

**Department of Chemistry**  
**5 year BSMS (Chemical Sciences) with exit policy**

**Component wise distribution**

Main Curriculum Components	Sub Components	Approved Credits for 5 year BSMS	Approved Credits Range	Proposed credits for 5 year BSMS by Department	Proposed Credits Range	Approved Credits for 4 year BSMS exit	Approved Credits Range	Proposed credits for 4 year BSMS exit by Department	Proposed Credits Range
Institute Core Course	HSSC	5	52-58	5	52	5	52-58	5	52
	HSSEC	6		6		6		6	
	MC	3		3		3		3	
	BSC	12-20		16		12-20		16	
	ESC	8-20		11		8-20		11	
	DSE	4		4		4		4	
	ESSC	3		3		3		3	
	TM	4		4		4		4	
Program Core Course	CCCC	52-62	127-133	59	128	40-48	87-91	50	91
	AI/ML	2		2		2		2	
	Engg. Analysis and design (design thinking based project)/Industry Oriented Problem Solving/ Lab based Project/ Practical Problem/ Case study	4		4		4		4	
	Technical Communication	2		2		2		2	
	BTP/Entrepreneurship/ Project-based internship/PEC	16		16		6-10		6	
	PEC	32-40		39		22-26		21	
	TEB	6-8		6		6-8		6	
	OEC	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12
	CORE	2	2	2	2	2	2	2	2
	Total	<b>190-200</b>		<b>191-194</b>		<b>150-160</b>		<b>154-157</b>	
	MSC/DHC	<b>18/20</b>		<b>18/20</b>		<b>18/20</b>		<b>18/20</b>	
	Grand Total			<b>209-211</b>				<b>172-177</b>	

**DEPARTMENT OF CHEMISTRY**  
**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**  
**5 Years BSMS (Chemical Sciences)**

Program Code : 321 - BS-MS (Chemical Sciences)  
Department : CY - Chemistry

**Teaching Scheme**

<b>Year</b>	<b>Credits in Autumn Semester</b>	<b>Credits in Spring Semester</b>	<b>Credits (Year-wise)</b>
1	23	23	46
2	23/24	23/24	46/48
3	24/25	19	43/45
4	18	22	40
5	6	10	16
Grand Total			<b>191/194</b>
Total with Minor Specialization Courses	with additional 18-20 credits (mentioned in the parentheses)		<b>209/214</b>

	<b>Components</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Comments</b>
	Discipline (DIS)	20	10	To be evaluated by DoSW
<b>Non-Credit Elements (NCE)</b>	NCC/NSS/NSO	8	4	To be evaluated by DoSW
	Internship (INT)	32	10	1 week internship= 1 unit (To be coordinated by departments/centres/school)
	Participation in professional development programs by Industry experts/ field experts (PPD-1, PPD-2 & PPD-3)	12	6	To be coordinated by departments/centres/school (2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup> Years)
<b>Minimum non-credit to be earned: 30</b>				

**DEPARTMENT OF CHEMISTRY**  
**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**  
**4 Years BSMS (Chemical Sciences) Exit**

**Program Code** : 321 - BS-MS (Chemical Sciences)  
**Department** : CY - Chemistry

**Teaching Scheme**

<b>Year</b>	<b>Credits in Autumn Semester</b>	<b>Credits in Spring Semester</b>	<b>Credits (Year-wise)</b>
1	23	23	46
2	23/24	23/24	46/48
3	24/25	19	43/44
4	13	6	19
Grand Total			<b>154/157</b>
Total with Minor Specialization Courses	with additional 18-20 credits (mentioned in the parentheses)		<b>172-177</b>

Non-Credit Elements (NCE)	Components	Maximum Units	Minimum Units	Comments
	Discipline (DIS)	16	8	To be evaluated by DoSW
	NCC/NSS/NSO	8	4	To be evaluated by DoSW
	Internship (INT)	24	8	1-week internship= 1 unit (to be coordinated by the deptt. /Centres/School)
	Participation in professional development programs by Industry experts/ field experts (PPD-1 & PPD-2)	8	4	To be coordinated by the departments/Centres/school (2 <sup>nd</sup> & 3 <sup>rd</sup> Years)
<b>Minimum non-credit units to be earned: 24</b>				

## DEPARTMENT OF CHEMISTRY

Program Code : 321 BS-MS (Chemical Sciences)  
 Department : CY Chemistry  
 Year : I

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	HSI-101	Soft Skills-I	HSSC	3	2	0	2	2	0	10-25	25	15-25	30-40	-
2.	MAI-101	Mathematics-I	BSC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
3.	PHI-101	Physics-I	BSC	4	3	1	2/2	3	0	15-30	20	15-25	30-40	0
4.	CYC-101	Computer Programming	PCC	4	3	0	2	3	0	10-25	25	15-25	30-40	0
5.	TMI-101	Tinkering & Mentoring	TM	4	T-2	-	-	-	-	70	30	-	-	-
					M-2	2	0	0	2	-	50	-	-	50
6.	CHE-101	Energy Engineering	ESC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
		<b>Total</b>		<b>23</b>										
<b>(Spring)</b>														
1.	HSI-102	Indian Knowledge System	HSSC	2	2	0	0	2	0	20-35	-	20-30	40-50	-
2.	MAI-102	Mathematics-II	BSC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
3.	ESS-103	Environmental Science and Sustainable	ESSC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	PHB-103	Modern Physics	BSC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
5.	CYC-102	Organic Chemistry-I	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
6.	BEE-102	Introduction to Computational Biology	ESC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
7.	BEE-105	Introduction to Biophotonics	ESC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
		<b>Total</b>		<b>23</b>										

## DEPARTMENT OF CHEMISTRY

Program Code : 321 BS-MS (Chemical Sciences)  
 Department : CY Chemistry  
 Year : II

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	HSSEC-I	HSS Elective Course	HSSEC	3										
2.	OEC-I	Open Elective Course	OEC	3/4										
3.	MSI-101	Fundamentals of Management	MC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	CYC-201	Thermodynamics and Electrochemistry	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
5.	CYC-203	Main Group and Cluster Chemistry	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
6.	CYC-205	Organic Chemistry-II	PCC	4	3	0	2	3	0	10-25	25	15-25	30-40	0
7.	CYC-207	Quantum Chemistry and Chemical Bonding	PCC	4	3	1	0	3	0	20-35	0	20-30	40-50	0
		<b>Total</b>		<b>23/24</b>										
<b>(Spring)</b>														
1.	DAI-101	Data Science	DSC	4	3	1	0	3	0	20-35	-	20-30	40-50	-
2.	OEC-II	Open Elective Course	OEC	3/4										
3.	CYC-202	Coordination and Organometallic Chemistry	PCC	4	3	0	2	3	0	10-25	25	15-25	30-40	0
4.	CYC-204	Chemical Kinetics and Catalysis	PCC	4	3	0	2	3	0	10-25	25	15-25	30-40	0
5.	CYC-206	Organic Chemistry-III	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
6.	CYC-208	Molecular Symmetry, Group Theory and Spectroscopy	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
7.	CYC-291	Technical Communication	PCC	2	2	0	0	2	0	20-35	0	20-30	40-50	0
		<b>Total</b>		<b>23/24</b>										

## DEPARTMENT OF CHEMISTRY

Program Code : 321 BS-MS (Chemical Sciences)  
 Department : CY Chemistry  
 Year : III

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	HSSEC-II	HSS Elective Course	HSSEC	3										
2.	OEC-III	Open Elective Course	OEC	3/4										
3.	CYC-351	Artificial Intelligence in Chemistry	PCC	2	2	0	0	2	0	20-35	-	20-30	40-50	-
4.	CYC-301	Advanced Coordination Chemistry	PCC	3	3	0	0	3	0	20-35	-	20-30	40-50	-
5.	CYC-303	Physical Laboratory	PCC	4	0	0	8	0	4	-	50	-	-	50
6.	CYC-305	Inorganic Laboratory	PCC	4	0	0	8	0	4	-	50	-	-	50
7.	CYT-I	Talent Enhancement-I	TEB	3	1	0	4	2	4	10-15	15-25	10-15	15-25	40-50
8.	CYC-399	Community Outreach	CORE	2	0	0	4	0	4	100				
		<b>Total</b>		<b>24/25</b>										
<b>(Spring)</b>														
1.	CYC-302	Organic Laboratory	PCC	4	0	0	8	0	4	-	50	-	-	50
2.	CYT-II	Talent Enhancement-II	TEB	3	0	0	6	0	4	-	50	-	-	50
3.	CYL-I	Program Elective Course-I	PEC	3	3	0	0	3	0	20-35	-	20-30	40-50	-
4.	CYL-II	Program Elective Course-II	PEC	3	3	0	0	3	0	20-35	-	20-30	40-50	-
5.	CYL-III	Program Elective Course-III	PEC	3	3	0	0	3	0	20-35	-	20-30	40-50	-
6.	CYL-IV	Program Elective Course-IV	PEC	3	3	0	0	3	0	20-35	-	20-30	40-50	-
7.	MSC/DHC-I	Minor Specialization Course-I/Departmental Honours Course-I	MSC/DHC	3/4										
		<b>Total</b>		<b>19/ 22-23</b>										
<b>Note:</b> Students willing to exit with BS Degree in Chemical Sciences must inform to Dean (Academic Affairs) after completion of 6 <sup>th</sup> semester														



**DEPARTMENT OF CHEMISTRY**

Program Code : 321 BS-MS (Chemical Sciences)  
 Department : CY Chemistry  
 Year : IV

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	CYC-401	Advanced Surface and Colloidal Chemistry	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
2.	CYL-V	Program Elective Course-V	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
3.	CYL-VI	Program Elective Course-VI	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	CYL-VII	Program Elective Course-VII	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
5.	CYL-VIII	Program Elective Course-VIII	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
6.	CYL-IX	Program Elective Course-IX	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
7.	MSC/DHC-II	Minor Specialization Course-II/Departmental Honours Course-II	MSC/DHC	3/4										
		<b>Total</b>		<b>18/21-22</b>										
<b>(Spring)</b>														
1.	CYC-400	Lab based Project	PCC	4	0	0	8	0	0	0	50	0	0	50
2.	CYC-402	Advanced Molecular Spectroscopy	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
3.	CYC-404	Heterocyclic Chemistry	PCC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	CYL-X	Program Elective Course-X	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
5.	CYL-XI	Program Elective Course-XI	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
6.	CYL-XII	Program Elective Course-XII	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
7.	CYL-XIII	Program Elective Course-XIII	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
8.	MSC/DHC - III	Minor Specialization Course-III/Departmental Honours Course-III	MSC/DHC	3/4										
		<b>Total</b>		<b>22/25-26</b>										

**DEPARTMENT OF CHEMISTRY**

Program Code : 321 BS-MS (Chemical Sciences)  
 Department : CY Chemistry  
 Year : V

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	CYP-501	Thesis Stage I	PCC	6	0	0	12	0	0	0	0	0	100	0
2.	MSC/DHC - IV	Minor Specialization Course-IV/ Departmental Honours Course-IV	MSC/DHC	3/4										
3.	MSC/DHC - V	Minor Specialization Course - V / Departmental Honours Course - V	MSC/DHC	3/4										
		<b>Total</b>		<b>6/12-14</b>										
<b>(Spring)</b>														
1.	CYP-502	Thesis Stage II	PCC	10	0	0	20	0	0	0	0	0	100	0
		<b>Total</b>		<b>10</b>										

## DEPARTMENT OF CHEMISTRY

Program Code : 321 BS-MS Exit Program (Chemical Sciences)  
 Department : CY Chemistry  
 Year : IV

S. No.	Sub. Code	Teaching Scheme			Contact Hours/Week			Exam. Duration		Relative Weight (%)				
		Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
<b>(Autumn)</b>														
1.	CYL-V	Program Elective Course-V	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
2.	CYL-VI	Program Elective Course-VI	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
3.	CYL-VII	Program Elective Course-VII	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	CYC-400	Lab based Project/Industry Oriented Problem	PCC	4	0	0	8	0	0	0	50	0	0	50
5.	MSC/DHC - II	Minor Specialization Course - II / Departmental Honours Course - II	MSC/DHC	3/4										
6.	MSC/DHC - III	Minor Specialization Course-III / Departmental Honours Course-III	MSC/DHC	3/4										
		<b>Total</b>		<b>13/ 19-21</b>										
<b>(Spring)</b>														
1.	CYP-400	Project	PCC	6	0	0	12	0	0	0	0	0	100	0
2.	MSC/DHC - IV	Minor Specialization Course-IV/ Departmental Honours Course-IV	MSC/DHC	3/4										
3.	MSC/DHC - V	Minor Specialization Course-V/ Departmental Honours Course-V	MSC/DHC	3/4										
		<b>Total</b>		<b>6/ 12-14</b>										

**List of Program Elective Courses**

Teaching Scheme					Contact Hours/Week			Exam. Duration		Relative Weight (%)				
S. No.	Sub Code	Course Title	Sub. Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
1.	CYL-302	Bioinorganic and Biomimetic Chemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
2.	CYL-306	Analytical Methods in Chemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
3.	CYL-308	Chemistry of Industrial Processes	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
4.	CYL-310	Polymer Chemistry	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
5.	CYL-312	Programming in Quantum Chemistry	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
6.	CYL-314	Machine Learning in Catalysis	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
7.	CYL-512	Nuclear and Radiochemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
8.	CYL-518	Structure, Bonding and Properties of Solids	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
9.	CYL-520	Inorganic Rings and Polymers	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
10.	CYL-522	Synthesis and Properties of Materials	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
11.	CYL-524	Modern Organic Synthetic Methods	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
12.	CYL-526	Solid State Chemistry and Applications	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
13.	CYL-606	Total Synthesis	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
14.	CYL-607	Electroanalytical Chemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
15.	CYL-609	Inorganic Biochemistry and Reaction Mechanism	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
16.	CYL-610	Molecular Modelling and Simulations	PEC	3	2	0	2	2	0	10-25	25	15-25	30-40	0
17.	CYL-612	Carbon Nanomaterials and their Applications	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
18.	CYL-613	Frontiers in Inorganic Biochemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
19.	CYL-614	Asymmetric Synthesis	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0

20.	CYL-615	Crystal and Molecular Structure	PEC	3	2	0	2	2	0	10-25	25	15-25	30-40	0
21.	CYL-617	Supramolecular Chemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
22.	CYL-621	Organic Structure Determination	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
23.	CYL-623	Organic Semiconductors	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
24.	CYL-625	Proteins and Polypeptides	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
25.	CYL-627	Solid State Chemistry and Applications	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
26.	CYL-629	Advanced Topics in Statistical Mechanics, and Quantum Chemistry	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
27.	CYL-633	Nanoscale Materials: Properties and Applications	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
28.	CYL-635	Advanced Magnetic Resonance Spectroscopy	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
29.	CYL-638	Reactivity, Structure Determination, Devices and Electronic Structure of Solids	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
30.	CYL-640	Organic Materials	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
31.	CYL-642	Computational Methods in Material Science	PEC	3	2	0	2	3	0	10-25	25	15-25	30-40	0
32.	CYL-644	High Energy Density Materials	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
33.	CYL-646	Fluorescence and Ultrafast Spectroscopy	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0
34.	CYL-648	Synthesis and Applications of Tetrapyrroles	PEC	3	3	0	0	3	0	20-35	0	20-30	40-50	0

## List of Talent Enhancement Course

		Teaching Scheme			Contact Hours/Week			Exam Duration		Relative Weight (%)				
S. No.	Course Code	Course Title	Area	Cr.	L	T	P	Th.	Pr.	C W S	P R S	MTE	E T E	P R E
<b>Talent Enhancement Course - A</b>														
1	CYT-101	Mathematical Methods in Chemistry	TEB	3	1	0	4	2	4	10-15	15-25	10-15	15-25	40-50
2	CYT-102	Computational Chemistry	TEB	3	0	0	6	-	-	-	50	-	-	50
<b>Talent Enhancement Course - B</b>														
1	CYT-103	Synthesis and Characterization of Functional Materials-I	TEB	3	1	0	4	2	4	10-15	15-25	10-15	15-25	40-50
2	CYT-104	Synthesis and Characterization of Functional Materials-II	TEB	3	0	0	6	-	-	-	50	-	-	50
<b>Talent Enhancement Course - C</b>														
1	CYT-105	Techniques for Analyzing (Inorganic) Molecules and Materials	TEB	3	1	0	4	2	4	10-15	15-25	10-15	15-25	40-50
2	CYT-106	Advanced Techniques for Analyzing (Inorganic) Molecules and Materials	TEB	3	0	0	6	-	-	-	50	-	-	50
<b>Talent Enhancement Course - D</b>														
1	CYT-107	Drug Design and Synthesis-I	TEB	3	1	0	4	2	4	10-15	15-25	10-15	15-25	40-50
2	CYT-108	Drug Design and Synthesis-II	TEB	3	0	0	6	-	-	-	50	-	-	50

## Minor Specialization Courses

SN	Course Code	Course Name	Credits	Semester
1.	CYC-102	Organic Chemistry-I	3	Spring
2.	CYC-202	Coordination and Organometallic Chemistry	4	Spring
3.	CYC-203	Main Group and Cluster Chemistry	3	Autumn
4.	CYC-204	Chemical Kinetics and Catalysis	3	Spring
5.	CYC-206	Organic Chemistry-III	3	Spring
6.	CYC-207	Quantum Chemistry and Chemical Bonding	4	Autumn
7.	CYC-208	Molecular Symmetry, Group Theory and Spectroscopy	3	Spring

## Departmental Honours Courses (20 credits)

SN	Course Code	Course Name	Credits
1.	CYL-608	Chemical Biology	3
2.	CYL-703	Advanced Material Characterization Techniques	4
3.	CYL-902	Advanced Inorganic Chemistry	3
4.	CYL-903	Advanced Organic Chemistry	3
5.	CYL-904	Advanced Physical Chemistry	3
6.	CYL-905	Spectroscopic Methods of Structural Elucidation	4