrometers are in advanced stages of procurement and are likely to be installed in the upcoming session 2019-20.

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### Eligibility Criteria for Admission to Ph.D. Programme

(A) Candidates for admission to the Ph.D. Programme in Chemistry shall have a Master's degree Chemistry/applied Chemistry or in allied subjects (including biochemistry, medicinal chemistry, industrial chemistry, nanoscience, environmental science) with at least 55% marks in aggregate or its equivalent grade 'B' in the UGC 7-point scale (or an equivalent grade in a point scale wherever grading system is followed) or an equivalent degree from a foreign educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions.

(B) A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled and other categories of candidates as per the decision of the Commission from time to time, or for those who had obtained their Master's degree prior to 19th September, 1991. The eligibility marks of 55% (or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned above are permissible based only on the qualifying marks without including the grace mark procedures.

(C) Subject to the conditions stipulated in these Regulations, the following persons are eligible to seek admission to the Ph.D. programme:

- a) Master's Degree holders satisfying the criteria stipulated under Clause (A) and (B) above.
- b) Candidates possessing a Degree considered equivalent to M.Phil. Degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions, shall be eligible for admission to Ph.D. programme.

### MODE OF ADMISSION

A candidate who has passed the qualifying examination with requisite percentage of marks is eligible for admission to the Ph. D. Programme through one of the following modes:

- (A) Admission through Entrance Test
- (B) Direct Admission

### COURSE WORK

- A candidate, admitted to the Ph.D. Programme in Chemistry, shall be required to undertake Course Work as approved by the Academic Council during the initial one or two semesters for a minimum period of one semester. However, this period may be extended for another semester as per the requirements of Department. The candidate shall have to qualify as per the criteria prescribed by the Course Work Ordinances of the concerned Department. The Course Work shall include a course on Research Methodology and Reviewing of Published Research Work in the relevant field.
- Candidates already holding M.Phil. Degree and admitted to the Ph.D. Programme, or those who have already completed the Course work in M.Phil. and have been permitted to proceed to the Ph.D. in Integrated Course, may be exempted by the DRDC/CRDC from the Course Work, subject to the fulfilment of the minimum credits requirement prescribed by the

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Department. Such candidates shall be issued an Exemption Certificate by the University. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. Course work prescribed by the Department.

- The credit assigned to the Ph.D. course work shall be a minimum of 08 credits and a maximum of 16 credits. A minimum of four credits shall be assigned to one or more courses on Research Methodology. Other courses shall be advanced level courses preparing the students for Ph.D. degree. **The details of the courses, course credits and other related matters shall be determined in accordance with the Ordinances of the Department.** However, a minimum of 75 % attendance shall be required in the Course Work for the research scholars registered on part-time basis.
- The Department where the scholar pursues his/her research shall prescribe the course(s) to him/her based on the recommendations of the Research Advisory Committee.
- The courses offered for the Ph. D. Programme may be through lecture, laboratory, field study, design and self-study courses, mini projects and seminars. Each of these courses shall be of doctoral level.

### Course Structure of Ph.D. Programme (Minimum Core: 12)

	Course Title	Theory/Practical (Hrs/Week)	Total Marks	Credit
Core	Research Methodology	4	100	4
Core	Tools, Techniques and Current Research Trends in Chemistry	4	100	4
Core	Research Proposal Preparation and Seminar Presentation	4	100	4

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**Department of Chemistry**  
**Central University of South Bihar, Gaya**

Date: 02/08/2019

A meeting of faculties of Chemistry department has been scheduled on 2<sup>nd</sup> August, 2019 at 10:30 a.m. in the office of Dr. Girish Chandra for discussing the issues related giving the code of courses of PhD.

Following course code has been approved by department committee.

**Course Code of Ph.D. Programme**  
(Minimum Core = 12)

CODE	Course Title	Theory/Practical (Hrs/Week)	Total Marks	Credit
PHCHE1001C04	Research Methodology	4	100	4
PHCHE1002C04	Tools, Techniques and Current Research Trends in Chemistry	4	100	4
PHCHE2003C04	Research Proposal Preparation and Seminar Presentation	4	100	4

Dr. Saurabh Kumar

*Amiya Priyam*  
2.8.19  
Dr. Amiya Priyam

*Sudip Mohapatra*  
02.08.2019  
Dr. Sudip Mohapatra

*Girish Chandra*  
2/8/2019  
Dr. Girish Chandra  
Head, (I/C)

## Research Methodology

**Course objectives:** This course is designed to provide an overview on fundamentals of doing research including scientific terminology, literature, methods, analysis and interpretation of data, preparation of research report and presentation, future aspects of research as a career, importance and applications of scientific research to the society. It will help the students to develop core research skills relevant to a wide spectrum of chemical research including written and oral communication, skills in making scientific observations, and recording and analysing data by participating in discussions or through presentations or group research project associated with a discipline of interest to them. Assignments and tutorials would be included to enhance the course deliver and outcome.

### UNIT I: Principles of Research (20H)

**Foundation of Research:** Objectives of scientific research, research & theory-conceptual and theoretical model, importance of research methodology in scientific research, types and methods of research, evaluation of research/study.

**Research problem:** meaning of research problems, sources of research problems, criteria/ characteristics of a good research problem, errors in selecting a research problem. Hypothesis: Meaning, types of hypothesis.

**Design and execution of experiments,** collection and interpretation of experimental data, arriving at conclusions.

**Errors in chemical analysis,** classification of errors, determination of accuracy of methods, improving accuracy of analysis, significant figures, mean, standard deviation.

**Basic knowledge of computer systems:** General awareness of software packages and other scientific applications. Knowledge of MS office application, spreadsheets, basic ideas on the use of internet in chemistry education. Knowledge of data analysis for research publications.

### UNIT II: Literature Survey (15H)

**Introductions:** Sources of information, need for reviewing literature, primary-secondary and tertiary sources, journals, journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text books, current contents, patents. Introduction to chemical abstracts and beilstein, subject index, substance index, author index, formula index and other indices with examples.

**Digital:** Web resources, E-journals, journal access, TOC alerts. Hot articles: Citation index, UGC infonet, E-books, Impact Factors, Search engines- Google scholar, chemical industry, Wiki-databases, chemSpider, ScienceDirect, SciFinder, Scopus.

### UNIT III: Concepts of Chemical Safety (15H)

Chemical safety and ethical handling of chemicals, safe working procedure and protective environment, emergency procedure and first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmosphere, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals.

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**UNIT IV: Ethics and IPR (10H)**

Regulatory bodies, practices and compliances, Good Laboratory Practices (GLP), Research Ethics & Misconduct, Patents, Copyrights, GI and Trademarks, Product and process patent, Patent Treaties and Convention, process of filing patent, database of patent, search and retrieval.

**References**

1. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd., Prentice Hall, (2002).
2. Research Methodology. Methods and Techniques: C. R. Kothari.
3. Paul D Leedy, Jeanne E Ormrod and Jeanne Ellis Ormrod, Practical Research: Planning and Design, Prentice Hall, 2004.
4. Robert V Smith, Graduate Research: A Guide for Students in the Sciences, University of Washington Press, 1998.
5. Biggs Pete, Computers in Chemistry, Oxford University Press, 2000.
6. Cropper William H, Mathematical Computer Programs for Physical Chemistry, Springer.
7. Chemical Safety Manual, IIT Bombay.  
<http://www.iitb.ac.in/safety/sites/default/files/chemical%20safety%20manual.pdf>.
8. Chemical Safety Manual, ACS.  
<https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/chemical-safety-manual-teachers.pdf>.

**Tools, Techniques and Current Research Trends in Chemistry**  
(Any Four Topics will be covered, Unit I or Unit II are compulsory)

**UNIT I: Spectroscopy and Spectrometry (24H)**

NMR phenomenon, spin 1/2 nuclei, Zeeman splitting, effect of magnetic field strength on sensitivity and resolution, chemical shift  $\delta$ , inductive and anisotropic effects on  $\delta$ , chemical structure correlations of  $\delta$ , chemical and magnetic equivalence of spins, spin-spin coupling, structural correlation to coupling constant J, first order patterns. Second order effects, selective decoupling, use of chemical shift reagents for stereochemical assignments.  $^1\text{H}$  and  $^{13}\text{C}$  chemical shifts to structure correlations. Study of dynamic processes by NMR. 2D NMR and its application in organic chemistry

UV-Vis and IR: Principles and applications

**Fluorescence Spectroscopy:** Introduction, Phenomenon and characteristic of fluorescence, fluorescence life time, Fluorescence Resonance Energy Fluorescence quenching, types of quenching processes, Transfer Instrumentations, experiments for fluorescence quenching measurements, Applications of Fluorescence Spectroscopy.

**Mass Spectrometry:** Introduction and its application

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- Signature: Anurag
- Signature: Jha
- Signature: S.P.E.
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### Unit II: Imaging and Microscopy (24H)

**Scanning Electron Microscope (SEM):** SEM Basics of electron optics, resolution in SEM. Contrast Mechanisms. Detectors. STEM. Sample preparation for the SEM.

**Atomic Force Microscopy (AFM):** Basic Machinery, Deflection detection methods, control systems. Harmonic oscillator response. Contact mode AFM. Lateral Force Microscopy. Determination of spring constants,

**Scanning Tunneling Microscopy (STM):** Theoretical Description of tip-sample tunnelling. STM components. Feedback control. Speed. Stability and Drifts. Vacuum and Low temperature STM. Application examples, Scanning Tunneling Spectroscopy and Spectroscopic Imaging. Interpretation of STM data;

**Transmission Electron Microscopy (TEM):** Theoretical Description of TEM image formation. Anatomy of the TEM. Sample preparation.

### Unit III: Nanomaterials (12H)

Introduction to the nano- the length scale, meaning of the terms nanomaterials, nanoscience and nanotechnology Nanomaterials as low dimensional systems, classification into 2D, 1D and 0D systems. Electronic structure of such systems

Stabilization of colloidal nanoparticles, electrostatic and steric stabilization, surface functionalization of nanoparticles. Classification of nanomaterials

Nanocomposites: Different types of Nanocomposite; Core-Shell structured nanocomposites; Superhard Nanocomposites

Synthesis of nanomaterials: Top-down, bottom-up approach, liquid-phase synthesis, gas-phase synthesis, vapour-phase synthesis

### Unit IV: Supramolecular Chemistry (12H)

Terminologies and nomenclature in supramolecular chemistry, Chemical interactions leading to supramolecular assemblies; Molecular recognition through pre-organisation and complementarity. Concept of molecular receptors and design principles. Receptors and coordination and inverse coordination, host-guest chemistry, synthesis of supramolecular structures.

Molecular machines, molecular and supramolecular devices, supramolecular photochemistry and photonic devices, Molecular wires and rectifying devices. Ion responsive monolayers, application of supramolecular chemistry.

### Unit V: Bio-inorganic Chemistry (12H)

Metal ions in biology; Active-site structure and function of metallo-proteins and enzymes with Mg, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo and W ions.

Heme and Nonheme structures with mono-, di- and multinuclear metal centers, such as Fe: Hb, Mb, Ht, P-450, MMO, ferridoxins, Fe-S clusters; Cu: hemocyanin, hemerythrin; Mn: SOD, Catalase; Co: vitamin B12; Zn, Ni, urease. Metal environments (ligand type, coordination geometry), electronic, magnetic and redox properties.

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Use in biological processes.

Additional discussions on Nitrogenase and Oxygen Evolving Centre in Photosystem II.

### Unit VI: Sustainable Energy Source (12H)

Introduction to hydrogen as a Green Fuel. Current energy Scenario, fuel, present, past and future. Hydrogen as a chemical fuel, the hydrogen economy, hydrogen production.

Concepts in photochemical water splitting, hydrogen production by water splitting. Recent trends in water splitting.

Solar cells: Principles for conversion of solar energy to electricity, fundamental calculations and measurement of efficiency of solar cells, different solar cell techniques, photoelectric energy, dye sensitized solar cells, charge separation and transport, new solar cell materials.

### Unit VII: C-H activation and C-C coupling (12H)

Introduction, History of C-H activation and C-C coupling reactions, brief comparisons of chemistry of different metal mediated reactions, Pd(II)-Catalyzed C-H Activation/C-C cross-coupling reactions, catalytic cycle, olefination of  $sp^2$  C-H bonds, arylation of  $sp^2$  and  $sp^3$  C-H bonds. Palladium-catalyzed carbon-carbon bond formation via cross coupling

### Unit VIII: Fluorine Chemistry (12H)

Introduction of organofluoro compounds, Properties of fluorine atom, Effects of fluorine in organic compounds, Electrophilic and nucleophilic fluorinating agents and their application in organic synthesis, medicinal chemistry and agrochemistry. Organic synthesis of fluoroorganic compounds directed by use of organometallic reagent and free radical fluorination

### Unit IX: Organocatalysis (12H)

General Principles: Energetic, Catalytic cycles, catalytic efficiency and life time, selectivity. Introduction of organocatalysis, activation mode, importance and classifications, examples by taking C-C bond formation reactions, asymmetric synthesis by organocatalysis

### Unit X: Green and Sustainable Organic Synthesis (12H)

Sustainable Organic Chemistry, catalyst, Introduction to Green Chemistry, Green Solvents: Water, ionic liquids, supercritical fluids, glycerol, biphasic systems, eutectic solvents. Radiation based techniques in green synthesis: microwave synthesis, and sonochemical based synthesis.

### Unit XI: Medicine from Natural Products (12H)

Natural Products, Metabolites, Drug, medicine and poison, Traditional medicine, drugs developed from natural products, drugs developed from traditional medicine, Case studies of development of drug for malaria and antibiotics. Nature as a source of inspiration for development of new drugs. Techniques of Isolation: extraction, separations, and characterisation

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### UNIT XII: Computational Chemistry (12H)

List useful numerical methods for chemistry. Potential energy surfaces and intermolecular interactions: Quantum mechanical ab initio calculations. Energy calculations using molecular mechanics. Approximation of the total potential energy. Study of cluster and bulk properties through simulations. Modelling of small molecules. Nonpolarizable and polarizable rigid models. Flexible models and calculation of force constants. Structural, dielectric and dynamical properties of a polar medium: Continuum models versus molecular models.

### UNIT XIII: Polymers (12H)

**Conducting polymers:** Electrically conducting polymers and their uses (polyanilines, polypyrrole, polyacetylene and polythiophene). Photoconductive polymers. Liquid crystal polymers – smectic, nematic and cholesteric structures. **Ionic exchange polymers:** Cationic and anionic exchange polymers and their uses. Eco-friendly polymers. Poly lactide from corn derived dextrose, PHB etc. Membrane separation. Filtration – micro, ultra and nanofiltration. Separation of gases – permselectivity and gas permeability of representative polymers. Liquid separation – dialysis, electro osmosis and reverse osmosis. Fire retarding polymers, photonic polymers. Inter penetrating networks (IPN), polymers in photo lithography.

### UNIT XIV: Biophysical and Surface Phenomena (12H)

**Biophysical Chemistry and Surface Chemistry:** Thermodynamics in Biochemistry (Fundamentals and Applications); Biopolymers; Biomembranes, Active transport and passive transport, Multiple equilibria, Specific examples of multiple equilibria, Transport processes; General features of transport processes; Optical systems for the study of transport processes, self organizing systems their interactions and solutions properties. Preparation, Characterization and Application of nanoparticles Surface and Biophysical Techniques.

#### References

1. Spectroscopic identification of organic compounds, R. M. Silverstein, G.C. Bassler, T. C. Morrill, John Wiley, 1991.
2. Spectroscopic methods in organic chemistry, D. H. Williams, I. Fleming, Tata McGraw Hill. 1988.
3. Organic Spectroscopy, W. Kemp, 2<sup>nd</sup> edition, ELBS-Macmillan, 1987.
4. D. A. Skoog and D. M. West, Fundamental of Analytical Chemistry, International Edition, 7th Edition (1996), Saunders College Publishing, Philadelphia, Holt, London.
5. R. L. Peacock, L.D. Shields, T. Cairns and L.C. McWilliam, Modern Methods of Chemical Analysis, 2<sup>nd</sup> (1976), John Wiley & Sons, New York.
6. L. R. Snyder and C. H. Harvath, An introduction to separation science, Wiley Interscience.
7. H. H. Willard; L. L. Merit; J. A. Dean & F. A. Settle, Instrumental Methods of Analysis (CBS).
8. Introduction to instrumental analysis by R. D. Broun, Mc Graw Hill (1987).
9. Fundamentals of analytical chemistry by D. A. Skoog, D. M. West and H. J. Holler sixth edition (1992) and Principles of Instrumental Analysis Skoog, West, Niemann
10. Vogel Text Book of quantitative analysis 6th Ed.

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11. Imaging: A Laboratory Manual" by Rafael Yuste (Editor) (ISBN: 0879699361).
12. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM" by Ray F. Egerton (ISBN: 1441938370).
13. Low Voltage Electron Microscopy: Principles and Applications" by David C. Bell and Natasha Erdman (ISBN: 111997111X).
14. "Micro Computed Tomography: Methodology and Applications" by Stuart R. Stock (ISBN: 1420058762).
15. Physical methods for chemists: R.S. Drago.
16. Diffraction and Imaging Techniques in Material Science. Electron Microscopy by S Amelinckx (North-Holland Publ. Comp).
17. Fluorine in Medicinal Chemistry and Chemical Biology, Iwao Ojima (Editor), Wiley-Blackwell, 2009, 978-1405167208.
18. Fluorinated Heterocycles (ACS Symposium Series), OUP USA, 2009, ISBN-13: 978-0841269538.
19. J.T.Welch, S. Eswarakrishnan, Fluorine in Bioorganic Chemistry, Wiley, New York, 1991.
20. B. E. Smart in Chemistry of Organic Fluorine Compounds II (Eds.: M. Hudlicky, A. E. Pavlath), American Chemical Society, Washington, DC, 1995.
21. T. Hiyama, Organofluorine Compounds: Chemistry and Applications, Springer, Berlin, 2000.
22. Berkessel, A. and Gröger, H. Asymmetric Organocatalysis, 2005, Wiley-VCH.
23. Dalco, P.I. Enantioselective Organocatalysis, 2007, Wiley-VCH.
24. MacMillan, D.W.C. The advent and development of organocatalysis. Nature 2008, 455, 304-308.
25. Organocatalysis, Manfred Reetz, Benjamin List, Stefan Jaroch, Hilmar Weinmann Springer, ISBN: 3540734945,9783540734949.
26. Stereoselective Organocatalysis, RAMON RIOS TORRES, Wiley.
27. Ionic Liquids in Synthesis, Peter Wasserscheid and Tom Welton, WILEY-VCH Verlag GmbH & Co. KGaA, 2008.
28. Green Chemistry and Catalysis, R.A. Sheldon, I. Arends and U. Hanefeld, WILEY-VCH Verlag GmbH & Co. KGaA (2007).
29. Green Solvents for Chemistry: Perspectives and Practice, William M. Nelson Oxford University Press (2003).
30. Biocatalysis for Green Chemistry and Chemical Process Development, Junhua Tao and Romas Joseph Kazlauskas, WILEY-VCH Verlag GmbH & Co. KGaA (2011).
31. Green chemistry for chemical synthesis, Chao-Jun Li and Barry M. Trost, Proceedings of National Academy of Sciences (USA), year 2008, vol. 105, pages 13197-13202
32. New Methodologies and Techniques for a Sustainable Organic Chemistry, Editors: Mordini, Alessandro, Faigl, Ferenc, springer.
33. Concepts of Nanochemistry, Ludovico Cademartiri, Geoffrey A. Ozin, Jean-Marie Lehn, WILEY-VCH Verlag GmbH & Co. KGaA, (2009).
34. Nano: the Essentials, T. Pradeep, Tata McGraw Hill Education Private Limited, New Delhi (2007).
35. Textbook of Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw Hill Education Private Limited, New Delhi (2012).
36. Nanochemistry: A Chemical Approach to Nanomaterials, Geoffrey A. Ozin, André C. Arsenault, Ludovico Cademartiri, Royal Society of Chemistry (2009).
37. Nanoparticles: From Theory to Application, Günter Schmid, WILEY-VCH Verlag GmbH & Co. KGaA, (2011).

**Supramolecular Chemistry:**

1. Supramolecular Chemistry by J. W. Steed and J. L. Atwood, John Wiley and Sons, Ltd.

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*Yun*  
*Jim*  
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2. Supramolecular Chemistry-Concepts and Perspectives by Jean –Marie Lehn, VCH.
3. Principles and Methods in Supramolecular Chemistry by Hans-Jorg Schnider and Anatoly K. Yatsimirsky, John Wiley and Sons, Ltd.
4. G. W. Gokel (Editor), Advances in Supramolecular Chemistry, Vol 1 (1990), Vol 2 (1992), Vol 3 (1993), JAI Press, Greenwich.
5. H. Dodziuk, Introduction to Supramolecular Chemistry, Kluwer Academic Publishers, The Netherlands (2002).

### Bio-Inorganic Chemistry:

1. S. J. Lippard, J. M. Berg, Principles of Bioinorganic Chemistry. 1<sup>st</sup> Ed, University Science Books, California, 1994.
2. H. B. Gray, E. I. Stiefel, J. S. Valentine, I. Bertini, Biological Inorganic Chemistry: Structure and Reactivity, 1<sup>st</sup> Ed, University Science Books, California, 2006.
3. L. Que (Editor), Physical Methods in Bioinorganic Chemistry: Spectroscopy and Magnetism, 1<sup>st</sup> Ed, University Science Books, California, 2000.

### Sustainable Energy Source:

1. Sustainable Chemistry by G. Reniers & C. A. Brebbia, WIT Press, 1<sup>st</sup> edition 2011.
2. Green Chemistry: An Introductory Text by Mike Lancaster, Royal Society of Chemistry, 2<sup>nd</sup> edition 2010.
3. Photochemical Water Splitting: Materials and Applications, N. Chouhan, Ru-Shi Liu, Jiujun Zhang, CRC Press; 1<sup>st</sup> ed. 2017.
4. Photoelectrochemical Water Splitting: Materials, Processes and Architectures Hans-Joachim Lewerenz, Laurie Peter, Royal Society of Chemistry, 2013.
5. Surface Modifications and Growth of Titanium Dioxide for Photo- Electrochemical Water Splitting John Alexander, Springer; 1<sup>st</sup> ed. 2016.

### References for Physical Chemistry

1. A.R. Leach, Molecular Modeling: Principles and Applications, Longman (1996)
2. D. Frenkel and B. Smit, Understanding Molecular Simulation: From algorithms to Applications, Academic Press (1996)
3. P.W. Atkins, Molecular Quantum Mechanics, Oxford (1997)
4. Nicholas J. Turro, Modern Molecular Photochemistry, Univ. Science Books; (1991)
5. K. K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, Wiley; (1978)
6. W. T. Silvest, Laser Fundamentals, Cambridge University Press ( 2008)
7. Jenny Nelson, The Physics of Solar Cells, ICP ( 2003)
8. Ryan O'Hayre, Suk-Won Cha, Whitney Colella and Fritz B. Prinz, Fuel Cell Fundamentals, Wiley; ( 2009)
9. TR Crompton, Battery Reference Book, Elsevier, (2000).

## Research Proposal Preparation and Seminar Presentation

### UNIT I: Research Proposal (15H)

**Developing a Research Proposal:** Format of research proposal, individual research proposal and institutional proposal. **Research Report:** Format of the research report, style of writing the report, references and bibliography

**Application and uses of common softwares in chemistry-** origin, chemsketch, chemdraw. Gaussian software and its use.

27/10  
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Soumitra  
Ananya Patra

Jishu

Elke

**UNIT II: Literature Survey (45H)**

Extensive survey of published literature relevant to the chosen topic of research which appeared in referred research journals of national and international repute, edited books, reference books, monographs, survey / study reports, dissertations / theses published in book form, and books / reports containing proceedings of national and international conferences / seminars / symposia. Students have to make a review on the given topic/proposal of research work.

There will be two seminar presentations (*viz.* presentation-I and presentation-II). The Ph.D. seminar courses require students to attend and deliver seminars as per their selected themes. Evaluation will be based on review preparation, participation and on the quality of the talk deliver.

A. K.  
Shankar  
29-05-19

107/19

John  
Amritha

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