



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh

शाहपुर परिसर, ज़िलाकाँगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in

165



Minutes of the Fifth Board of Studies Meeting

Held online via google meet on 23rd September, 2020 from 3:00 P.M
onwards

Department of Chemistry and Chemical Science
School of Physical and Material Sciences



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh
 शाहपुर परिसर, ज़िलाकाँगड़ा, (हि.प्र.) - 176206
 Shahpur Campus, Distt. Kangra (HP) - 176206
 Website: www.cuhimachal.ac.in



The Fifth Board of Studies (BOS) Meeting of the Department of Chemistry and Chemical Science, SoPMS was held via Google Meet (Online Medium) on 23rd September, 2021 at Shahpur campus of Central University of Himachal Pradesh.

Professor Shahshi Kant Sharma, Professor Department of Chemistry, H.P University Shimla, **Professor Hum Chand**, Dean SOPMS and Head Department of Physics and Astronomical Sciences, CUHP, **Professor Bhag Chand Chauhan**, Professor Department of Physics and Astronomical Science, CUHP, **Dr. Sunil Thakur**, Associate Professor and Head, Department of Animal Science, School of Life Sciences, CUHP **Dr. Neeraj Gupta**, Assistant Professor Department of Chemistry and Chemical Science, CUHP and **Dr. Rajender Kumar**, Associate Professor and Head, Department of Chemistry and Chemical Science, CUHP were present in the Meeting.

Dr. Devinder Kumar Sharma Couldn't attend the meeting due to prior commitment. However, he provided his valuable comments telephonically.

The Chairman started the meeting with introduction of Honourable Members of BOS and Following Business was transacted.



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh

शाहपुर परिसर, जिलाकाँगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in



1. **Agenda Item No. CCS-BOS-5/21-1:** Confirmation of Minutes of 4th BOS meeting held on 28th December 2020.

Resolution No. 1 : The Minutes of 4th BOS meeting held on 28th December 2020 is given in Annexure I and are approved.

2. **Agenda Item No. CCS-BOS-5/21-2:** In principle approval of Modification/change/Addition etc of M.Sc Chemistry syllabus (2 Years programme from Academic Year 2021-22) as required in National Education Policy 2020. Various changes /revisions in syllabus from time to time will be reported in the ensuing BOS Meetings.

Resolution No. 2: Honourable Members deliberated at length and gave their in principle approval to design the syllabus for M.Sc Chemistry (2 Year Programme) in line with spirit of National Education Policy (NEP) 2020. Hence Approved.

3. **Agenda Item No. CCS-BOS-5/21-3:** Scheme of Syllabus for M.Sc. Chemistry two years (Session 2021-22), syllabus as per National Education Policy (NEP) and Guidelines provided by Central University of Himachal Pradesh Vide Committee formed in this respect.

Resolution No.3: Honourable members deliberated on the scheme at Length as given in Annexure II of 5th BOS Agenda. Professor, Shashi Kant Sharma, External Subject Expert suggested to make the scheme structure uniform and cohesive. The suggestions were incorporated and accordingly the **agenda item is approved.**

4. **Agenda Item No. CCS-BOS-5/21-4:** Detail Syllabus of Courses Semester wise. (Annexure III, IV &V)

Resolution No.4: Honorable members discussed the syllabus semester wise and provided their valuable inputs. As per suggestions of External Subject



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh

शाहपुर परिसर, ज़िलाकाँगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in



168

expert, Professor Shashi Kant Sharma the units in the syllabus were modified to make the units in all courses concise and uniform.

Further as per suggestion of Internal member **Dr. Sunil Kumar Thakur**, the syllabus will be remodified as and when future guidelines from university in this regard are released. **The Agenda Item is approved.**

5. Agenda Item No. CCS-BOS-5/21-5: Exit /Entry Option for M.Sc Chemistry Students after Completion of First Two Semester of course.

Resolution No.5: Professor B.C Chauhan, Internal Member suggested to change **Advanced Diploma in Chemical Sciences** to **Post Graduate Diploma in Chemical Sciences**. Accordingly the Students after completion of first two semester of M.Sc Chemistry Course will be awarded **Post Graduate Diploma in Chemistry**. The agenda item is approved with this modification.

6. Agenda Item No. CCS-BOS-6/21-6: Adoption of NEP Guidelines as Proposed by the Committee constituted by Central University of Himachal Pradesh for Implementation of National Education Policy 2020 from Academic Session 2021-22.

Resolution No. 6: Professor Shashi Kant Sharma suggested to make scheme for distribution of Marks for Various examinations and also to include multiple choice questions (MCQs) in Examinations. All members appreciated the suggestion and it was resolved that the uniform marks distribution and pattern of question papers will be followed as decided by Central University of Himachal Pradesh to have university wide uniformity. **Agenda Item Approved.**

[Handwritten signatures]



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh
शाहपुर परिसर, जिलाकाँगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in



169

7. Agenda Item No. CCS-BOS-5/21-7: Item from Chair: (1) For reporting and Noting of PhD Co-Supervisor ship of Dr. Manish Kumar at Sri.Sai University Palampur (H.P).

Resolution No. 7 (1): On basis of request received from Dr. Manish Kumar Assistant Professor, Department of Chemistry and Chemical Science, Central University of Himachal Pradesh, members noted the status of Dr. Manish Kumar as PhD Co-supervisor of Ms.Atul (Roll No. 714024001). The PhD viva-voce examination of Ms. Atul was held on 18-02-2020. at Sri.Sai University Palampur.

Item from Chair: (2) Scheme of PhD Course work from Session 2021 onwards as per NEP Guidelines (Annexure VII)

Resolution No. 7 (2): Approved

In the end Professor Shashi Kant, External Member suggested that as per the New Curriculum scheme which requires publication of Research Papers/Conference presentation etc and research dissertation in 4th Semester will require tremendous infrastructure and financial support. Hence University may be requested to allocate grants for development of Infrastructure like Scientific equipment's, Software's, Computer systems, etc so that required research environment could be created. All members appreciated this and approved to convey to university for necessary action.

by Email-(attached)

Dr. Shashi Kant Sharma (Member)
Professor, Department of Chemistry
Himachal Pradesh University Shimla-05

by Email (attached)

Dr. Devinder Kumar Sharma
Professor, Department of Chemistry
Himachal Pradesh University Shimla-05

हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh

शाहपुर परिसर, जिलाकाँगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in

75
आज़ादी का
अमृत महोत्सव



H. Chand

Dr. Hum Chand (Member)
Dean SOPMS & Professor
Department of Physics and Astronomical
Science, CUHP-176206

Sunil Thakur

Dr. Sunil Thakur (Member)
Associate Professor & Head, Department
of Animal Sciences Science, CUHP-
176206

B. C. Chauhan

Dr. Bhag Chand Chauhan (Member)
Professor, Department of Physics and
Astronomical Science, SOPMS, CUHP-
176206

N. Gupta

Dr. Neeraj Gupta (Member)
Assistant Professor, Department of
Chemistry and Chemical Science
CUHP-176206

Rajender Kumar

Dr. Rajender Kumar (Chairman)
Department of Chemistry and Chemical Science
CUHP-176206

Gmail

Pankaj Sharma <pankaj.sharma@hpcu.ac.in>

Fwd: 5th BOS Meeting Minutes for Approval

3 messages

rajender kumar <rajender.cuhp@hpcu.ac.in>
To: pankaj.sharma@hpcu.ac.in

Sun, Sep 26, 2021 at 8:38 PM

Dear Pankaj

Please Take the printout of all attached documents (5th BOS Minutes, Annexure I,II,III,IV,V,VI and VII) , Agenda of 5th BOS along with approvals granted in trailing emails and compile them as a file to forward to Dean SOPMS for necessary action. You may also get signatures of Members present at Shahpur Viz: Professor Hum Chand, Professor Bhag Chand, Dr. Sunil Thakur, Dr. Neeraj Gupta. After they sign, send me the scanned copy so that I can put a signature.

In case of any query do contact me.
thanks

thank you
with regards

----- Forwarded message -----

From: neeraj gupta <gupta_nrj@yahoo.co.in>

Date: Sun, Sep 26, 2021 at 7:23 PM

Subject: Re: 5th BOS Meeting Minutes for Approval

To: <sunilibes@gmail.com>, rajender kumar <rajender.cuhp@hpcu.ac.in>

Cc: Hum Chand <humchand@hpcu.ac.in>, Prof. B. C. Chauhan <bcawake@hpcu.ac.in>, <dean_spms@hpcu.ac.in>, <dksharma_dk@rediffmail.com>, <drsklomesh@gmail.com>, <gupta_nrj@hpcu.ac.in>

Dear Sir

Changes approved from my end.

Regards

Dr Neeraj Gupta

Sent from Yahoo Mail on Android

On Sun, 26 Sep 2021 at 4:21 PM, Dr Sunil Kumar Thakur
<sunilibes@gmail.com> wrote:

Sir

Approved from my end.

Thanks

On Sun, 26 Sep 2021 at 11:28 rajender kumar <rajender.cuhp@hpcu.ac.in> wrote:

Honourable BOS Members

Please find attached the Minutes of 5th BOS Meeting of Department of Chemistry and Chemical Science Held on 23 September 2021, for your kind approval. As pointed by Prof. Hum Chand, we inadvertently missed the Agenda item related to the PhD course work framework.

I have included it in the Minutes of BOS as item from chair (2) in Agenda Item 7 and the detailed framework is attached as Annexure VII. If honourable members approve it, I shall be obliged.

Minutes with all annexures are attached for Approval of Honourable Members.

Thank you
with regards
Rajender

--
डॉ सुनील कुमार / Dr Sunil Kumar

सह-प्रोफेसर और विभागाध्यक्ष / Assoc. Prof. & Head

जंतु विज्ञान विभाग / Department of Animal Sciences

जैविक विज्ञान स्कूल / School of Life Sciences

Proctor / कुलानुशासक



3:51 PM

Central University of Himachal Pradesh Mail - Fwd: 5th BOS Meeting Minutes for Approval

172

हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय / Central University of Himachal Pradesh
अस्थायी शैक्षणिक स्तण्ड, शाहपुर / TAB Shahpur, Kangra HP - 176206
Mob. 9418050067, 7018445774, website: www.cuhmachal.ac.in

2 attachments

-  Annexure VI.pdf
926K
-  5th BOS agenda .pdf
190K

Pankaj Sharma <pankaj.sharma@hpcu.ac.in>
To: rajeev.singh@hpcu.ac.in



Mon, Sep 27, 2021 at 9:04 AM

[Quoted text hidden]

--

Pankaj Sharma
Data Entry Operator
School Of Physical and Material Science
Central University of Himachal Pradesh
TAB-Shahpur, Distt.-Kangra
Pin Code 176206 India
Mobile--8219411688

2 attachments








-  Annexure VI.pdf
926K
-  5th BOS agenda .pdf
190K

rajender Kumar <rajender.cuhp@hpcu.ac.in>
To: pankaj.sharma@hpcu.ac.in

Mon, Sep 27, 2021 at 9:25 AM

[Quoted text hidden]

7 attachments

-  Annexure IV.pdf
157K
-  Annexure V.pdf
105K
-  Annexure III.pdf
157K
-  Annexure I.pdf
157K
-  5th BOS Minutes.pdf
324K
-  Annexure VII.pdf
104K
-  Annexure-II.pdf
131K

7/173

Minutes of the Fourth Board of Studies Meeting

Held online via google meet on 28th December, 2020 from 11:00 AM onwards

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

174

The fourth Board of Studies (BOS) Meeting of the Department of Chemistry and Chemical Science, SoPMS was held via Google Meet (Online Medium) on 28th December, 2020 at TAB Shahpur campus.

Professor Devinder Kumar Sharma, Professor Department of Chemistry, H.P University Shimla, Professor Hum Chand ,Dean SOPMS and Head Department of Physics and Astronomical Sciences,CUHP, Professor Bhag Chand Chauhan, Professor Department of Physics and Astronomical Science, CUHP, Dr. Sunil Thakur, Associate-Professor, Department of Animal Science, School of Life Sciences,CUHP Dr. Neeraj Gupta, Assistant Professor Department of Chemistry and Chemical Science, CUHP and Dr. Rajender Kumar, Associate Professor and Head, Department of Chemistry and Chemical Science, CUHP were present in the Meeting.

Dr. Shashi Kant Sharma Couldn't attend the meeting due to prior commitment.

The Chairman started the meeting with introduction of Honorable Members of BOS and Following Business was transacted.

1. Agenda Item No. CCS-BOS-4/20-1: Confirmation of Minutes of 3rd BOS meeting held on 23rd May 2019.

Resolution No. 1 : The Minutes of 3rd BOS meeting held on 23rd May 2019 is given in Annexure I and are approved.

2. Agenda Item No. CCS-BOS-4/20-2: Approval of Supervisor of PhD students Admitted in Session 2020-21 in Department of Chemistry and Chemical Sciences as tabulated below.

The List of Students with Allotted supervisors is given below:

Sr. No.	Student Name	Student Enrollment No.	Supervisor
---------	--------------	------------------------	------------

177
175

1.	Ishani Saini	CUHP20 RD CHEM 01	Dr. Rajender Kumar
2.	Kirna Devi	CUHP20 RD CHEM 02	Dr. Rajender Kumar
3.	Manisha Chadha	CUHP20 RD CHEM 03	Dr. Shivani Berry
4.	Pooja Kumari	CUHP20 RD CHEM 04	Dr. Manish Kumar
5.	Purnima Justa	CUHP20 RD CHEM 05	Dr. Pramod Gangwar

Resolution No. 2 : Approved

3. **Agenda Item No. CCS-BOS-4/20-3: Approval of Dr. Rajender Kumar as Co-Supervisor and Supervisor in his parent Institute (Department of Applied Chemistry, SVNIT Surat) from where Dr. Rajender Kumar is on Lien.**

List of PhD students at SVNIT Surat with Dr. Rajender Kumar is given below:

Student Name	Registration No.	Status of PhD Degree	Supervisor /Co-Supervisor
Mrs. Khushbu Patel	D14CY003	PhD Viva Voce held in Feburary 2020	Supervisor (Dr. Rajender Kumar)
Ms. Jyotsna M Nayak	DS17CY003	In Progress	Supervisor (Dr. Rajender Kumar)
Mr. Anuj K Saini	D18CY006	In Progress	Co-Supervisor (Dr. Rajender Kumar)
Mr. Seshu Vardhan	D19CY007	In Progress	Co-Supervisor (Dr. Rajender Kumar)

Resolution No. 3: Approved

4. Agenda Item No. CCS-BOS-4/20-4: Approval of Dr. Neeraj Gupta as Supervisor/Co-Supervisor for Students in his previous Institute, Shoolini University, Solan, Himachal Pradesh.

List of PhD students is Given below:

Name of Student	Registration No./Enrollment No.	Status of PhD Degree	Supervisor/Co-SUPervisor
Kshipra Sen	1734701006	Viva Voce held on 9 th October 2020	Dr Neeraj Gupta (Supervisor)
Deepika Sharma	1734701002	Thesis submitted on 30 th Sept 2020	Dr Neeraj Gupta (Supervisor)
Ashima Dogra	1734701008	Thesis submitted on 28 th Nov 2020	Dr Neeraj Gupta (Supervisor)
Tokuma Getahun	1834701013	Pre-thesis presentation completed on 14 th Oct 2020	Dr Neeraj Gupta (Supervisor)
Shalini Arora*	16301001	Pre-Thesis presentation done in 30 th Sept 2020	Dr Neeraj Gupta (Co-supervisor)
Vinit Sharma	1834701003	In Progress	Dr Neeraj Gupta (Supervisor)
Minal Verma (M.Phil student)	1934701002	In progress	Dr Neeraj Gupta (Cosupervisor) for MPhil
*Student registered in PEC University of Technology Chandigarh			

Resolution No. 4 : Approved

5. Agenda Item No. CCS-BOS-4/20-5: Approval of the Course work for PhD students in Department of Chemistry and Chemical Sciences.

Course Code CCS-700 is given in Annexure II, CCS 701 is given in Annexure III and RPE as recommended by UGC and Adopted by CUHP is given below



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh

शाहपुर परिसर, जिला कांगड़ा, (हि.प्र.) - 176206
Shahpur Campus, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in

75
आज़ादी का
अमृत महोत्सव

H. Chand

Dr. Hum Chand (Member)
Dean SOPMS & Professor
Department of Physics and Astronomical
Science, CUHP-176206

Sunil Thakur

Dr. Sunil Thakur (Member)
Associate Professor & Head, Department
of Animal Sciences, Science, CUHP-
176206

Bhag Chand Chauhan

Dr. Bhag Chand Chauhan (Member)
Professor, Department of Physics and
Astronomical Science, SOPMS, CUHP-
176206

Neeraj Gupta

Dr. Neeraj Gupta (Member)
Assistant Professor, Department of
Chemistry and Chemical Science
CUHP-176206

Rajender Kumar

Dr. Rajender Kumar (Chairman)
Department of Chemistry and Chemical Science
CUHP-176206

178

Annex
Annex
BOS

...re-II

Suggested Scheme

Total Credits to be completed =80 with 20 credits in each semester



2 YEARS MASTER'S DEGREE PROGRAMME
Eligibility: 3 Year Bachelor's Degree Programme

Semester	Disciplinary/ Interdisciplinary : Major Course	Disciplinary/ Interdisciplinary: Minor Course	Vocational/ Skill	IK S	Review of Literature, Research Proposal	Dissertation	Total
1 st	10	04	02	04	0	0	20
2 nd	12	04	04	0	0	0	20
3 rd	04 (Research Methodology)	04 (Tool Development)	04 (Analysis of Data through Software)	0	08	00	20
4 th	04 (Academic Writings) 04 (Paper Publications/Seminar-Conference Presentation at National Level)	0	04 (Analysis of Data through Software)	0	0	08	20
	34	12	14	04	08	08	80

PROPOSED SCHEME For M.Sc Chemistry Two Year Degree

Semester	Disciplinary/ Interdisciplinary: Major Course	Disciplinary/ Interdisciplinary: Minor Course	Vocational/ Skill	IK S
1 st	1.CCS 511 Inorganic Chemistry I (2 credit) 2. CCS 512 Organic Chemistry I (2 credit)	CCS 516 Spectroscopic techniques (4 credits)	1. CCS 517 Commercial and Green synthesis (CCS 517) (2 credits) 2. CCS 518 Nanoscience (2 credits)	2 credits University Wide

Handwritten signatures and marks:
1
[Signature]
[Signature]
[Signature]

	<p>3. CCS 513 Physical chemistry I (2 credit)</p> <p>4. CCS 514 Advance Analytical Techniques (2 credits)</p> <p>5. Practical I (CCS 515) (2 credits)</p> <p>Total credits: 10</p>	Total credits: 4	Total credits: 4	Total credits: 4
2 nd	<p>1. CCS 521 Inorganic chemistry II (4 credits)</p> <p>2. CCS 522 Organic Chemistry II (4 credit)</p> <p>3. CCS 523 Physical chemistry II (4 credit)</p> <p>Total credit: 12</p>	<p>1. CCS524 Biochemistry (2 credit)</p> <p>2. CCS 525 Practical II (2 credit)</p> <p>Total credits: 4</p>	<p>1. CCS 526 Natural Products in Medicinal chemistry (2 credits)</p> <p>Total credits: 4</p>	<p>IKS (2)</p> <p>CCS 527</p>
3 rd	<p>CCS 611 (Inorganic chemistry Specialization - I)</p> <p>CCS 612 (Organic chemistry Specialization -I)</p> <p>CCS 613 (Physical chemistry Specialization I)</p> <p>Elective Specialization</p>	<p>CCS 614 Research Methodology (Credit 4) (Credit 4)</p> <p>Total credit: 4</p>	<p>CCS 615 Software based data Analysis (Credit 4)</p> <p>Total credit: 4</p>	<p>CCS 616 Review of Literature/ Research Proposal (Credit 8)</p> <p>Total credit: 8</p>

[Signature] 2
[Signature]

[Signature]

[Signature]

	Total credit: 4			
4th	CCS 621(Inorganic chemistry Specialization - II) CCS 622 (Organic chemistry Specialization -II) CCS 623 (Physical chemistry Specialization I) Elective Specialization Total Credit =4	1. CCS 624 Academic Writing (02 Credits) 2. CCS 625 Practical (Paper Publication/Seminar- Conference presentation at National Level) (2 Credits) Total:4	CCS 626 Subject based data analysis and interpretation (4 Credits) Total Credit=4	CCS 627 Dissertation (8 credits) Total credit :8

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]

Annexure -III

Detailed Syllabus of M.Sc 1st Semester (2021-22 Session)

CCS 511: Inorganic Chemistry -I

Credit: 2

UNIT-I: Theory of Coordination Chemistry

Crystal Field Theory: Splitting of d orbitals in crystal fields of different symmetry for similar and dissimilar ligands (Octahedral, tetrahedral, Linear, trigonal planar, trigonal bipyramidal, square pyramid), crystal field stabilization energies (CFSE), spectrochemical series, octahedral site preference energy (OSPE) and their applications. Tetragonal distortion (Jahn-Teller effect). Thermodynamic aspects of crystal field splitting (variation of ionic radii, lattice energy, hydration enthalpy and stability constants of complexes – Irving Williams order).

UNIT II: Nuclear Chemistry and Radioactive techniques

Nuclear stability, Nuclear cross-sections, Nuclear reactions: types of reactions, Nuclear fission-fission product and fission yields, Tracer technique, (neutron activation analysis), Counting techniques such as G.M. Ionization and proportional counters.

CCS 512: Organic Chemistry I

Credit :2

Unit I: Reaction Mechanism

Reaction Mechanism: Structure and Reactivity: Thermodynamic and kinetic requirements, Kinetic and Thermodynamic control, Hammonds postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates.

Effect of structure on reactivity: resonance and field effects, steric effect. Quantitative treatment: Hammett equation and linear free energy relationship, Substituent and reaction constants, Taft equation. Methods of determining Reaction mechanisms.

UNIT II: Addition to C-C multiple bonds, C-Hetero Multiple Bonds

Addition to C-C multiple bonds : Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemo selectivity, orientation and reactivity. Hydrogenation of double and triple bonds and aromatic rings. Hydroboration reaction, Sharpless asymmetric epoxidation. **Addition to Carbon-Hetero**

Multiple Bonds: Mechanism of metal hydride reaction of substituted and unsubstituted carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organo-Zn and organo-Li reagents to saturated and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation involving enolates.

[Handwritten signatures]

CCS 513: PHYSICAL CHEMISTRY I

Credit-2

UNIT I:

Quantum Mechanics: Time independent Schrödinger equation, probability concept. Linear operators in quantum mechanics, Eigen value equation. Properties of the operators, commutation relations, Applications: Particle-in-a box (1-, 2-, 3- dimensional), different potential functions and barrier problems, degeneracy, density of states. Simple harmonic oscillator, Rigid rotor, Angular momentum operator, Hydrogen atom. Approximate method: Elementary perturbation theory up to second order in energy, Variation theorem, Simple applications. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

UNIT-II:

Statistical Thermodynamics: Thermodynamic probability and entropy, Maxwell Boltzman, Partition function: rotational, translational, vibrational and electronic partition functions of diatomic molecules, calculation of thermodynamic functions and equilibrium constants. Theories of heat capacities of solids. Microcanonical ensemble, Canonical ensemble distribution probability partition function, its relation with different thermodynamic state functions. Gibb's paradox and Sackur-Tetrode equation. Equipartition theorem and its validity. Chemical potential and heat capacity of solids.

CCS 514: ADVANCE ANALYTICAL TECHNIQUES

Credit-2

UNIT I: Introduction to Chromatography

Basic principle of Analytical techniques. Different types of Chromatography techniques and their applications. Thin layer Chromatography – Basic principle, methodology, application. **High Performance Liquid Chromatography:** Basic Principle, Methodology, Application. Discussion with examples, **Gas Chromatography:** Basic Principle, Methodology, Application. Discussion with examples. **Liquid and Gas Chromatography - Mass spectrometry:** Basic Principle, Methodology, Application. Discussion with examples.

UNIT II: Transmission Electron Microscopy: Basic principle, Instrumentation and Applications, Scanning electron microscopy: Basic principle, Instrumentation and Applications, AFM : Basic principle, Instrumentation and Applications, Light scattering and XPS : Basic principle, Instrumentation and Applications.

Handwritten signatures:
N Gupta
Praveen
Baa
my

CCS 515: Practical I

Credit-2

The In-house manual will be prepared according to the requirement

CCS 516: Spectroscopic techniques

Credit:4

UNIT-I

Infrared Spectroscopy: Theory of IR absorption, Types of vibrations, Observed number of modes of vibrations, Intensity of absorption bands, Theoretical group frequencies, Factors affecting group frequencies and band shapes (Physical state, Vibrational Coupling, Electrical effects, Resonance, Inductive effects, Ring strain). Basic Principle of Raman Spectroscopy, Differences between IR and Raman spectra.

UNIT-II

UV spectroscopy: Basic principles and Instrumentation of UV spectroscopy, Beer lambert law, absorbance, transmittance, Λ_{\max} , ϵ_{\max} , various fundamental transitions, solvent effect, Chromophores and Auxochromes. Rules for finding Λ_{\max} .

UNIT-III

Nuclear Magnetic Resonance Spectroscopy:-Introduction to Nuclear Magnetic Resonance, Chemical shift, Mechanism of electron shielding and factors contributing to the magnitude of chemical shift, Nuclear overhauser effect, Double resonance, Chemical exchange, Lanthanide shift reagents and NMR spectra of paramagnetic ions. Contact shifts. Experimental technique (CW and FT). C^{13} NMR, COSY.

UNIT IV: Mass spectrometry

Basic instrumentation, ion production - E1, C1, FD, FAB and MALDI techniques. Mass spectral fragmentation of typical organic compounds, common functional groups.

Vocational Skills Course

CCS 517 - Commercial and Green Synthesis

(Credit-2)

UNIT I: Disconnection Approach




Introduction to synthons and synthetic equivalents, disconnection approach (basic concept only), functional group inter-conversions and importance of the order of events in organic synthesis. One group C-X and C-C along with two group C-X disconnections (case studies of representative molecules are required). Reactivity umpolung and importance of functional group protection in organic synthesis. Principle of protection of alcohol, amine, carbonyl and carboxyl groups.

UNIT II Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry, Twelve principles of Green Chemistry, solvent-free organic reactions. Green solvents- water, super critical fluids as a solvent for organic reactions, ionic liquids. Energy requirements for reactions - alternative sources of energy: use of microwaves and ultrasonic energy.

CCS 518: Nanoscience

Credit-2

UNIT I:

Properties of Nanomaterials :Introduction: Properties of materials & nanomaterials, role of size and shape in nanomaterials.

Electronic Properties: Classification of materials: Metal, Semiconductor, Insulator, Band structures, Brillouin zones, Mobility, Resistivity.

Magnetic Properties: Superparamagnetism, blocking. Important properties in relation to nanomagnetism.

Optical Properties: Photoconductivity, Optical absorption & transmission, Photoluminescence, Fluorescence, Phosphorescence, Electroluminescence. Thermal Properties and Mechanical Properties;

UNIT II:

Synthesis of Nanomaterials :

Chemical Methods: Metal nanocrystals by reduction, Solvothermal synthesis, Photochemical synthesis, Electrochemical synthesis, Nanocrystals of semiconductors and other materials by arrested precipitation, Thermolysis routes, Sonochemical routes, Post-synthetic size-selective processing. Sol-gel, Micelles and microemulsions.

Biological Methods of Synthesis: Use of bacteria, fungi, Actinomycetes for nanoparticles synthesis, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation; Viruses as components for the formation of nanostructured materials; Synthesis process and application, Role of plants in nanoparticle synthesis.

ngupta

na

rajendra
pan

CCS 521: Inorganic Chemistry II**UNIT I: Organometallic Chemistry**

The 18- electron rule for organometallic compounds of transition metals: Classification based on 18- electron rule: complexes of two, three, four, five six, seven, eight-electron pi-ligands: nomenclature. Exceptions to 18 electron rule: the 16-electron rule. Agostic interaction, isolobal and isoelectronic relationship of complexes. Elementary idea about homoleptic and non-homoleptic compounds: oxidative addition and reductive elimination reaction: insertion. Direct combination of carbon monoxide and metal.

UNIT II: Molecular Clusters and cages

Metal-carbonyl clusters, types, structures, the closo-, nido-, arachno-boranes, Wades rule, capping. Clusters having interstitial main group elements, halide type cluster, cubane clusters and naked or Zintl clusters. Molecular clusters in catalysis, boron-carbides and metal borides. Synthesis of heteronuclear metal carbonyls.

UNIT III Inorganic Reactions and Mechanism:

Substitution reactions in octahedral complexes, acid hydrolysis reactions, base hydrolysis and anation reactions, substitution reaction, reactions occurring without rupture of metal-ligand bond. Substitution reactions of square planar complexes. Theories of trans-effect and application, labile and inert complexes. Mechanism of redox reactions.

UNIT-IV: Chemistry of d- and f- Block Elements (Comparative Study)

Electronic configuration, oxidation states; aqueous, redox and complex chemistry, spectral and magnetic properties of compounds in different oxidation states, horizontal and vertical trends in respect of 3d,4d, and 5d elements with references to Ti-Zr- Hf, Cr- Mo- W, Mn Tc-Re and Pt group metals.

Lanthanide and Actinide Elements: Electronic configuration, oxidation states, aqueous, redox and complex- chemistry; electronic spectra and magnetic properties (one example each). Lanthanide and actinide contractions and their consequences, separation of lanthanides and actinides and their applications (with examples).



UNIT I: Pericyclic Reactions

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl systems. Classification of pericyclic reactions. Woodward – Hoffmann correlation diagrams. FMO and PMO approach, concept of aromaticity of pericyclic transition states. Selection rules and stereochemical aspects of electrocyclic reactions, cycloaddition and sigmatropic shifts. Electrocyclic reactions: conrotatory and disrotatory motions, $4n$, $4n+2$. Cycloaddition reactions: antarafacial and suprafacial additions, $4n$ and $4n+2$ systems; 2, 2 addition of ketenes, 1,3 dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangements: suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3-sigmatropic rearrangements. Cope, Claisen and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

UNIT II Photo chemistry

Photo chemistry – Introduction to photochemistry. cyclisation reaction and ring opening of 1, 3 Butadiene, 1, 3, 5 hexatriene systems. Jablonski diagram - Norish I & Norish II reaction, quantum yield. Primary & Secondary, photochemical reactions, Rearrangement – Paterno Buchi reaction. Barton reaction di-pi methane rearrangement, Photo reduction of ketones, Photo Fries rearrangement

UNIT III: Oxidation reactions

Introduction, Oxidation of hydrocarbons (Oxidation of alkenes: oxidation of carbon-carbon double bonds to epoxides (epoxidation) and diols, Woodward and Prevost Reaction, wacker process, Lemieux reagents, Oxidation of saturated hydrocarbons, Etard reaction, Oxidation at allylic positions, oxidation of alcohols by various reagents and methods, oxidation of ketones. Oxidation with ruthenium tetroxide, iodobenzene diacetate, and thallium (III) nitrate.

UNIT IV: Reduction reactions

Introduction, reduction of hydrocarbons, alkenes, Catalytic hydrogenation, homogeneous, heterogeneous hydrogenation, selectivity of reduction, di-imides, reduction of functional groups, Reduction by dissolving metals-reduction with metal and acid, reduction of carbonyl compounds, Birch reduction. reduction of epoxides, reduction by hydride transfer reagents, LAH and NaBH_4 , lithiumtrialkoxaluminium hydride, diisobutylaluminiumhydride (DIBAL), sodiumcyanoborohydride, sodium triacetoxylborohydride, trialkylborohydrides. Other

methods-desulphurisation of thio-acetals (moringo reaction), low-valent titanium species, trialkyltinhydrides.

CCS 523: PHYSICAL CHEMISTRY I I

Credit-4

UNIT-I Group Theory:

The concept of group, Symmetry elements and symmetry operations, Symmetry properties of atomic orbital, Elements of group theory: groups, subgroups, classes and characters, classes of symmetry operations, symmetry point groups; representation of groups by matrices, Representation of symmetry operator transformation of basis vector, Symmetry transformation of operators; The Great Orthogonality Theorem (without proof) and its consequences; construction and applications of character tables, representation of cyclic groups. Assignment of point groups to Inorganic molecules, some general rules for multiplications of symmetry operations, Multiplication tables for water and ammonia, Representations (matrices, matrix representations for C_{2v} and C_{3v} point groups irreducible representations), Character and character tables for C_{2v} and C_{3v} point groups.

UNIT-II Chemical Kinetics:

Review of theories of reaction rate-Collision theory and Transition state theory, Comparison of collision theory with transition state theory, Arrhenius equation- characteristics, Significance of energy of activation, Temperature coefficient and its evaluation. Thermodynamical formulation of reaction rates (Wynne-jones and Eyring treatment), Reaction between ions in solutions – Influence of ionic strength on reaction rates (primary and secondary salt effects). Concept of Steady state kinetics, Chain reactions – chain length and chain inhibition, comparison of photochemical and thermal reactions, Mechanisms of thermal and photochemical reactions between hydrogen-bromine and hydrogen-chlorine. Comparative study of thermal and photochemical hydrogen-halogen reactions. Pyrolysis of acetaldehyde, Decomposition of ethane. Kinetics of fast reactions- Introduction, Study of reactions by relaxation method (Temperature and pressure jump), flow method (Plug flow method and Stopped flow method), Flash photolysis and Shock tube method. Kinetics of homogeneous catalysis-kinetics of auto catalytic reactions, kinetics of acid-base catalysed reactions. Comparison of enzyme catalysed and chemical catalysed reactions, Mechanism (Lock and Key theory), Kinetics of enzyme catalyzed reactions – Henri-Michaelis Menten mechanism, Significance of Michaelis-Menten constant.

UNIT III: Electrochemistry:

Kohlrausch law of independent migration of ions. Determination of transference numbers using Hittorf and Moving Boundary methods. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application

Handwritten signatures and scribbles at the bottom of the page.

of EMF measurements in determining. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Electrochemistry of solutions: Ionic atmosphere, Debye-Huckel theory for the problem of activity coefficient, Debye-Huckel limiting Law, Debye-Huckel equation for appreciable concentration, Debye-Huckel Onsager conductance equation. Structure of electrified interface: Helmholtz theory, Guoy- Chapman theory.

UNIT IV:

Polymers and Macromolecules:

Determination of molecular weight of polymers (M_n , M_w , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. Kinetics of Polymerization: Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

UNIT V:

Surface chemistry:

Surface chemistry- Types of adsorption isotherms, Effect of temperature on adsorption, Mechanical adsorption, Estimation of surface area using BET equation, Gibbs adsorption isotherm and its significance, Surface tension and surface energy, Pressure difference across curved surface (Laplace equation), Vapour pressure of droplets (Kelvin equation), Surface film on liquids (electro-kinetic phenomena), Catalytic activity of surfaces.

CCS 524: Bio-Chemistry

Credit 2

UNIT I: The primary, secondary, tertiary and quaternary structures of proteins and enzymes. Function of proteins and enzymes. Nucleic acids and nucleotides, polynucleotides, nucleosides, DNA, RNA, helix-coil transition, A, B and Z conformations. Free energy changes in biological reactions: ATP-ADP inter-conversion.

UNIT II: Bioinorganic Chemistry

Reversible oxygenation in life process O_2 -uptake proteins, myoglobin, haemoglobin, hemerythrin, hemocyanin, electron transport proteins, Fe-S proteins, ferredoxin, rubredoxin, respiratory electron transport chains: cytochromes, photosynthetic electron transport chain, chlorophyll, PS-I and PS-II, Biological nitrogen fixation (Nitrogenase) and a biological nitrogen fixation; metalloenzymes: superoxide dismutase (SOD), cytochrome P 450, cytochrome C oxidase, carbonic anhydrase, carboxypeptidase; molybdoenzymes.

Metal dependent diseases Wilsons, Alzheimer, vitamin B12 -enzyme, Chelation therapy Metal complexes in therapeutic use of chelated and non chelated compounds,

Moupta

Prac
my
for

189

CCS 525: Practical II

Credit-2

The In-house manual will be prepared according to the requirement

CCS 526: Nanoscience

Credit-2

UNIT I:

Properties of Nanomaterials :Introduction: Properties of materials & nanomaterials, role of size and shape in nanomaterials.

Electronic Properties: Classification of materials: Metal, Semiconductor, Insulator, Band structures, Brillouin zones, Mobility, Resistivity.

Magnetic Properties: Superparamagnetism, blocking. Important properties in relation to nanomagnetism.

Optical Properties: Photoconductivity, Optical absorption & transmission, Photoluminescence, Fluorescence, Phosphorescence, Electroluminescence. Thermal Properties and Mechanical Properties;

UNIT II:

Synthesis of Nanomaterials :

Chemical Methods: Metal nanocrystals by reduction, Solvothermal synthesis, Photochemical synthesis, Electrochemical synthesis, Nanocrystals of semiconductors and other materials by arrested precipitation, Thermolysis routes, Sonochemical routes, Post-synthetic size-selective processing. Sol-gel, Micelles and microemulsions.

Biological Methods of Synthesis: Use of bacteria, fungi, Actinomycetes for nanoparticles synthesis, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation; Viruses as components for the formation of nanostructured materials; Synthesis process and application, Role of plants in nanoparticle synthesis.

Msupm

Rac
ms
pac

Vocational/ Skills

CCS 527: Natural Products and Medicinal Chemistry

Credit-2

UNIT I: Drug Design and Medicinal Chemistry

Introduction: Drugs: Drug design, Classification of drugs, brief discussion of drug targets, Drugs based on enzyme inhibition: penicillin antibiotics and sulphonamides (Mechanism of drug action). Drug targets on nucleic acids (Alkylating agents and intercalating agents). Concepts of antagonist, agonist, prodrugs, pharmacokinetics and pharmacodynamics, concept of structure-activity relationship (SAR) with special reference to penicillin antibiotic and sulphonamides. Antineoplastic Agents (Cancer chemotherapy), Cardiovascular drugs.

UNIT II: Alkaloids:

General definition, isolation and classification of alkaloids. Biogenesis of alkaloids. General methods for structure elucidation, Structure Elucidation and general features of phenylethylamine, pyrrolidine, pyridine, indole, isoquinoline type alkaloids. Structure elucidation (by chemical and spectroscopical methods) of atropine, nicotine, coniine and papaverine.

UNIT III: Terpenoids

Classification and biosynthesis, isolation of terpenoids, Introduction to Isoprene rule, general methods for structure elucidation, structure elucidation (by chemical and spectroscopical methods) of acyclic, monocyclic and bicyclic monoterpenes (examples Citral, terpeniol, alpha-pinene). General introduction to sesqui-, di-, and tri-terpenes with a case study of camphor.

Group

Prac

Prac

Prac

Annexure V

**Course Code and Titles for M.Sc Chemistry 3rd and 4th
Semester (20121-22 Session)**

(Semester III)

Elective specialization**Elective course: Inorganic chemistry Specialization I (CCS 611)****credit: 4****UNIT-I**

Nuclear Magnetic Resonance Spectroscopy: Introduction to Nuclear Magnetic Resonance, Chemical shift, Mechanism of electron shielding and factors contributing to the magnitude of chemical shift, Nuclear overhauser effect, Double resonance, Chemical exchange, Lanthanide shift reagents and NMR spectra of paramagnetic ions. Contact shifts. Experimental technique (CW and FT).

UNIT-II

Nuclear Quadrupole Resonance Spectroscopy: Basic concepts of NQR (Nuclear electric quadrupole moment, Electric field gradient, Energy levels and NQR frequencies), Effect of magnetic field on spectra, Factors affecting the resonance signal (Line shape, position of resonance signal) Relationship between electric field gradient and molecular structure.

UNIT-III

Mössbauer Spectroscopy: Introduction, Principle, Conditions for Mössbauer Spectroscopy, parameters from Mössbauer Spectra, Isomer shift, Electric Quadrupole Interactions, Magnetic Interactions MB experiment, Application of MB spectroscopy in structural determination
Photo electron Spectroscopy: Basic Principle of Photo electron Spectroscopy.

UNIT-IV

Electron Spin Resonance Spectroscopy: Introduction, Similarities between ESR and NMR, Behaviour of a free electron in an external Magnetic Field, Basic Principle of an Electron Spin Resonance Spectrometer, Presentation of the spectrum, Hyperfine coupling in Isotropic Systems (Hydrogen, methyl, benzene and Naphthalene radicals). Factors affecting the magnitude of g-values. Zero field splitting and Kramer's Degeneracy, Line width in solid state ESR, Double resonance technique in e.s.r. (ENDOR) Applications of ESR

Elective course CCS 612: Organic Chemistry Specialization I**Credit-4****UNIT-I**

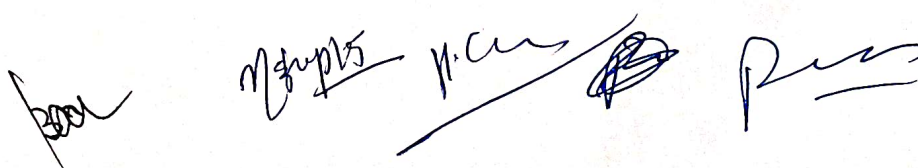
Terpenoids and Carotenoids: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination and synthesis of citral, geraniol, camphor, farsenol, santonin, abetic acid.

UNIT-II

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of elucidation, degradation, classification based on nitrogen heterocyclic ring, Structure and synthesis of ephedrine, nicotine, atropine, morphine.

UNIT-III

Steroids: Occurrence, nomenclature, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Androsterone, testosterone, estrone,



progesterone.

UNIT-IV

Plant Pigments: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Anthocyanins (Cyanin and pelargonidin), polyphenols: Flavones (chrysin), Flavonols (quercetin) and isoflavones (daidzein) coumarin, Quinones (lapachol), Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

Elective course: PHYSICAL CHEMISTRY SPECIALIZATION (CCS 613) Credit-4

UNIT-I Group Theory-I:

The concept of group, Symmetry elements and symmetry operations, Symmetry properties of atomic orbital, Elements of group theory: groups, subgroups, classes and characters, classes of symmetry operations, symmetry point groups; representation of groups by matrices, Representation of symmetry operator transformation of basis vector, Symmetry transformation of operators; The Great Orthogonality Theorem (without proof) and its consequences; construction and applications of character tables, representation of cyclic groups. Assignment of point groups to Inorganic molecules, Some general rules for multiplications of symmetry operations, Multiplication tables for water and ammonia, Representations (matrices, matrix representations for C_{2v} and C_{3v} point groups irreducible representations), Character and character tables for C_{2v} and C_{3v} point groups.

UNIT-II Group Theory-II:

Applications of group theory to chemical bonding (hybrid orbitals for σ -bonding in different geometries and hybrid orbitals for π -bonding. Symmetries of molecular orbitals in BF_3 , C_2H_4 and B_2H_6 . Application of Group Theory in Vibrational Spectroscopy: A brief idea about Infrared and Raman scattering spectroscopy. Vibrational modes as basis of group representations w.r.t. SO_2 , $POCl_3$, $PtCl_4^{2-}$ and RuO_4 , Mutual exclusion principle, Classification of vibrational modes (i.e. stretching and angle deformation vibrations w.r.t. SO_2 , $POCl_3$ and $PtCl_4^{2-}$).

UNIT III: Electrochemistry-I :

Kohlrausch law of independent migration of ions. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers.

UNIT IV: Electrochemistry-II :

Electrochemistry of solutions: Ionic atmosphere, Debye-Huckel theory for the problem of activity coefficient, Debye-Huckel limiting Law, Debye-Huckel equation for appreciable concentration, Debye-Huckel Onsager conductance equation and its extension to ion solvent interactions, Debye-Huckel Bjerrum mode, Ion association, triple ions, triple ions and conductance minima. Thermodynamics of electrified interface, derivation of electro capillary Lipmann's equation, surface excess, thermodynamic aspects of surface excess. The method of determination and measurement of interfacial tension as a function of applied potential

Handwritten signatures and initials at the bottom of the page, including a large signature on the left and several smaller ones on the right.

difference across the interface. Structure of electrified interface: Helmholtz theory, Guoy-Chapman theory, Stern model. Overpotential: Concentration overpotential and activation overpotential, Derivation of Butler-Volmer equation. Electrocatalysis: Definition and Influence of various parameters. Polarography: Ilkovic equation, half wave potential and its significance, qualitative and quantitative estimation of metal ions. Semiconductor- solution interface: Theory of double layers at semiconductor- electrolyte interface.

CCS 614: Research Methodology

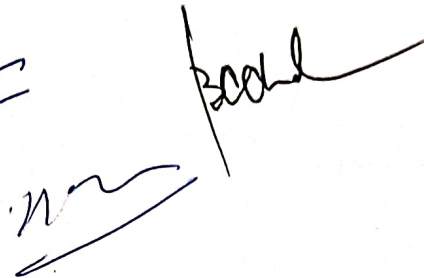
Credit: 4

CCS 615: Software based data Analysis

Credit: 4

CCS 616: Review of Literature/ Research Proposal

Credit: 8



(Semester IV)

Elective Specialization

CCS 621: Inorganic Chemistry specialization- II

Credit :4

UNIT I: Organometallic Chemistry

The 18- electron rule for organometallic compounds of transition metals: Classification based on 18- electron rule: complexes of two, three, four, five six, seven, eight-electron pi-ligands: nomenclature. Exceptions to 18 electron rule: the 16-electron rule. Agostic interaction, Isolobal and isoelectronic relationship of complexes. Elementary idea about homoleptic and non-homoleptic compounds: oxidative addition and reductive elimination reaction: insertion. Direct combination of carbon monoxide and metal.

UNIT II: Molecular Clusters and cages

Metal-carbonyl clusters, types, structures, the closo-, nido-, arachno-boranes, Wades rule, capping. Clusters having interstitial main group elements, halide type cluster, cubane clusters and naked or Zintl clusters. Molecular clusters in catalysis, boron-carbides and metal borides. Synthesis of heteronuclear metal carbonyls.

UNIT III Inorganic Reactions and Mechanism:

Substitution reactions in octahedral complexes, acid hydrolysis reactions, base hydrolysis and anation reactions, substitution reaction, reactions occurring without rupture of metal-ligand bond. Substitution reactions of square planar complexes. Theories of trans-effect and application, labile and inert complexes. Mechanism of redox reactions.

UNIT IV: Advanced Organometallic Chemistry

Catalysis by organometallic compounds: Tolman Catalytic loop, Hydrogenation, Wilkinson Catalyst, Polymerization -Ziegler Natta catalysis, Phase transfer catalyst (PTC), Synthesis gas-Water gas shift reaction, Hydroformylation (Oxo process), Monsanto Acetic Acid process, Walker process, Synthetic gasoline – Fischer Tropsch process and metatheses reaction.

Elective Specialization

CCS 622: Organic Chemistry Specialization II

Credit-4

UNIT I: Pericyclic Reactions

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl systems. Classification of pericyclic reactions. Woodward – Hoffmann correlation diagrams. FMO and PMO approach, concept of aromaticity of pericyclic transition states. Selection rules and stereochemical aspects of electrocyclic reactions, cycloaddition and sigmatropic shifts. Electrocyclic reactions: conrotatory and disrotatory motions, $4n$, $4n+2$. Cycloaddition reactions: antarafacial and suprafacial additions, $4n$ and $4n+2$ systems; 2, 2 addition of ketenes, 1,3 dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangements: suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3-sigmatropic rearrangements. Cope, Claisen and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

Handwritten signatures and initials:

UNIT II Photo chemistry

Photo chemistry – Introduction to photochemistry, cyclisation reaction and ring opening of 1, 3 Butadiene, 1, 3, 5 hexatriene systems. Jablonski diagram - Norish I & Norish II reaction, quantum yield. Primary & Secondary, photochemical reactions, Rearrangement – Paterno Buchi reaction. Barton reaction di-pi methane rearrangement, Photo reduction of ketones, Photo Fries rearrangement

UNIT III: Oxidation reactions

Introduction, Oxidation of hydrocarbons (Oxidation of alkenes: oxidation of carbon-carbon double bonds to epoxides (epoxidation) and diols, Woodward and Prevost Reaction, wacker process, Lemieux reagents, Oxidation of saturated hydrocarbons, Etard reaction, Oxidation at allylic positions, oxidation of alcohols by various reagents and methods, oxidation of ketones. Oxidation with ruthenium tetroxide, iodobenzene diacetate, and thallium (III) nitrate.

UNIT IV: Reduction reactions

Introduction, reduction of hydrocarbons, alkenes, Catalytic hydrogenation, homogeneous, heterogeneous hydrogenation, selectivity of reduction, di-imides, reduction of functional groups, Reduction by dissolving metals-reduction with metal and acid, reduction of carbonyl compounds, Birch reduction. reduction of epoxides, reduction by hydride transfer reagents, LAH and NaBH_4 , lithiumtrialkoxylaluminium hydride, diisobutylaluminiumhydride (DIBAL), sodiumcyanoborohydride, sodium triacetoxyborohydride, trialkylborohydrides. Other methods-desulphurisation of thio-acetals (mosingo reaction), low-valent titanium species, trialkyltinhydrides.

Elective course CCS 623- PHYSICAL CHEMISTRY SPECIALIZATION (Credit-4)**Principles & Basic Instrumentation of NMR/ESR/NQR/Mossbauer Spectra and Photochemistry**

UNIT I: Nuclear Magnetic Resonance (NMR) Spectroscopy: Basic instrumentation, nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift, and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant 'J'. Classification of molecules: (ABX, AMX, ABC, A2B2, etc. types), spin decoupling. FT NMR (qualitative idea) and its advantages, Applications of NMR in medical diagnosis.

UNIT II: Electron Spin Resonance (ESR) Spectroscopy: Basic principles, zero field splitting, and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship.

UNIT III: Nuclear Quadruple Resonance (NQR) Spectroscopy: Qudrupole nuclei, qudrupole moments, electric field gradient, coupling constant. hyperfine splitting in various systems, factors affecting, hyperfine coupling constants, zero-field splitting and Kramers' degeneracy, nuclear quadrupole interactions, Application.

UNIT IV: Mössbauer (MB) Spectroscopy: Gamma ray emission and absorption by nuclei, Mössbauer effect, Isomer shift, quadrupole splitting, Application to the elucidation of structure and bonding of FeII and FeIII, SnIV and SnII compounds, detection of oxidation states and inequivalent MB atoms. Basic principle, instrumentation, spectral parameters and spectrum

Handwritten signature

Handwritten signature

198

display, quadrupole and magnetic interactions. Photoelectron spectroscopy: Photo-excitation and photo-ionization. Core level and valence level photo-ionization (XPS, UV-XPS). Detection of atoms in molecules, chemical shift. Applications.

CCS 624: Academic Writings

Credit: 2

CCS 625: Practical (Paper Publications/Seminar-Conference Presentation at National Level)

Credit: 2

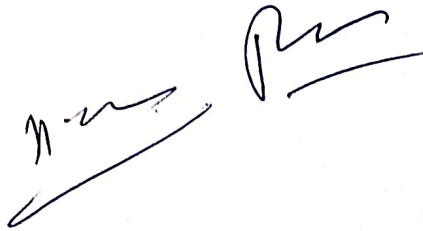
CCS 626 Subject based data analysis and interpretation

Credit: 4

CCS 627: Dissertation and presentation/Viva-Voce

Credit: 8







Annexure VII

Research Degree - Detailed Frame-Work

1st Semester:			
Course Type	Course Code	Course Name	Credits
Core Course (8 Credits)	CCS 705	Research Methodology	4
	CCS 700	CCS 700- Application of spectroscopic studies in chemical research	4
Elective Specializations (4 Credit)	CCS 701	CCS 701 Organometallic and Nano chemistry.	4
Research Ethics (2 credits)	CCS 702	Research Ethics	2
Indigenous Knowledge System (2 credits)	CCS 703	(Indian Knowledge Systems and practices)	2
Teaching Pedagogy (2 credits)	CCS 704	Teaching pedagogy	2

Students can also opt for Research Methodology, Research Ethics and Teaching pedagogy courses from any Science department of Central University of Himachal Pradesh.



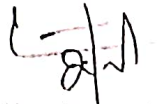
दिनांक अगस्त/17/2020

अभिसूचना

हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय के परिचय (Statute)(16) न अन्वयेण (4) में दिए गए प्रावधानों के अनुरूप माननीय कुलपति महोदय द्वारा "रसायन एवं रासायनिक विज्ञान विभाग" की पाठ्य समिति (Board of Studies) का पठन नियम प्रकार से किया जाता है

नियुक्ति का आधार	सदस्यों का नाम एवं पदनाम	कार्यकाल
पठन सदस्य	1. विभागाध्यक्ष - अध्यक्ष एवं संयोजक 2. संबंधित स्कूल के अध्यापक अथवा उनके/उनकी नामित/नामिती - सदस्य 3. विभाग के सभी प्रोफेसर - सदस्य	कार्यकाल के आधार पर
व्यतिरिक्त के क्रम से (ByRotation) विभाग का एसोसिएट प्रोफेसर		
व्यतिरिक्त के क्रम से (ByRotation) विभाग का एक सहायक प्रोफेसर	1. डॉ. नीरज गुप्ता, सहायक प्रोफेसर, रसायन एवं रासायनिक विज्ञान विभाग, हि.प्र.के.वि.	20.10.2020 से 19.10.2023
कुलपति द्वारा विश्वविद्यालय के संबन्धित सदस्यों में से, जो सम्बद्ध अथवा सजात विषयों (Allied & Cognate Disciplines) से ताल्लुक रखते हैं, नामित दो अध्यापक	1. प्रो. भूप चंद चौहान, प्रोफेसर, भौतिकी एवं खगोलशास्त्र विज्ञान विभाग, हि.प्र.के.वि. 2. डॉ. सुनील कुमार, एसोसिएट प्रोफेसर, जंतु विज्ञान विभाग, हि.प्र.के.वि.	20.10.2020 से 19.10.2023 20.10.2020 से 19.10.2023
कुलपति द्वारा नामित दो विषय विशेषज्ञ, जो इस विश्वविद्यालय में कार्यरत न हों।	1. डॉ. देविंदर कुमार शर्मा, प्रोफेसर, रसायन विभाग, हिमाचल प्रदेश विश्वविद्यालय, शिमला-171005, ईमेल- devsml@rediffmail.com मोबाइल नं: 9418019301 2. डॉ. अशोकान्त लोमश, रसायन विभाग, हिमाचल प्रदेश विश्वविद्यालय, शिमला-171005,	20.10.2020 से 19.10.2023

पाठ्य समिति के कार्य प्रक्रिया विश्वविद्यालय के परिचयों में दिए गये प्रावधानों के अनुरूप होंगी



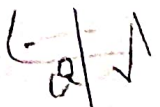
डॉ. संजीव शर्मा
कुलसचिव

पृष्ठांकन: रामसंख्या

दिनांक: 17 अक्टूबर, 2020

प्रतिलिपि - निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाई हेतु:

1. विभिन्न स्कूलों के सभी अधिष्ठाता, हि.प्र.के.वि., टैब, शाहपुर, धौलाधार परिसर-I & II, धर्मशाला/ साप्तसिन्धु परिसर, देहरा, जिला कांगड़ा।
2. विभिन्न विभागों/केन्द्रों के सभी विभागाध्यक्ष/निदेशक, टैब, शाहपुर/धौलाधार परिसर-I&II, धर्मशाला/ साप्तसिन्धु परिसर, देहरा।
3. वित्त अधिकारी, धौलाधार परिसर-II, धर्मशाला, जिला कांगड़ा।
4. सहायक निदेशक (राजभाषा) एवं कुलपति महोदय के ओ.एस.डी. - कृपया माननीय कुलपति महोदय के सूचनार्थ।
5. संबंधित सदस्य।
6. मॉड पत्रावल।


कुलसचिव