P. D. E. A's Prof. Ramkrishna More Arts, Commerce and Science College Akurdi Pune-411044



Affiliated to



B.Sc. Chemistry / B.Sc. Honors Chemistry

(Three Years B. Sc. and Four Years B. Sc. Honors Program)

Choice Based Credit System [CBCS] Under Autonomy and NEP-2020 (2024 Pattern)

> From Academic Year 2024-2025

Syllabus First Year Graduate (F. Y. B. Sc.) Chemistry

Board of Studies in Chemistry

Rules and Regulations

- 1. National Credit Framework (NCrF): For creditisation and integration of all higher education qualifications leading to a certificate/ diploma/ degree with multiple entry and exit options, college will refer to National Credit Framework (NCrF) which encompasses the qualification frameworks for higher education, vocational and skill education and school education, namely National Higher Education Qualification Framework (NHEQF), National Skills Qualification Framework (NSQF) and National School Education Qualification Framework (NSEQF) respectively.
- 2. Structure of Four years multidisciplinary UG Programme and Five Years Integrated Multidisciplinary Master's Degree Programmes with Multiple Entry and Exit Options at Different Levels:
 - (i) Students will have the flexibility to enter four years multidisciplinary Under Graduate Programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.
 - (ii) Students will get a Certificate after a One year programme (minimum 40 Credits), a Diploma after two years (minimum 80 Credits), a Bachelor's degree after three years (minimum 120 Credits), and a Bachelor's degree with Research or Honours after Four years (minimum 160 Credits).
- **3.** Qualification Type and Credit Requirements of Four Years Multidisciplinary Degree Programme with Multiple Entry and Exit Options

		Cr	edit			
Levels	Qualification Title	Requir	rements	Semester	Year	
		Minimum	Maximum			
4.5	UG Certificate	40	44	2	1	
5.0	UG Diploma	80	88	4	2	
5.5	Three Years	120	132	6	3	
	Bachelor's degree					
6.0	Bachelor's degree	160	176	8	4	
	Honour's with Major					
	Bachelor's degree	160	176	8	4	
	Honour's with Major					
7.0	Master's Degree	200	220	10	5	
8.0	Ph. D.					

(i) Details of qualifications, minimum credit requirements, exit credit courses, year and semester are as under:

- (ii) An exit 6-credit bridge course(s) lasting two months, including at least 6-credit job specific internship/apprenticeship that will help the graduates acquire job-ready competencies required to enter the workforce will be an additional requirement for the award of the undergraduate Certificate/ Diploma/ three year Bachelor's Degree.
- (iii) On exit, the students will have the option to re-enter the programme in the college, or in a different higher education institution. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.

- (iv) Eligibility for admission to the fourth year of four-year **Honours with Research Degree Programmes** as per UGC guidelines: Minimum CGPA of 7.5 or minimum 75% at three-year degree.
- (v) PG curriculum, as illustrated below, have flexibility a) One-year Post-Graduate Diploma (PGD), b) Two year Post-graduate Programme and c) 5 Years Master's degree programmes with multiple Entry and Exit options at different levels.
- (a) **Post-Graduate Diploma (PGD):** Programme duration- One year (2 semesters) after any bachelor's degree, min. 40 credits
- (i) UGC: 1-Year (2 semesters) Post-Graduate Diploma (PGD) after 3-years Bachelor's degree: Level 6.0
- (ii) UGC: 1-Year (2 semesters) PGD after 4 years Bachelor's degree (Honors/ Research): Level 6.5

(b) Master's Degree:

 (i) UGC: 2-Years (four semesters) Master's Degree after obtaining a 3-years Bachelor's degree, Minimum 40 credits/year, second year devoted entirely to research, PG – 2nd year: Level 6.5

OR

- (i) 1-Year (two semesters) Master's Degree after obtaining a 4-year Bachelor's degree (Honours/Research): Minimum 40 credits: Level 6.5
- (c) Level 8 represents Ph. D. Research Degree.
- (d) A 5-year Integrated Bachelor's and Master's programme shall have a minimum of 220 credits.
- (e) Master's and doctoral programmes, while providing rigorous research-based specialization, should also provide opportunities for multidisciplinary work, in academia, government, research institutions, and industry.

4. Lateral Entry/ Re-entry at higher Levels after exit from lower levels of four years multidisciplinary UG degree programme:

- (i) The credit points earned and accumulated shall be used to determine the eligibility for taking admission to various programs at multiple levels, subject to fulfilment of the broad principles laid down under NCrF. Students who leave with a Certification, Diploma, or a Basic Bachelor's Degree will be eligible to re-enter the programme at the exit level to complete or progress to the next level through lateral entry mode. Depending upon the academic and physical facilities available, the State Universities/ Autonomous Colleges (Higher Education Institutions or HEI) may earmark specific seats/ intake for lateral entry into the second year/ third year/ fourth year of a four years multidisciplinary UG degree programme as approved by Professional Standard Setting Bodies (PSSB/Govt. of Maharashtra/ statutory council of affiliating University plus any consequential vacancies caused by exits to an ongoing programme (four-year Degree Programme and Integrated Master's or second year Master's). Lateral entry or Re-entry is open to those students if he/she has either
 - (a) successfully completed the first year/second year/third year of the particular four years multidisciplinary degree programme in any ABC registered HEI with valid credits in ABC and re-entering into the second year/third year/fourth year, respectively of the same four years degree programme of any ABC registered HEI, within stipulated/ permissible period of years as decided by Statutory Councils of that HEI

OR

- (b) Already successfully completed a multidisciplinary four-year first-degree programme and is desirous of and academically capable of pursuing another multidisciplinary four years first-degree programme in an allied subject.
- (ii) A student will be allowed to enter/re-enter only at the odd semester. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits

as deposited and accumulated in Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records. However, in terms of the admission eligibility requirements, the student shall belong to the same faculty/ discipline in terms of Major Subject i.e., the Major subject of his earlier Programme and the Major subject of the new Programme for which he is seeking admission must be from the same faculty/discipline. Reservation for lateral entry will be executed as per the Government of Maharashtra norms.

5. Distribution of Credits across Multidisciplinary Four Years Degree Programme:

- (i) Four-year multidisciplinary degree programme with Honours/ Specialization Degree will have Internship and Core /Major Courses with a minimum of 22 credits per sem. in the Fourth Year.
- (ii) Four-year multidisciplinary degree programme with Research will have Research Projects, Seminars, Dissertations and Internships with a minimum of 22 credits per Sem. in the Fourth Year.
- (iii) Students shall select a 'Major or Core Subject/Discipline' and a 'Minor Subject/Discipline' from the lists of various Subject Combinations and Options provided the Colleges. In general, for the four years multidisciplinary bachelor's degree programme, the distribution of credits will be as follows:
 - (a) Disciplinary/interdisciplinary Major/ Core Subject (minimum of 68 credits)- Mandatory and Elective Courses
 - (b) Disciplinary/interdisciplinary Minor Subject (maximum of 22 credits)
 - (c) Skill based/Vocational studies corresponding to the Major/ Core Subject (8 credits)
 - (d) Field projects/internship/apprenticeship/community engagement and service corresponding to the Major/ Core Subject (14-22 credits) with a maximum of six credits per Semester
 - (e) Generic/ Open Electives through Baskets of Elective Courses (12 credits),
 - (f) Ability Enhancement Courses including Languages, Literature and Environmental Studies (12 credits),
 - (g) In-built modules on the Indian Knowledge System (IKS) in Major/ Core Subject at Level 4.5 2 credits
 - (h) Value-based Education, Life Skills and Professional Ethics: Co-curricular Courses such as Sports and Culture, NSS/NCC and Fine/ Applied/Visual Arts (8 credits).

Student can earn some credits (SEC/VSC/GE/OE) in the form of online from-

- (i) The National Skills Qualifications Framework (NSQF) organizes qualifications for Vocational and Skill Courses in a series of 8 levels based on professional knowledge, professional skills, core skills and responsibilities, in the increasing order of complexity and competency.
- (ii) University Grants Commission (Credit Framework For Online Learning Courses through Study Webs of Active-Learning for Young Aspiring Minds) Regulations, 2021, permits up to 40 per cent of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) platform.

6. Examination and Assessment Process:

- (i) The basic principle of the credit framework is that credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- (ii) Exit options are provided with certification, diploma and basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a four years multidisciplinary degree programme. Students will receive a Bachelor's degree with Honours/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.
- (iii) For the smooth success of four-year multidisciplinary degree programme with multiple entry and exit systems, the examination mode will be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination

modes. This is in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019)'.

(iv) Evaluation of each students in each course will be done as follows

- a. Each theory or practical course will be of 2 credits = 50 marks
- b. Internal evaluation 30% weightage (15 marks)
- c. External evaluation 70% weightage (35 marks)
- d. Students should secure 40% marks in each type of evaluation for successful completion of a course (student should secure at least 6 marks in internal and 14 marks in external evaluation).

(v) Evaluation Pattern.

a. Internal evaluation - Two written test, each of 20 marks will be conducted i. e. two tests on two modules. 1st assignment after completing 6 weeks of teaching and 2nd on completion of 13th week of teaching. 5 marks out of 15 will be assigned from these written tests. Remaining 10 marks will be assigned from other types of evaluation such as seminars, orals, poster presentation, open book challenging tests, surprise test, objective test etc. Examination (Internal and external) will conducted so that CO, PO, PSO can be evaluated.

b. External Evaluation - External evaluation will be done at the end of each semester.

- i. For theory, 35 marks written examination will be conducted and time of examination will be 2-hours.
- ii. For practical, 35 marks practical examination will be conducted and time of examination will be 4-hours.
- iii. For project / field project, 35 marks evaluation will done on the basis of viva-voce and examination of thesis by the examiners.
- iv. For OJT 35 marks evaluation will be done on the basis of report of industrial mentor / supervisor / industry and viva-voce. However, student has to produce and submit OJT certificate from competent authority of industry.

7. Attendance: The student must have at least 70% attendance, to appear any type of examination.

8. Declaration of Results:

(i) Declaration of result is based on the Semester Grade Point Average (SGPA) earned towards the end of each semester or the Cumulative Grade Point Average (CGPA) earned at the completion of all eight semesters of the programme and the corresponding overall alpha-sign or letter grades as given in Table 2. If some candidates exit at the completion of the first, second or third year of the four years Undergraduate Programmes, with Certificate, Diploma or Basic Degree, respectively, then the results of successful candidates at the end of the second, fourth or sixth semesters shall also be classified on the basis of the CGPA obtained in the two, four, six or eight semesters, respectively. Successful candidates at the end of the tenth semester of the integrated Master's Degree Programmes shall also be classified on the basis of CGPA obtained in the ten semesters of the Programmes. Likewise, the successful candidates of one year or two semesters Master's Degree Programme are also classified on the basis of the CGPA of two semesters of the Master's Degree Programme.

Table-2: Grades on degree certificate/mark sheet will be assigned to the students as per
the following table

	the rono wing tast	•
Semester GPA/ Program	% of Marks	Alpha-Sign / Letter
CGPA		Grade Result
Semester/Program		
9.00-10.00	90-100	O (outstanding)
8.00 - <9.00	80.00 - <90.00	A+ (Excellent)
7.00 - <8.00	70.00-<80.00	A (Very Good)
6.00 - <7.00	60.00-<70.00	B+ (Good)
5.50 - <6.00	55.00-<60.00	B (Above Average)
5.00 - <5.50	50.00-<55.00	C (Average)

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4.00 - <5.00	40.00-<50.00	P (Pass)	
Below 4.00	< 40	F (Fail)	
Ab		Absent	

(ii) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. For non-credit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9. Award of Major and Minor Degree:

- (i) A student pursuing four-year multidisciplinary UG programme will be awarded an appropriate Honours/ Research degree in Major/ Core Subject on completion of VIII Semester with the minimum of 176 credits if he secures in that Subject at least 50% of the total credits for that programme. He shall thus study the specific number of Mandatory Core Courses, Core Electives, Vocational and Skill Courses and Field projects/ Internships connected to Core Subjects in eight semesters so as to cover at least 50% of the total credits.
- (ii) In case of Research Degree, a student shall pursue research project and write dissertation in that Major in the VII and VIII semesters.

On the basis of above rules and regulations under NEP-2020 following course frame work is adopted by the Prof. Ramkrishna More Arts, Commerce and Science College, Akurdi, Pune-411044 for the completing of four years honours degree in Major and Minor subjects.

10. Distribution of Credits across Four Years Degree Programmes:

In general, for the four years' bachelor's degree programme, the distribution of credits will be as follows:

(a) Major (Core) Subject comprising Mandatory and Elective Courses:

- i. Minimum 50% of total credits corresponding to Three/Four year UG Degree- Mandatory Courses offered in all Four years;
- ii. 2 credit course on Major Specific IKS shall be included under Major;
- iii. Elective courses of Major will be offered in the third and/or final year.
- iv. Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects connected to Major first to fourth year.

(b) Minor Subject: 18-20 Credits

- i. The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.
- ii. The credits of Minor subjects shall be completed in the first three years of UG Programme.

(c) Generic/ Open Elective Courses (OE): 10-12 credits

- i. It is to be offered in I and/or II year
- ii. Faculty-wise baskets of OE shall be prepared by University/ Autonomous Colleges.
- iii. OE is to be chosen compulsorily from faculty other than that of the Major.

(d) Vocational and Skill Enhancement Courses (VSEC): 14-16 credits

- # Vocational Skill Courses (VSC): 8-10 credits, including Hands on Training corresponding to the Major and/or Minor Subject:
- i. To be offered in first to three years;
- ii. Wherever applicable vocational courses will include skills based on advanced laboratory practicals of Major

Skill Enhancement Courses (SEC): 06 credits

i. To be offered in I and II year;

ii. To be selected from the basket of Skill Courses approved by University/ Autonomous Colleges (e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): 14 Credits

• AEC: 08 credits

i. To be offered in I and II year

ii. English: 04 Credits

iii. Modern Indian Language: 04 credits

iv. To be offered from the Basket approved by the College;

The focus for both languages should be on linguistic and communication skills.

o IKS: 2 Credits

i. To be offered in I Year

ii. Courses on IKS to be selected from the basket of IKS courses approved by the Colleges

o VEC: 04 Credits

- i. To be offered in I year
- ii. Value Education Courses (VEC) Environmental Science Education (Compulsory), Understanding India, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project o Internship/Apprenticeship corresponding to the Major (Core) Subject: 8 Credits

o Field Projects/Community Engagement and Service corresponding to the Major (Core) Subject: minimum 4-6 credits

To be offered in II, and III years of UG Degree Programmes.

o Co-curricular Courses (CC) such as Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts: 8 credits. To be offered in I and/or II year

o Research Projects: 12 credits

To be offered in the final year for 4-year Honours with Research UG Degree

The UGC Regulations, 2021 permit up to 40% of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the SWAYAM platform and/or other State Level Common Platforms which can be developed in due course with the participation of different Universities/ HEIs.

Abbreviations: Generic/ Open Electives: GE/OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC; Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Indian Knowledge System: IKS; Value Education Courses: VEC; OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; Community engagement and service: CEP; Co-curricular Courses: CC; Research Methodology-RM; Research Project: RP Note: The Credit Distribution Table given above is illustrative only. The Universities/ Autonomous Colleges may suitably modify within the broader framework of credit distribution across six verticals.

11. Definitions:

i. One semester = 15 weeks

ii. 1-credit theory = 15 hours i.e. for 1 credit, 1 hour per week teaching is to be performed.

- 15 hours of 1-credit are splinted as 12 hours actual teaching + 3 hours Tutorial (Numerical problem solving sessions, revision on difficult topics, dialog on student's difficulties, and internal evaluation)
- **iii. 1-credit practical** = 30 hours. Thus, 1 credit practical = 2 contact hours in laboratory per week. 30 hours splinted as 24 hours actual table work and 6 hours for journal competition, oral on each practical and other internal evaluation.
- iv. Each theory course of any type (major, minor, VSC, VEC, OE/GE, VEC, SEC, CC, etc.) is of 2 credits.
- **v. Theory per semester:** Each theory course is of 2 credits. Thus, for each theory course contact hours = 24 teaching + 6 tutorials

vi. Each practical course is of 2 credits = 60 hours per semester

- a. Minimum 12 laboratory sessions will be conducted in one semester.
- b. Each laboratory sessions will be of 4 hour.

P. D. E. A's.

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Graduate and Honors Degree Course Framework under Autonomy as per NEP-2020; With Major Chemistry

Sem.	Subject-1 (Major)	Major Elective Curses	Subject-2 (Minor)	VSC	IKS	FP/OJT/CEP	GE/OE	SEC	AEC	VEC	СС	Total Credits
]	First Year C	Certificate Co	ourse				
Ι	CHMAT-111 CHMAT-112 CHMAP-113	0	2 Theory + 1 Practical Other than chemistry	0	GEIKT- 111	0	CHGET-111	CHSEP-111	Marathi (MAAET-111) /Hindi (HIAET-111)	Environment Awareness VEEAT-111	0	22
II	CHMAT-121 CHMAT-122 CHMAP-123	0	2 Theory + 1 Practical Other than chemistry	0	0	0	CHGEP-121	CHSEP-121	Marathi (MAAET-121) /Hindi (HIAET-121)	Democracy and Indian Constitution VEPOT-121	Physical Education CCPEP-121	22
	Second Year Graduate Diploma											
	Major		Minor	VSC	IKS	FP/OJT/CEP	GE/OE	SEC	AEC	VEC	СС	Total Credits
III	CHMAT-231 CHMAT-232 CHMAT-233	0	1 Theory + 1 Practical Other than chemistry	CHVST- 231	CHIKT- 231	Field Project (2 Credit) CHFPP-231	1 theory / 1 Practical From Basket	0	1 theory English AEENT- 231		CCHRT-231 Human Rights	22
IV	CHMAT-241 CHMAT-242 CHMAT-243	0	1 Theory + 1 Practical Other than chemistry	CHVSP- 242	0	Community Engagement and Service (2 Credit) CHCEP-241	1 theory / 1 Practical From Basket	CHSEP-231	1 theory English AEENT- 241		CCCST-241 Cyber Security	22
					r	Fhird Year	Graduate De	egree				
V	CHMAT-351 CHMAT-352 CHMAT-353 CHMAP-354 CHMAP-355 CHMAP-356	CHMET-351-A CHMEP-352-A Or CHMET-351-B CHMEP-352-B	1 Theory	CHVST- 351	0	Research project (2 Credit) CHRPP-351	0	0	0	0	0	22
VI	CHMAT-361 CHMAT-362 CHMAT-363 CHMAP-364 CHMAP-365 CHMAP-366	CHMET-361A CHMEP-361A Or CHMET-361B CHMEP-361B		CHVSP- 351	0	OJT (4 Credit) CHOJT-361	0	0	0	0	0	22

	VII and VIII Semester Honours Degree with Major											
Sem.	Major Courses	Major Elective Curses	Minor Curses	VSC	IKS	FP/OJT/CEP	GE/OE	SEC	AEC	VEC	СС	Total Credit s
VII	CHMAT-471 CHMAT-472 CHMAT-473 CHMAT-474 CHMAT-475 CHMAP-476 CHMAP-477	CHMET-4718-A CHMEP-472-A Or CHMET-471-B CHMEP-472-B	Research methodology (4 Credits) CHRMT-471	0	0	0		0	0	0	0	22
VIII	CHMAT-481 CHMAT-482 CHMAT-483 CHMAT-484 CHMAT-485 CHMAP-486 CHMAP-487	CHMET-481-A CHMEP-482-A Or CHMET-481-B CHMEP-482-B	0	0	0	On Job Training (4 Credit) CHOJT-481	0	0	0	0	0	22
			V	'II and V	/III Sem	ester Hono	urs Degree w	ith Research	l			
VII	CHMAT-471 CHMAT-472 CHMAT-473 CHMAT-474 CHMAP-476	CHMET-471-A CHMEP-472-A Or CHMET-471-B CHMEP-472-B	RM 4 Credits	0	0	Research Project-I (4 Credit) CHPRP-471	0	0	0	0	0	22
VIII	CHMAT-481 CHMAT-482 CHMAT-483 CHMAT-484 CHMAT-485 CHMAP-486	CHMET-481-A CHMEP-482-A Or CHMET-481-B CHMEP-482-B	0	0	0	Research Project-II (6 Credit) CHPRP-481	0	0	0	0	0	22

Program: B.Sc. [Chemistry], 2024-25

Program Outcomes

- PO-1: **Disciplinary knowledge and skill:** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical fundamental concepts in all disciplines of Chemistry. Further, the student will be capable of applying modern technologies, handling advanced instruments and Chemistry related soft-wares for chemical analysis, characterization of materials and in separation technology.
- PO-2: **Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.
- PO-3: **Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to graduate students to develop critical thinking and to design, carry out, record and analyze the results of chemical reactions. Students will be able to think and apply evidence based comparative chemistry approach to explain chemical synthesis and analysis.
- PO-4: Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.
- PO-5: **Team player:** The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.
- PO-6: **Skilled project manager:** The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.
- PO-7: **Digitally literate:** The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, use of chemical simulation software and related computational work.
- PO-8: **Ethical awareness:** A graduate student requires understanding and developing ethical awareness or reasoning which is adequately provided through the course curriculum. Students CO-2: To know how to handle the technical devices for presenting research works. can also create an awareness of the impact of chemistry on the environment, society, and also make development outside the scientific community.
- PO-9: **Environmental Awareness:** As an inhabitant of this green planet a Chemistry graduate student should have many social responsibilities. The course curriculum is designed to teach a Chemistry graduate student to follow the green routes for the synthesis of chemical compounds and also find out new greener routes for sustainable development. The course also helps them to understand the causes of environmental pollution and thereby applying environmental friendly policies instead of environmentally hazard ones in every aspect.
- PO-10: Analytical skill development and job opportunity: The course curriculum is designed in such a way that Chemistry graduate students can handle many Chemistry based software, modern instruments and advanced technologies to synthesize, characterize and analyze the chemical compounds very skillfully. Such a wonderful practice in the graduate level will bring a good opportunity to the students for getting job in industries besides academic and administrative works. Programme.

Program Specific Outcomes

After completing B. Sc. Chemistry, students will be able to

- PSO1: Understand the nature and basic concepts of Physical, Organic and Inorganic chemistry.
- PSO2: Analyze Organic and inorganic compounds qualitatively and quantitatively
- PSO3: Understand the applications of physical, organic, inorganic and analytical chemistry in pharmaceutical, agriculture and chemical industries.
- PSO4: Able to perform experimental procedures as per laboratory manual in thearea of physical, Inorganic and organic chemistry.
- PSO5: interpretation and synthesis of chemical information and data obtained from chemical and instrumental analysis.

F. Y. B. Sc. Chemistry Syllabus

CBCS Semester Pattern

Under Autonomy and NEP-2020

To Be Implemented From

Academic Year 2024-25

Courses Offered by Chemistry Department at First year of Graduation

	Subject-1 (Major) and Subject-2 Chemistry (Minor) Courses								
Semester	Course code	Generic Name	Title of the paper						
Ι	CHMAT-111	Chemistry theory paper-1	Physical Chemistry –I						
	CHMAT-112	Chemistry theory paper-2	Analytical Chemistry –I						
	CHMAP-113	Chemistry practical paper-1	Practical Chemistry -I						
II	CHMAT-121	Chemistry theory paper-3	Inorganic Chemistry –I						
	CHMAT-122	Chemistry theory paper-4	Organic Chemistry –I						
	CHMAP-123	Chemistry practical paper-2	Practical Chemistry -II						
	Indian Knowledge System (IKS) Related for Chemistry Major								
Ι	GEIKT-111	Indian knowledge system paper-I	Generic IKS						
	Skill Enhan	cement Course (SEC) for Science	e Faculty Students						
Ι	CHSEP-111	Skill Enhancement Chemistry	Chemistry Practical for Clinical						
		Course Practical-I	Lab						
II	CHSET-121	Skill Enhancement Chemistry	Chemistry for Clinical						
	Course Theory-I Technician								
	(Generic Elective / Open Elective	(GE/OE)						
Ι	CHGET: 111	GE/OE Chemistry-I	Chemistry for Competitive						
			Examination -I						
II	CHGEP -121	GE/OE Chemistry-II	Formulation of Soaps and related						
			products						
		Ability Enhancement Course	(AEC)						
Ι	MAAET-111	Marathi Paper-I	Vyavharic Marathi Part-I						
	HIAET-111	Hindi Paper-I	General Hindi-I						
II	MAAET-121	Marathi Paper-II	Vyavharic Marathi Part-II						
	HIAET-121	Hindi Paper-II	General Hindi-II						
Value Education Course (VEC)									
Ι	VEEAT-111	Value Education Course-I	Environment Awareness						
II	VEDIT-121	Value Education Course-II	Democracy and Indian						
			Constitution						
		Curricular Courses (CC							
II	CCPEP-121	Curricular Courses-I	Physical Education and Sports						

Sr. No	2019 (CBCS Pattern	NEP-2020; 2023 CBCS Pattern		
51. 190.	Course Code	Course Name	Course Code	Course Name	
1	CH-101	Physical Chemistry	CHMAT-111	Physical Chemistry –I	
2	CH-102	Organic Chemistry	CHMAT-122	Organic Chemistry –I	
3	CH-103	Chemistry Practical -I	CHMAP-113	Practical Chemistry -I	
4	CH-201	Inorganic Chemistry	CHMAT-121	Inorganic Chemistry –I	
5	CH-202	Analytical Chemistry	CHMAT-112	Analytical Chemistry –I	
6	CH-203	Chemistry Practical -II	CHMAP-123	Practical Chemistry -II	

Equivalence to Previous i.e. 2019 CBCS pattern of SPPU

Equivalence to Previous syllabus i.e. CBCS 2023 pattern, NEP-2020

Sn No	NEP-202	4 CBCS Pattern	NEP-2023 CBCS Pattern		
SI. NU.	Course Code	Course Name	Course Code	Course Name	
1	CHMAT-111	Physical Chemistry –I	CHMAT-111	Physical Chemistry –I	
2	CHMAT-122	Organic Chemistry –I	CHMAT-122	Organic Chemistry –I	
3	CHMAP-113	Practical Chemistry -I	CHMAP-113	Practical Chemistry -I	
4	CHMAT-121	Inorganic Chemistry –I	CHMAT-121	Inorganic Chemistry –I	
5	CHMAT-112	Analytical Chemistry –I	CHMAT-112	Analytical Chemistry –I	
6	CHMAP-123	Practical Chemistry -II	CHMAP-123	Practical Chemistry -II	

Course Wise Detailed Syllabus

CHMAT-111; Chemistry Theory paper-1; Physical Chemistry-I [2 Credit, 30L]

Chapter No	Name of the Chapter	Lectures Assigned
1	First law of thermodynamics	7 L
2	Thermochemistry	8 L
3	Chemical Equilibrium	9 L
4	Ionic Equilibria	6 L

Module-1

Chapter-1. First law of thermodynamics

Thermodynamic Terms: System, Boundary, Surround. Homogeneous and Heterogeneous systems, Types of thermodynamic systems, Intensive and extensive properties, State of system, Equilibrium and non-equilibrium states, Thermodynamic processes, Reversible and irreversible processes, Nature of heat and work, Internal energy Units of internal energy, First law of thermodynamics, Enthalpy of system, Molar heat capacities, Joule Thomson effect, Adiabatic expansion of an ideal gas, Work done in adiabatic reversible expansion, numerical, (Reference -1 Page no. 236 - 270).

Chapter-2. Thermochemistry

Introduction, units of energy changes, enthalpy of a reaction, exothermic and endothermic reactions, sign of ΔH and ΔE , calculation of ΔH from ΔE and *vice versa*, thermochemical equations, heat of reaction or enthalpy of reaction, variation of heat (or enthalpy) of reaction with temperature, Different types of heat (enthalpy) of reaction: heat of formation, standard heat of formation, heat of combustion, application of heat of combustion, heat of solution, heat of neutralization. Heat changes during transition or phase changes: Heat of fusion, heat of vaporisation, heat of sublimation, heat of transition. Hess's law of constant summation; applications of Hess's law, Bond energy. Numerical, (Reference -1 Page no. 271 - 302).

Module-2

Chapter-3. Chemical Equilibrium

Reversible reactions, characteristics of chemical equilibrium, law of mass action, equilibrium constant, equilibrium law, equilibrium constant expression in terms of partial pressures, units of equilibrium constant, heterogeneous equilibria, Le Chatelier's, Conditions for maximum yield in industrial processes, synthesis of ammonia (Haber process), Manufacture of sulphuric acid (contact process), manufacture of nitric acid (Birkeland -Eyde process). Numericals, (Reference -1 Page no. 621-671)

Chapter-4. Ionic Equilibria

Ostwald's dilution law, experimental verification of Ostwald's law, limitation of Ostwald's law, theory of strong electrolytes, Ghosh's formula, Debye-Huckel theory, degree of dissociation, solubility equilibria and solubility product, applications of solubility product. Numerical, (Reference -1 Page no. 909 -922)

Reference-1: Essentials of physical Chemistry, 4th Ed., Arun Bahl, B. S. Bahl, G. D. Tuli, publisher-S. Chand.

Course Outcome: At the end of couse student will -

- CO-1: Able to remember Ostwald's law, first law of thermodynamics, Debye-Huckel theory, Le Chatelier's principle etc.
- **CO-2:** Explain the fundamentals of thermodynamics, thermochemistry, ionic equilibria and chemical equilibria
- **CO-3:** The students able to solve numerical problems related to solubility products, enthalpy of various reactions, bond energy.

[8 L]

[7 L]

[15 L]

[9 L]

[6 L]

[15 L]

CO-4: Interpret the various types of heat of reactions with respect to thermodynamic parameters.

CO-5: Justify the conditions for maximum yield in industrial processes

CO-6: Differentiate among various thermochemical parameters

Chapter No	Name of the Chapter	Lectures Assigned
1	The Nature of Analytical Chemistry	04 L
2	Aqueous Solutions and Chemical Equilibria	11 L
3	pH-Measurement	06 L
4	Analytical Separation: Paper and Thin layer	09 L
	chromatography	

CHMAT-112; Chemistry Theory paper-2; Analytical Chemistry-I [2 Credit, 30L]

Module-1

[15 L]

[4 L]

Chapter-1: The Nature of Analytical Chemistry

The Role of Analytical Chemistry, Quantitative Analytical Methods, Typical Quantitative Analysis (Choosing a Method, Processing the Sample, Eliminating Interferences, Calibrating and Measuring Concentration, Calculating Results, Evaluating Results by Estimating Reliability, Acquiring the Sample, An Integral Role for Chemical Analysis: Feedback Control Systems, Deer Kill: A Case Study Illustrating the Use of Analytical Chemistry to Solve a Problem in Toxicology. **Ref-1:** pp: 1-13

Chapter-2: Aqueous Solutions and Chemical Equilibria in Analytical Chemistry [11 L]

Theories of acids and bases-Arrhenius definition of acids, bases and salts, Bronsted theory, Lewis theory. The Chemical Composition of Aqueous Solutions, Classifying Solutions of Electrolytes, The Chemical Composition of Aqueous Solutions, Acids and Bases, Amphiprotic Species, Autoprotolysis, Strengths of Acids and Bases, Chemical Equilibrium, The Equilibrium State, Equilibrium-Constant Expressions, Types of Equilibrium Constants in Analytical Chemistry, Applying the Ion-Product Constant for Water, Using Solubility-Product Constants, The Solubility of a Precipitate in Pure Water, The Effect of a Common Ion on the Solubility of a Precipitate, Using Acid/Base Dissociation Constants, Hydronium Ion Concentration of Solutions of Weak Bases, Buffer Solutions, Calculating the pH of Buffer Solutions, Properties of Buffer Solutions, Buffer Capacity, Preparation of Buffers. Problems, *Ref-1: pp: 197-232*

Module-2

Chapter-3: pH-Measurement

[15 L] [6 L]

Revision of Arrhenius definition of acids and bases, dissociation of acid and bases in aqueous solution, Units to express H^+ ion conc.: molar H^+ ion conc. and concept of pH and pH Scale, Electrochemical cell, Def. reference and indicator electrode,, Calomel and silver-silver chloride electrode, glass electrode for pH measurement (composition and structure of glass electrode, membrane potential, boundary potential, asymmetry potential, glass membrane potential, the alkaline error, the acid error), Potentiometric pH Measurement with the Glass Electrode, Errors Affecting pH Measurements, The Operational Definition of pH, pH meter, combine glass electrode, Standard Buffers as reference for pH measurement (preparation of phthalate buffer of pH = 4 and sodium tetraborate buffer of pH- 9.2), Calibration of pH meter, measuring pH of aqueous solutions using pH meter. Problems *Ref-1 and 2 relevant pages*

Unit-4: Analytical Separation: Paper and Thin layer chromatography[9 L]

Introduction to chromatography, Definition of chromatography, IUPAC definition of chromatography, History of Chromatography, Classification of Chromatographic methods. *Ref-3: pp 1 to 14*

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Theoretical Basis: Introduction, Distribution ratio and separations, Factors influencing retention, retention and equilibrium in chromatography, *Ref-3*: *pp17-26*

Thin Layer Chromatography: theory and principle; outline of the method; surface adsorption process and spot shape; composition of thin layer with other forms of chromatography, adsorbents: additives, silica gel, Kieselguhr, alumina, cellulose powder, DEAE cellulose; preparation of plate - spreading, pouring, spraying, dipping; activation; application of sample, auto-spotter; documentations; Development: only Ascending, Descending methods and two dimensional methods; solvents; system, development of plate, location of separated substances – chemical methods and ultraviolet lamp method, only, Preparative TLC (def., method and uses). Definition of R_f and measurement of R_f , qualitative analysis by TLC. *Ref-3: pp 44-80*

Paper Chromatography: Origin, overview of the technique, sample preparation (preparation of specimens, removal of matrix), types of paper (Ion exchange papers, reverse phase methods, dual phase PC), solvents, equilibrium, developments (radial development), sample application and detection, quantitative method, application of paper chromatography, **Ref-3: 81-92**

Text Books

- **Referenc-1:** Fundamentals of Analytical Chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Ninth Edition
- **Referenc-2:** Vogel's Textbook of Quantitative Chemical Analysis, 5th (ELBS publication) or 6th Ed (Pearson Education).
- **Reference-3:** Chromatographic method, A Braithwaite and F. J. Smith, 5th Edition, Kluwer Academic publishers Pp 44-92

Further Reading

- **Reference-4:** Analytical Chemistry, Gary Christian, Kevin A. Schug, Purnendu Dasgupta, Wiley, 9th Ed.
- **CO-1:** To identify a role of analytical chemist, and analytical chemistry in chemical analyses of substances.
- **CO-2:** Define / discuss/ explain basic concepts in stoichiometric calculations in analytical chemistry, acid base equilibria, pH measurement and planar chromatographic methods and their uses in analytical chemistry.
- **CO-3:** Differentiate / compare among acid and base, weak acid-strong acid, weak base-strong base, pH measurement, paper and thin layer chromatography, molarity-normality,
- **CO-4:** Apply his knowledge in stoichiometric calculations of analytical chemistry, explaining acid base equilibria, pH measurement and related calculations, preparation of standard and stock solutions, TLC or Paper chromatographic methods for separation of compounds, etc.
- **CO-5:** Solve numerical on stoichiometric calculations in analytical chemistry, acid base equilibria and pH measurement.
- **CO-6:** Design / plan TLC or Paper chromatographic methods for separation of compounds.

CHMAT-113; Chemistry Practical Paper-1; Practical Chemistry-I [2 Credit, 60 L]

Experiment-1: Introduction to laboratory safety: a. Toxicity of the compounds used in chemistry laboratory. b. Safety symbol on labels of pack of chemicals and its meaning c. What is MSDS sheets? Find out MSDS sheets of at least hazardous chemicals ($K_2Cr_2O_7$, Benzene, cadmium nitrate, sodium metal, etc.) d. Precautions in handling of hazardous substances like Conc. acids, ammonia, organic solvents, etc. e. Handling of glassware's

Experiment-2: Table work: Selecting and Handling Reagents and Other Chemicals, Cleaning and Marking, of Laboratory Ware, Evaporating Liquids, Measuring Mass, Equipment and Manipulations Associated with Weighing, Filtration and Ignition of Solids, Measuring Volume, Calibrating Volumetric Glassware, Laboratory notebook.

Experiment-3: Determination of oxidation state and equivalent of reactive metals like Zinc, Aluminium, Magnesium by eudiometry.

Thermochemistry (Any three)

- **Experiment-4:** Determination of enthalpy of neutralization of hydrochloric acid and acetic acid with sodium hydroxide. Calculation of heat of ionization of acetic acid.
- **Experiment-5:** Determination of integral enthalpy of solution of salts (KCl, NaCl) and Born Haber Cycle.
- **Experiment-6:** Determination of enthalpy of displacement reaction of Cu from CuSO₄ by Zn metal.
- **Experiment-7:** Study of the solubility of benzoic acid in water and determination of ΔH .

b. pH-metry (Any two experiments)

- **Experiment-8**: Standardization of pH meter and measurement of pH of a) different samples of water (tap water, waste water, Bore well water) and compare them, b) detergents different brands (Nirma, Aerial, surf Excel, Wheel, etc.) and compare them, c) pH of cold drinks. Calculate H⁺ ion conc. in each of these solution.
- **Experiment-9:** Calculate amount of sodium acetate (0.1M) and acetic acid (0.1M) for the preparation of acetate buffer of pH = 4.0, 4.5, 5.0, 5.5 and 6. Prepare series of acetate buffer and determination of their pH by pH meter. Compare observed value with theoretically expected values. Calculate H⁺ ion conc. in each of these solution.
- **Experiment-10:** Determination of buffer capacity: preparation of 50 ml ammonia ammonium hydroxide buffer of pH 10 from 5 M Ammonium chloride and 10 M ammonia and determine its buffer capacity with 1 M HCl.

Section C: Paper Chromatography (two experiments)

- Experiment-11: Separation of constituents of mixtures by Paper Chromatography: Measure the Rf value Plant Pigments from plant extract. OR
- **Experiment-12:** Separation of constituents of mixtures by paper Chromatography and measure the Rf value of organic dyes or food colours thereby identification of dyes.
- **Experiment-13:** Separation of constituents of mixtures of two metal ions by paper Chromatography, their identification and measure the Rf value. **OR**
- **Experiment-14**: Separation of constituents of mixtures of two amino acids by Paper chromatography, their identification and measure the Rf value.

Section D: Thin Layer Chromatography (two experiments)

- **Experiment-13:** Choice of composition of mobile phase for the separation of o-nitro and p-nitro phenol/aniline by thin layer chromatography, and measure the R_f value in each case organic compounds.
- **Experiment-14:** Choice of composition of mobile phase for the separation of mixture of colourless substances (benzoic acid and naphthalene) by thin layer chromatography and measure the R_f value in each case organic compounds.
- **Experiment-15:** Synthesis of azo dye between aniline and beta-napthol. Identify colourless impurities by thin layer chromatography, and measure the Rf value in each case organic compounds.

Reference Books:

- **Reference-1:** Laboratory Manual Prepared by Department of Chemistry, Prof. Ramkrishna More College Akurdi.
- **Referenc-2.** Text book of Practical Organic Chemistry, Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G., Prentice-Hall, 5th edition, 1996.
- Referenc-3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R.Chand & Co.: New Delhi (2011).
- Referenc-4. Prof. Robert H. Hill Jr., David C. Finster Laboratory Safety for Chemistry Students, 2nd Edition, Wiley ISBN: 978-1-119-02766-9 May 2016

Course Outcome: Students will learn

CO-1: Importance of chemical safety and Lab safety while performing experiments in laboratory

- CO-2: Determination of thermochemistry parameters of some chemical reactions and related concepts
- CO-3: Techniques of pH measurements using pH meter and application of pH measurement.
- **CO-4:** Preparation of buffer solutions using Henderson equation and determination of buffer capacity
- **CO-5**: Technique of thin layer and paper chromatography for separation and identification from mixture of compound.
- **CO-6:** Preforming analytical chemistry calculations.

CHMAT-121: Chemistry Theory paper –3; Inorganic Chemistry-I [2 credits, 30L]

Chapter	Name of the Chapter	Lectures
No		Assigned
1	Electronic Structure of Atom	07 L
2	Long form of periodic table and Periodic properties	08 L
3	Introduction to bonding	02 L
4	The Covalent Bond	09 L
5	Hydrogen bond	04 L

Module-1

[7 L]

[15 L]

[15 L]

[2 L]

[9

Chapter-1: Electronic Structure of Atom

Definition of atom, Constituent of atom (electron, nucleus-neutron and protons and their characteristics), atomic number atomic mass number, The atom as a nucleus with orbital electrons, Atomic spectra of hydrogen atom and Bohr theory, Refinement to the Bohr theory, the Heisenberg uncertainty principle, the Schrodinger wave equation, radial and angular functions (type of orbitals and their shapes), Pauli exclusion principle, Buildup of the elements, Hund's rule, Sequence of energy levels, *Reference-1: pp 3 to 25; Rreferenc-2-Relevent pages*.

Chapter-2: Long form of periodic table and Periodic properties [8 L]

Modern periodic law Long form of periodic table (IUPAC system of labeling of group only -1 to 18 groups), electronic configuration and arrangement of elements in the groups in periodic table, four blocks in periodic table, Periodic Properties-Size of atoms and ions, Ionization energies, electron affinity, polarizing power and polarizibility, electronegativity, metallic character, variable valence and oxidation state, types of elements-metals, non-metals, inert gases. *Reference-1: pp 25 to 27 and 146 to 165; Referenc-2: Relevant pages*.

Module-2

Chapter-3: Introduction to bonding

Attainment of a stable configuration, Types of chemical bonds-Ionic, Covalent, co-ordinate and metallic bonds; *Reference-1: pp 30 to 39*.

Chapter-4: The Covalent Bond

Introduction, General characteristics of the molecules, Lewis theory, the Octet rule, Exceptions to the Octet rule, Sidgwick-Powell Theory, Valence Shell Electron Repulsion (VSEPR) Theory, Valence Bond Theory, Hybridization, the extent of d-orbitals participation in molecular bonding, Sigma and Pi bonds, Structure of some molecules BeF₂, BF₃, HClO₄, PCl₅, SF₆, *Reference-1: pp 72 to 89. Referenc-2: Relevant pages.*

L]

Chapter-5: Hydrogen Bond

F. Y. B. Sc. /M. Sc. -I

Origin of intermolecular forces in liquids: dipole-dipole interaction, dipole-induced dipole attraction, induced dipole-induced dipole attraction, Definition of hydrogen bond, Hydrogen bond and liquid state of matter, types of hydrogen bond (intra and intermolecular with suitable examples), anomalous behavior of water. *Refence-2:* 287-292

Refence-1: Concise Inorganic Chemistry, J. D. Lee, 5th Ed. Blackwell Science

Reference-2: University general chemistry, an introduction to chemical science, Edited by CNR Rao, published by Macmillan.

Course Outcome: Students will learn

- **CO-1:** Define basic concepts included in syllabus of atomic structure, periodic table, valance bond theory and hydrogen bonding.
- **CO-2:** Discuss/ explain basic concepts included in syllabus of atomic structure, periodic table, valance bond theory and hydrogen bonding.
- **CO-3:** Differentiate / compare among various concepts such as electron and proton; different types of orbitals; different series in spectra of hydrogen atom, different types of bonds; periodic properties, types of hybridization, etc.
- **CO-4:** Apply his knowledge to write correct electronic configuration of elements, to explain or predict structure of some molecules, predict trends in periodic properties of elements, effect of hydrogen bonding on physical properties of compounds, etc.
- **CO-5:** Solve numerical or logical problem on atomic structure, periodic table, Octet rule, valance bond theory and hydrogen bonding.
- **CO-6:** Predict / elucidate structure of small molecules on the basis of VSEPR theory and hybridization, observed periodic properties, etc.

CHMAT-122: Chemistry Theory paper –4; Organic Chemistry-I [2 credits, 30L]

Chapter No	Name of the Chapter	Lectures Assigned
1	Fundamentals of Organic Chemistry	08 L
2	Stereochemistry part-I	07 L
3	Stereochemistry part-II	07 L
4	Chemistry of Hydrocarbons	08 L

Module-1

Chapter-1: Fundamentals of Organic Chemistry

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation, Toutomerism, Steric effect, Hydrogen bonding. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. **Ref. 1. pp. 01 to 74**

Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. **Ref. 7. pp. 236, 245, 258.**

Aromaticity: Benzenoids and Hückel's rule. Ref. 7. pp. 39 to 48.

Chapter-2: Stereochemistry part-I

Introduction, classification, Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Conformations with respect to ethane, butane and cyclohexane. Configuration: Geometrical - cis – trans, and E / Z Nomenclature (for upto two C=C systems). Ref. 2. pp. 09 to 44.

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[8 L]

[15 L]

Module-2

Optical isomerism Enantiomerism, Diastereomerism and Meso compounds). Concept of chirality (upto two carbon atoms). Three and erythre; D and L; nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) **Ref. 2. pp. 73 to 88.**

Chapter-4: Chemistry of Hydrocarbons

Chapter-3: Stereochemistry part-II

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Up to 5 Carbons) Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Up to 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO₄) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Up to 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalide Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4. **Ref. 3. pp 75 to 89.**

Aromatic Hydrocarbons: benzene, Naphthalene, Anthracene (Preparation and Reactions) Ref. 3. pp. 432 to 437.

Reference Books

Reference-1: Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

- Reference-2: Stereochemistry of Organic Compounds, V. K. Ahluvalia, Springer (2022).
- Reference-3: Textbook on Organic Chemistry, K. S. Mukherjee, NCBA, 2007.

Reference-4: Morrison, R.T. & Boyd, R. N. Organic Chemistry, Pearson, 2010.

Reference-5: Organic Chemistry-Clayden, Oxford Uni. Press.

Reference-6: Stereochemistry of Organic Compounds-Eliel Tata Mc Graw Hill 1989.

Reference-7: Advanced Organic Chemistry-Jagdamba Singh and L.D.S. Yadav, Pragati prakashan, 20th edition 2014.

Course outcome

Students will learn

- **CO-1:** Define and explain the fundamentals, principles, and recent developments in the Organic Chemistry
- **CO-2:** Discuss the concept of Acidity and basicity with respect to Structural effect.
- **CO-3:** Interpreted various reactive intermediates.
- **CO-4:** Apply stereochemistry knowledge to the organic Compounds. To assign exact configurations
- **CO-5:** Explain reaction and synthesis of hydrocarbons.
- CO-6: Differentiate among the Hydrocarbons, name them according to IUPAC

[8 L]

CHMAP- 123: Chemistry Practical –2 (2 Credits, 60 L)

Section A: Inorganic Chemistry

Part-I: Synthesis of commercially important inorganic compounds (any three)

Experiment-1: Synthesis of potash alum from aluminium metal (scrap Aluminium metal)

Experiment-2: Synthesis of Mohr's Salt [(FeSO₄) (NH₄)₂SO₄]•6H₂O

Experiment-3: Synthesis of FeSO₄•7H₂O

Experiment-4: Preparation of Dark red inorganic pigment: Cu₂O (compulsory)

Note: In synthesized compound student must confirm the particular Cation and anion by performing qualitative tests.

Part-II: Inorganic Volumetric Analysis, Investigative Practical's (compulsory)

- **Experiment-5:** Determination of equivalent weight of oxidizing agent KMnO₄ and K₂Cr₂O₇ by titration with standard Fe(II) solution.
- **Experiment-6:** Determination of basicity of boric acid or oxalic acid or citric acid hence determination of their equivalent weigh by acid base titration.

Experiment-7: Estimation of water of crystallization in Mohr's salt by titrating with KMnO₄.

Section B: Organic Chemistry Practical

Part-III: Organic purification Techniques

- **Experiment-9:** Purification of two organic compounds by Crystallization (one from water one from water-alcohol) with respect to melting point of pure and impure compound and percent yield of purified product.
- **Experiment-10:** Purification of organic compounds by sublimation with respect to melting point of pure and impure compound and percent yield of purified product.
- **Experiment-11:** Purification of organic liquid by distillation with respect to boiling point of pure and impure liquid and percent yield of purified product.

Part-IV: Organic preparations: (any three)

- Derivatives Preparations: Mechanism of various reactions involved to be discussed. Recrystallization, determination of melting point and calculation of quantitative yields to be done.
- Experiment-12: Bromination of Cinnamic acid using sodium bromide and Sodium bromate. (Green Chemistry Approach)
- Experiment-13: Bromination of acetanilide using KBr and Ceric ammonium nitrate in aqueous medium. (Green Chemistry Approach)
- Experiment-14: Semicarbazone derivatives of aldehydes and ketones

Experiment-15: Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

- Note: Presence of extra element in the synthesized compound must be tested (Br and N in respective compound)
- **Reference-1:** Laboratory Manual Prepared by Department of Chemistry, Prof. Ramkrishna More College Akurdi.
- Reference-2: Handbook of inorganic chemistry,
- Referenc-3. Preparative Inorganic Chemistry, Brauer G., Academic publisher, 1965
- **Referenc-4**. (editor), G. Leib (translator Practical Inorganic Chemistry, K. M. Dunaeva, E. A. Ippolitova, N. S. Tamm, V. I. Spitsyn) O.I. Vorobyova Mir Publishers (1987).
- Referenc-5. Practical Inorganic Chemistry Preparations, reactions and instrumental methods, Geoffrey Pass B.Sc., Ph.D., Haydn Sutcliffe B.Sc., Ph.D., F.R.I.C., Springer Netherlands (1974)
- **Reference-6.** Text book of Practical Organic Chemistry, Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G., Prentice-Hall, 5th edition, 1996.

Course outcome

Students will learn

- **CO-1**. Chemical synthesis and controlling reaction parameters in laboratory synthesis of inorganic and organic compounds.
- CO-2. Preparation of commercially important inorganic compounds and their qualitative analysis.
- **CO-3.** Concepts like molecular wt. and equivalent weight and how to determine equivalent weight of oxidizing agent.
- CO-4. Acid base titration and determination of equivalent weight of polyprotic acids.
- **CO-5.** Preparation of derivatives of organic compounds and identification of new element introduced in product.
- CO-6. Preforming analytical chemistry calculations.

Skill Enhancement Chemistry Course- 1; 2 Credit, 30 L

CHSEP-111: Chemistry Practical for Clinical Lab

1. Visit to clinical lab to observe functioning in clinical lab / preparation of lab reports.

2. Table work/Visit to hospital: Urea and blood collection method and their preservation

Body fluid analysis practical's: All practical described here should be performed on simulated laboratory samples which has same composition as urine / blood plasma.

- a) The typical composition of urine of normal person is 0.05% Ammonia, 0.18% sulfate, 0.12 %phosphate, 0.01% Mg, 0.015% calcium, 0.6% K, 0.1% Na, 0.1% creatinine, water soluble Vitamins, 2% urea. (For salts add NH4SO4, Na₂HPO4, KCl, CaCl₂)
- b) Typical blood plasma composition: 100 ml blood plasma contains approximately: glucose 80 to 140 mg (normal person), total proteins 5 g, Calcium 7 mg, phosphate 11 mg, Mg 1.5 mg, Na 320 mg, potassium 16 mg; Cl⁻ 100 mg, vit-C 0.5 to 2 mg, thiamine 2.5 to 6 microgram, riboflavin 3 to 19 microgram. etc. Thus, prepare simulated blood plasma sample by adding appropriate quantity of each constituents.
- 3. Qualitative test for reducing sugars and proteins
- 4. Physical observation of urine sample for its pH, colour, turbidity, etc.
- 5. Analysis of urea from urine sample by colorimetry.
- 6. Analysis of creatinine from urine sample by colorimetry.
- 7. Analysis of Vit-C from urine sample by titrimetric method.
- 8. Analysis of urine and blood glucose level by colorimetry.
- 9. Analysis of blood cholesterol level by colorimetry.
- 10. Calcium in blood
- 11. Estimation bilirubin
- 12. Estimation of total plasma proteins by Lowry Method.
- 13. Oral glucose tolerance test.
- 14. Estimation of chloride in urine
- 15. Estimation of Sulphate in Urine.

CBCS Syllabus Under NEP-2020F. Y. B. Sc. /M. Sc. -IDepartment of ChemistryRef-1: Clinical Chemistry A Laboratory Perspective, Wendy Arneson, Jean Brickell, F. A. Davis

Company, 2007

Ref-2: Standard Methods of Clinical Chemistry Volume I By The American Association Of Clinical Chemists, Editor-in-Chief: Miriam Reiner, Academic Press New York, San Francisco, London, 1953

Ref-3: Basic Concepts in Clinical Biochemistry: A Practical Guide, Vijay Kumar • Kiran Dip Gill, Springer.

Students will learn

CO-1: Safety precautions and safely disposal of when working in clinical lab.

CO-2: Care, Calibration and handling of laboratory equipment in clinical lab.

- **CO-3:** Analysis of body fluid (urine/blood) qualitatively and quantitatively for particular component of interest.
- CO-4: Quantitative analytical calculations for component of interest.

CO-5: Interpret the analytical results.

CO-6: How to present the results?

Chemistry Skill Enhancement Course-II ; 2 Credit, 30 L CHSET-121: Chemistry for Clinical Lab Technician [30 L]

Module-1 [15 L]

1. pH and its Measurement

Definitions of acids, bases, dissociation of acids and bases, concept of pH, pH Scale, pH measurement: Glass electrode, calomel electrode, pH meter, calibration of pH meter, Applications of pH measurement in clinical diagnosis.

2. Colorimetric

Basic definitions in colorimetry, Beers Law, deviation from Beer's law, instrumentation of colorimeter, quantitative analysis by colorimetry, Applications of colorimetry in clinical diagnosis.

3. Flame Photometry

Basic definitions and principle of flame photomery, instrumentation of flame photomery, quantitative analysis by flame photomery, Applications of flame photomery in clinical diagnosis.

Module-2 [15 L]

4. Nephelometry and Turbiditymetry

Basic definitions and principle of nephelo-turbiditymetry, instrumentation of nepheloturbiditymetry, quantitative analysis by nephelo-turbiditymetry, Applications of nephelo-turbiditymetry in clinical diagnosis.

5. Urine and Blood Collection and preservation techniques	[2 L]
6. Body Fluid Composition and its Importance in Diagnosis	[8 L]

Urine: Importance of each of the following - normal levels of constituents in urine, qualitative and quantitative analysis of urine for a) pH and physical examination b) urea c) creatinine d) glucose e)

[5 L]

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[5 L]

[5 L]

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uric acid f) Ketone bodies, g) urea clearance test for kidney function, h) Na and K content, i) chloride and sulphate content j) water soluble vitamins

Blood: Diabetes Mellitus and glucose level in blood, glucose tolerance test, Estimation of glucose by colorimetry and by using electrochemical sensors, blood urea, blood creatinine, Hb level, Iron level, micronutrients.

Ref-1: Clinical Chemistry A Laboratory Perspective, Wendy Arneson, Jean Brickell, F. A. Davis Company, 2007

Students will learn

CO-1: Basic definitions and fundamentals in clinical laboratory analysis.

- CO-2: Principle, working, Care, Calibration and handling of laboratory equipment used in clinical lab.
- CO-3: Methods of analysis of body fluid (urine/blood) qualitatively and quantitatively for particular component of interest.
- **CO-4:** Quantitative analytical calculations for component of interest. Interpret the analytical results.
- **CO-5:** Composition of body fluid under normal condition and their importance.
- **CO-6:** What happens to composition of body fluid under disease condition?

Value Education Course -1; 2 Credit, 30 L

VEEAT-111: Environment Awareness (30 Lecture of 60 min.; 2-credits)

MODULE-1 [15 L]

Unit 1: Introduction to environmental studies [02 L]

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

- Concept and structure.
- Ecosystem functions.
- Types of Ecosystem.

Unit 3: Biodiversity and Conservation

- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions;

[07 L]

• Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE-2 [15 L]

Unit 4: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, and soil pollution.
- Solid and liquid waste management: Control measures of urban and industrial waste.

Unit 5: Environmental Programs and Policies [08 L]

- Developed countries, Developing countries.
- New environmental policy of India; Government initiatives.

References:

- 1. Singh R. B. (1993) Environmental Geography. Delhi, India: Heritage Publishers.
- 2. Odum, E.P., Odum, H.T. & amp; Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

[06 L]

[07 L]

- 3. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
- 4. Rosencranz, A., Divan, S., & amp; Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
- 5. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
- 6. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
- 7. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 8. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi
 - **CO-1:** Define and explain terms Environment, Sustainability Ecosystem biodiversity.
 - CO-2: Discuss Conservation of Biodiversity and Pollution control
 - CO-3: Apply his knowledge to find out impact of pollution on environment
 - **CO-4:** Differentiate among different types of pollution, biodiversity and ecosystems.
 - CO-5: Explain Environmental Programs and Policies
 - **CO-6:** Evaluate Threats to biodiversity and pollution.

Value Education Course VEC- Sem.-II; POVET-121: Democracy and Indian Constitution

2 Credit, 30 L

Unit-1: The Concept of Democracy

- A. Meaning Nature and Definition.
- B. Origin and Development.
- C. Types of Democracy. Direct and Indirect
- **Unit-2:** A. Major Feature of Democracy.
 - B. Social Democracy.
 - C. Demerits of Democracy.

Unit-3: Making of Indian Constitution.

- A. Fundamental Rights in the Indian Constitution.
- B. Basic Structure of the Indian Constitution.
- Unit: 4 A. Fundamental Duties of Citizens

B. Election Commission of India (Electoral Reforms/ E.V.M./Code of Conduct)

English Reference Books/Text

- 1. An introduction to Political Theory, Author: Rajiv Bhargava Publication: Pearson.
- 2. Bryce, Modern Democracies.
- 3. E. Asirvatham, political Theory.
- 4. Bharatiya Rajyaghatna va Ghatanatmak prakriya, Author: Tukaram Jadhav Publication: Unique Academy Pune.
- 5. Introduction to the Constitution of India Author: Dr. Durga

मराठी संदर्भ साधने: १) डॉ. बाळ कांबळे, २०१२, भारताची राज्यघटना, राजकारण व कायदा डायमंड प्रकाशन पुणे. २) पाटील बी. बी.,२०१६ भारतीय शासन आणि राजकारण फडके प्रकाशन कोल्हापूर. ३) डॉ. जोती बीडलन, डॉ.देशपांडे. भारतीय संविधानाचा परिचय, निराली प्रकाशन, पुणे. ४) प्राचार्य. काने राजकीय सिद्धांत आणि राजकीय विचार, पिंपळापुरे प्रकाशन, नागपूर ५) प्रा. प्रमोद तांबे, राज्यशास्त्र परिचय, निराली प्रकाशन, पुणे. ६) डॉ. विजय देव, आधुनिक राजकीय विश्लेषण कोश, डायमंड प्रकाशन, पुणे, ७) भार्गव राजीव, राजकीय सिद्धांत परिचय, अनुवाद-हेमंत खानझोडे, पीयरसन प्रकाशन. ८) ना य. डोळे, राजकीय विचाराचा इतिहास, कॉन्टिनेन्टल प्रकाशन, पुणे.

PROGRAMME OUTCOMES

- Political Science undergraduate program was born out of recognition of the increasing significance of cross-disciplinary studies in the social sciences. The program is organized around the combined perspectives and analytical tools of Sociology, Political Science, International Relations, and History.
- 1. Develop knowledge of theories, concepts, and research methods in humanities and social sciences.
- 2. Assess how global, national and regional developments affect society.
- **3**. The Political Science degree furnishes the students with a unique multidisciplinary approach in social sciences and prepares them for further academic study and for careers in the public and the private sector.

Video Lecture Links

Unit 1: https://youtu.be/fJaLKyF8Qhw?si=qhL26a4lYps9UV4C

Unit 1 and 2 : <u>https://www.youtube.com/watch?v=DXcJoihea7Y</u>

Unit 2: <u>https://www.youtube.com/watch?v=GIyiyEBlpH4</u>

Unit 3: <u>https://youtu.be/XCvTZzvzh2E?si=kd4eVMXfTTf-IsAL</u>

Unit 4: https://drive.google.com/file/d/1v_E9q_5UwgyVXF0BcR35u2LOgYVMgYa7/view

OE/GE: 2 Credit, 30 L CHGET: 111:- Chemistry for Competitive Examination -I

Module	Chapter No.	Title of Topic/Chapter	No. of lecture
Ι	1	Introduction to Physical Chemistry	08
	2	Introduction to Inorganic Chemistry	07
II	3	Introduction to Organic Chemistry	10
	4	Miscellaneous Chemistry	05

Module-I: (15 L)

Chapter-1: Introduction to Physical Chemistry (8 L)

- 1. Atom and its structure: Introduction, constituents of an atom, Thomson model, Rutherford model, Bohrs model, Quantum model, Atomic number, atomic mass, Isotope, Isobar, Quantum numbers.
- 2. Chemical bonding: Introduction, Valency, Types of bonding, Dipole moment, Fajan rule, VSEPR, VBT, MOT, Hydrogen bond.

Specific heat capacity, Temperature. **Reference: II Page no 2 to 30**

Chapter-2: Introduction to Inorganic Chemistry

1. Periodic Table: Introduction, Dobereiner triads, Newlands octaves, Mendeleeves periodic law, modern periodic table, Important elements and its properties and function, Perodic properties of element.

2. Classification of Elements: Introduction, Metals, non-metal, Metalloids and its properties, uses, Important Reactions with metals.

Reference: II Page no 42 to 55

Module- II:

Chapter-3: Introduction to Organic Chemistry

- 1 World of Carbon: Introduction, Carbon, Hydrocarbon and its types, Structure of hydrocarbon, Isomerism, Nomenclature, Catenation, Allotrops of carbon, Chemical reactions of carbon compounds, Coal, Petrolium and its purification, some intresting facts.
- 2. Chemical Reactions: Introduction, Important terminology, rules for writing chemical reaction, Types of chemical reactions, Oxidation and reduction, order of reaction, Important points.

Reference: II Page no 60 to 86

Chapter-4: Miscellaneous Chemistry

- 1. Polymer: Properties, Types, applications.
- 2. Rubbers: Properties, Types, uses.
- 3. Explosives: TNG, TNT, TNB, TNP, RDX
- 4. Drugs and chemicals: Introduction, Basic terms used in drugs, Classification, Antibiotics, antipyretics, analgesics, antiseptics, Transquilizers, Disinfectant, Antifertility drugs, antacid, pesticide, insecticide, fungicide, insecticide, herbicide

Reference: I Relevant pages

Reference Book:

- 1. Lucent's General Science by Sunil Kumar Singh, Lucent Publication
- 2. General Science book Part-II for competitive examination by Dr.Sachin Bhaske

Course Outcomes (CO): Chemistry for competitive Examination

- CO-1: Define the terms matter, atom, chemical bond, valency, dipole moment, hydrogen bond, oxidation, reduction, acid, base, catalysis, solution, element, metal, isomerism, polymer, rubber, explosives, drugs, etc.
- CO-2: Describe structure of atom, chemical bonding, Chemical symbol, formula and equation, Periodic classification of elements.
- CO-3: Explain the terms catenation, Petroleum, Allotrops, Polymers, Rubbers, Explosives, Drugs & chemicals, latent heat, specific heat capacity
- CO-4: Distinguish between the metal and nonmetal, VBT and MOT, acid and bases, oxidation and reduction, etc.
- CO-5: Classify chemical bond, polymers, explosives, rubber, Matter, elements, Drugs.
- CO-6: Give uses of polymers, explosives, rubber, petroleum, Drugs and chemical, pesticide, insecticide, fungicide, herbicide, etc.

(15 L)

(10 L)

(7 L)

(05 L)

GE/OE; 2 Credit, 30 L

CHGEP -121: Formulation of Soaps and related products

- **Experiment-1:** List the material required for soap, shampoo, hand wash, dish wash, toilet and bathroom cleaning. Find out their sources and cost. Function of some ingredients in the soap and soap making.
- Experiment-2: Saponification value of oil.
- Experiment-3-4: Soap making cold process (prepare two three types of soaps by cold process such as awesome Bar Soap, Bay Rum Soap Bar, Big 'N' Beautiful Bubbles Soap Bar, Bubble Gum Kid-Approved Soap Bar, Bug Repellent Soap, etc)
- **Experiment-5-6:** Soap making hot process (prepare two three types of soaps by cold process such as marbled Clay Soap, Lard-Base Soap, Bastille Soap, Lemon Poppy Seed Soap, etc.).
- Experiment-7: Melt and Pour soap making
- Experiment-8: Facial and Shaving Soap Products almond & Tea Tree Oil Facial Wash, Almond Oil & Black Tea Facial Scrub, Aloe Vera & Tea Tree Shaving Soap, Foaming Shave Soap
- Experiment-9: Preparation of hand wash (different types)

Experiment-10: Preparation of hand sanitizer (different types)

Experiment-11: Preparation of dish wash different types.

Experiment-12: Preparation of Toilet Cleaner.

Experiment-13: Determination of CMC of detergent / soap

Experiment-14: Determination of soap solution by stalganometer.

Experiment-15: Determination pH of different detergent / soap solution

- **Experiment-16:** Calculating costing of production of at least two product, their packaging, labelling and marketing
- **Reference-1:** Soap Making Step-by-Step Guide to Make Homemade Soaps. Advanced and Beginner Recipes Included, Carol Varney.
- Webliography: <u>https://5.imimg.com</u> (swachh herbl manufacture of cleaning and hygiene products)
- **CO-1:** Explain various ingredients required to manufacture particular product, their source and cost.
- **CO-2:** Discuss composition of particular product and choice of ingredients for the formulation of particular product.
- **CO-3:** To select / design / modify method / process for the formulation of particular product.
- **CO-4:** Actually, formulate and produce particular product at a laboratory scale.
- **CO-5:** Able to evaluate cost manufacture and of product and decide cost for marketing of product.
- **CO-6:** Explain/ Discuss properties and uses/application s of the product which is formulated by him.

Curricular Course; 2 Credits, 60L (Sem-II) CCPEP-121: Physical Education and Sports

Theory and Active Participation

- Introduction to Physical Education and Sports
- > Concept of Physical Education, its Definition and Scope.
- Concept of Physical Fitness
- Components of Health Related Physical Fitness
- (Cardio-vascular Endurance, Muscular Strength, Endurance, Flexibility, and Body Composition)
- Components of Skill Related Physical Fitness (Agility, Balance, Co-ordination, Speed, Power, Reaction Time
- Concept of Health, Wellness, and Health & Hygiene.

Fitness Assessment & Participation in Sports

In order to improve the physical fitness standards of students, they should be given opportunity and facilities to participate in Physical Fitness Activity and a game / sport from the list of Association of Indian Universities, New Delhi (List of events available on website www.aiuweb.org). The choice of game / sports will be according to the facilities available in the college.

Participation in Fitness Activity :

Every student should participate in Fitness Activity for 12 hours.

Participation in Games and Sports :

A student will have to select one game/sport from the list of Association of Indian Universities, New Delhi (List of events available on website www.aiuweb.org). The choice of game/sports will be according to the facilities available in the college.

Every student should participate in Games and sports for 12 hours.

Fitness Assessment :

- Cardiovascular Endurance
- ➢ Flexibility
- Muscular Strength Endurance
- Body Composition (No marks) EVALUATION STRUCTURE:

Table 1

Course	Type of	Marks	Mode of Evaluation			
	Assessment					
COURSE –	Internal	15	Assignment (15 marks)			
CCPEP-121	Assessment		Project on the selected Sports Event			
PHYSICAL						
EDUCATION,						
SPORTS						
	External	35	Participation (10 marks) (24 hrs.			
	Assessment		of participation in Fitness and			
			selected game/sport).			
			Practical – Fitness Test- 25 marks			

To complete first credit of Course – Physical Education, Sports, Teacher will have to **conduct 5 theory lectures** (college may schedule these lectures during first or second semester before fitness assessment) and student will have to attend 5 theory lectures and has to participate in Fitness and selected game / sport for **minimum 24hrs.and submit the assignment**.

- Procedure for fitness tests are given in the guidelines section which also includes Norms Table . Marks to be awarded in accordance with the norms table .
- \triangleright

CBC	CS Syllabus Under NEP-2	020 F. Y. B. Sc. /M. ScI Department	t of Chemistry
Sr. No.	Component	Test	Marks
1	Cardiovascular	1. Modified Queens College Test or	
	Endurance (Any	2. 12 Min. Run Walk	10
	One)		
2	Flexibility	2. Sit and Reach Test	05
			05
3	Muscular	3. Bent Knee Sit Ups	
	Strength		10
	Endurance		
4	Body	4. Fat Percentage	
	Composition		
		Total	25

CONSIDERATIONS AND EXEMPTIONS : Differently Able Students

Differently able students will be exempted from the course **CCPEP-121** PHYSICAL EDUCATION AND SPORTS after producing the valid documents. This is not depriving them from the equality of opportunity with other students. The student shall have to submit his/her medical certificate at the time of admission from a Civil Surgeon of respective District Civil Hospital.

Important Note:

Temporary illness will not give students exemption from the course. If he / she miss any assessment/task he / she will be given opportunity in the ensuing semester.

Exemption

Any Student representing college / institute in the enlisted games of Association of Indian Universities / Indian Olympic Association / State Olympic Association shall be **exempted from mandatory**

participation in selected game / sport for minimum 24hrs of first credit of Course - CCPEP-121 Physical Education and Sports .

Ability Enhancement Courses (AEC),

Transactional Marathi Part-I; Sem.-I, 30 L 2-Credits

व्यावहारिक मराठी भाग -१ AEC - MAAET-111

अभ्यासक्रम :

घटक	तपशील	श्रेयांक	घड्याळी तास
१.	अर्जलेखन	8	१५
	 अर्जलेखन विविध नमुने –विनंती अर्ज , संगणकीय अर्ज ,माहिती अधिकारातील अर्ज इ . 		
२	• भाषांतर	१	१५
	• सारग्रहण		
	• परिच्छेद लेखन		

संदर्भ ग्रंथ

- व्यावहारिक मराठी –ल.रा.नासिराबादकर .
- व्यावहारिक व उपयोजित मराठी –डॉ.वेदश्री थिगळे,डॉ. प्रभाकर जोशी.
- CO 1 नोकरीसाठी अर्ज करता येईल .
- CO 2 भाषांतर करता येईल .
- CO 3 सारग्रहण करता येईल .
- CO 4 व्यावहारिक मराठीतील बारकावे समजतील .

Ability Enhancement Courses (AEC), Transactional Marathi Part-II; Sem.-II, 30 L 2-Credits

व्यावहारिक मराठी भाग -२ AEC- MAAET-121

अभ्यासक्रम :

घटक	तपशील	श्रेयांक	घड्याळी तास
१.	पत्रलेखन	१	१५
	• पत्रलेखनाचे विविध प्रकार व घटक व स्वरूप		
2	• संवादलेखन	8	१५
	 पारिभाषिक संज्ञा 		
	 निबंध लेखन 		

संदर्भ ग्रंथ

- व्यावहारिक व उपयोजित मराठी डॉ. प्रभाकर जोशी , डॉ .वासुदेव वळे ,प्रशांत पब्लिकेशन.
- व्यावहारिक मराठी –ल.रा.नासिराबादकर .
- CO 1 पत्र लिहिता येईल व पत्राचे इतर प्रकार समजतील .
- CO 2 संवाद लेखन करता येईल .
- CO 3 कार्यालयीन पत्रव्यवहार करता येईल .
- CO 4 पारिभाषिक संज्ञा समजतील.

Ability Enhancement Courses (AEC), Hindi

AECFIRST YEAR- BBA,B.VOC,BCS,BBA CA,B.sc, SEMESTER-I & II] २०२३-२४ से[
Title of	सामान्य हिंदी SEMESTER I & II	Number	
the		of Credits	
Course		: 02	
Course	HIAET-111 🛛 AECसामान्य हिंदी – ।] कहानी,कविता और निबंध लेखन [
Code	HIAET-121 🛛 AECसामान्य हिंदी – ॥ [कहानी,कविता और व्यावहारिक हिंदी [

HIAET-111 AECसामान्य हिंदी – ।] कहानी,कविता और निबंध लेखन

Unit No.	Title of Unit and Contents	No. of
		Lectures
I	अ] कहानी विधा - १. एक टोकरी भर मिटटी– माधवराव सप्रे २. कफ़न-प्रेमचंद ३. आकाश द्वीप– जयशंकर प्रसाद ४. क्लेम– मोहन राकेश	12
Ш	आ] कविता विधा- १. फूल की चाह– माखनलाल चतुर्वेदी २. जन-जन का चेहरा एक– गजानन माधव मुक्तिबोध ३. माँ– चित्रा डोंगे ४. नॉट आउट– प्रवीण कोटला	10
Ш	इ] साहित्येत्तर पाठ्यक्रम १.निबंध लेखन] पर्यावरण,आत्मकथा,विज्ञान,समस्या,समाचार आदि [२.पत्राचार लेखन] सरकारी गैर सरकारी[8

संदर्भ ग्रन्थ-

१ [हिंदी कथाधारा– सं.दूधनाथ सिंह २ [गद्य वैभव– सं. राजेंद्र खैरनार ३ [वसुधा– चित्रा डोंगे ४ [फिर से शून्य– प्रवीण कोटला ५ [हिंदी कविता– सं.दूधनाथ सिंह

Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	हिंदी कहानियों की गरिमा को समझ जायेंगे ।	
CO2	चरित्र प्रधान कहानियों की जानकारी प्राप्त होंगी ।	
CO3	घटना प्रधान कहानियों से परिचित हो जायेंगे ।	
CO4	आत्मकथा परक विषयों पर निबंध लिखना सिख जायेगे ।	
CO5	सरकारी कार्यालयों के लिए पत्राचार करना सिख जायेंगे ।	
CO6	सरकारी पत्राचार के महत्व को समझ जायेंगे।	

F.Y. BSC, BCS, VOC, BBA & ALL SCI DEPT Semester II				
Title of the Course	॥ –SEMESTER HIAET-121) सामान्य हिंदी –।। [कहानी,कविता और व्यावहारिक हिंदी[Number of Credits : 02		
Course Code Unit No.	HIAET-121 सामान्य हिंदी – ॥ Title of Unit and Contents	No. of		
		Lectures		
I	अ] कहानी विधा – १.उसने कहा था– चंद्रधर शर्मा' गुलेरी' २. खेल– जैनेन्द्र कुमार ३.लाल पान की बेगम– फनीश्वरनाथ रेणु ४.पार्वती एक– दीप्ती खंडेलवाल	10		
II	ब) कविता विधा – १.तोडती पत्थर– निराला २.हम दीवानों की क्या हस्ती– भगवती चरण वर्मा ३.अकाल और उसके बाद– नागार्जुन ४.साथी दुःख से घबराता हैं– नीरज	10		
Ш	क] पाठ्यपुस्तकेत्तर 1.कल्पना विस्तार 2.पारिभाषिक शब्दावली १.कल्पना विस्तार] विषय[:- १[जहाँ सुमति वहां सम्पति नाना, २[जिन खोजा तिन पाइयां गहरे पानी पैठी, २[जिन खोजा तिन पाइयां गहरे पानी पैठी, ३[मन के हारे हार हैं.मन के जीते जीत ३[मन के हारे हार हैं.मन के जीते जीत ४[वही मनुष्य हैं कि जो मनुष्य के लिए मरे, ५[पराधीन सपने हूँ सुख नही २.पारिभाषिक शब्द] अंग्रेजी के 30 शब्द हिंदी पर्याय :-	10		
	1]ACCOUNT-लेखा/ खाता 2]BILL-विधायक 3] CIRCULAR-परिपत्र 4] COMMISSIONआयोग 5] DESIGNATION-पदनाम 6] DIRECTOR-निर्देशक 7] EMPLOYEE-कर्मचारी 8] FUND-निधि 9] FACULTYसंकाय 10] GRANTअनुदान 11] HEAD-प्रमुख 12] INVESTIGATERअन्वेषक 13] JUDGE			

CBCS Syllabus Under NEP-2020	F. Y. B. Sc. /M. ScI	Department of Chemistry	
14] ISSUE-जारी करना			
15] JUNIOR-कनिष्ठ			
16] LEAVE–छुट्टी/ अवकाश			
17] MANAGER-प्रबंधक			
18] MINISTER-मंत्री			
19] MINISTRY-मंत्रालय			
20] NOTICE-सूचना			
21] OFFICIAL- कार्यालयीन			
22] PLAN–योजना			
23] POST-पद			
24] QUALIFICATION–अहर्ता	,योग्यता		
25] RECORD—अभिलेख/ रिक	ਜਤ		
26] REGISTRATION-पंजीक	रण		
27] SANCTION–स्वीकृति/ मंच	नूरी		
28] SECRETARY–सचिव			
29] TRANSFER–तबादला/ बत	रली		
30] UNDERTAKING-उपक्रम	/ वचनबद्धता		
31] WHIP-सचेतक			

संदर्भ ग्रन्थ–

१ [हिंदी कथाधारा– सं.हिंदी अध्ययन मंडल,प्रा.रामकृष्ण मोरे महाविद्यालय,आकुर्डी पुणे- ४४ २ [काव्य] वैभव– सं . हिंदी अध्ययन मंडल,प्रा.रामकृष्ण मोरे महाविद्यालय,आकुर्डी पुणे- ४४

Course O	utcomes (COs)
On compl	letion of the course, the students will be able to:
CO1	हिंदी कहानियों की गरिमा को समझ लेगे ।
CO2	चरित्र प्रधान कहानियों की जानकारी प्राप्त कर लेंगे ।
CO3	घटना प्रधान कहानियों से परिचित हो जायेगे ।
CO4	कल्पना विस्तार का महत्व समझ लेंगे ।
CO5	पारिभाषिक शब्दों की जानकारी प्राप्त कर लेगे ।
CO6	पारिभाषिक शब्दावली की महत्ता को समझ जायेंगे।
	अंक विभाजन– पूर्णाक= 50
	आंतरिक परीक्षा- 15 अंक) शोध परियोजना, समूह चर्चा, मौखिक प्रस्तुति, क्षेत्रीय अध्ययन आदि[
	सत्रांत परीक्षा- 35 अंक
समय-	दो घंटे पूर्णांक- 35
१. प्रथम इ २ .द्वितीय इ	काई पर प्रश्न] दो में से एक [१० अंक इकाई पर प्रश्न] दो में से एक [१० अंक कार्ड पर प्रश्न] दीन में से एक निवंध लेखन (१० अंक

३.तृतीय इकाई पर प्रश्न] तीन में से एक निबंध लेखन [१० अक ४ .तृतीय इकाई] पत्राचार लेखन _[५ अंक

Course: Indian Knowledge System, Generic

GIKST-111: A Basic Course on Indian Knowledge System; 02 Credits; 30 L

Course Aim and Objectives:

Bhārata boasts a rich and versatile knowledge system and cultural heritage that has evolved over millennia. Originating during the Vedic period and the Saraswatī-Sindhu Civilization, and continuing through the Middle Ages to modern times, the Bhāratīya knowledge system has had a profound and enduring influence. The course "A Basic Course on Indian Knowledge System " introduced in NEP 2020This course focuses on the historical development of ideas in ancient society, exploring their implications for understanding the material world, as well as religious, social, and cultural beliefs. Upon closer examination, it becomes evident that religion, culture, and science are epistemologically interconnected within the Bhāratīya knowledge system. Bhārata has made invaluable contributions to society and the world across various spheres, including aeronautics, astronomy, mathematics, life science, medical science, architecture, polity, trade, art, music, dance, literature, and drama. By studying these interconnected areas, one can gain a comprehensive understanding of the depth and breadth of the Bhāratīya knowledge system and its cultural heritage.

The Indian Knowledge System course is not just an academic endeavor but a vital component of holistic education. It nurtures a deeper understanding of India's intellectual traditions and their relevance in contemporary times, fostering a balanced and enriched perspective on life and knowledge.

Learning Outcomes

- Understanding the foundational concepts and principles of IKS
- Appreciating the contributions of ancient Indian scholars and scientists
- Integrating IKS perspectives into modern academic and practical contexts
- Promoting cultural awareness and appreciation of India's intellectual heritage

UNIT -I: Bharatiya Civilization and Knowledge System (6 hours)

The primary sources of ancient Indian philosophy: Vedas and Upanishads, Overview of the six schools of Indian philosophy. Ancient Indian civilization: the discovery of the Saraswatī River and the Saraswatī-Sindhu civilization. The ancient Indian education system: Gurukul system, Takṣaśilā University, Nālandā University, and their notable alumni. History of knowledge export from Bhārata. [प्राचीन भारतीय तत्त्वज्ञानाचे प्राथमिक स्रोत: वेद आणि उपनिषद, भारतीय तत्त्वज्ञानाच्या सहा शाळांचे सिंहावलोकन. प्राचीन भारतीय संस्कृती: सरस्वती नदीचा शोध आणि सरस्वती-सिंधू संस्कृती. प्राचीन भारतीय शिक्षण पद्धती: गुरुकुल पद्धती, तक्षशिला विद्यापीठ, नालंदा विद्यापीठ आणि त्यांच्या प्रसिद्ध माजी विद्यार्थी. भारतातून ज्ञान निर्यातीचा इतिहास.]

UNIT-II: Arts, Literature, and Scholars in Ancient India

The history of ancient Indian art, music, and dance. Națarāja a unique symbol of Indian art. In the field of literature, the works of Agastya, Ghoșā, Vālmīki, Patañjali, Gārgī, Vedwalmiki, Lopāmudrā, Maitreyī, and Bodhāyana. In the fields of science and medicine, the contributions of Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaņāda, Patañjali, Kauțīlya, Pāṇini, Thiruvalluvar, Ādi Śaṅkarācārya, Bhāskarācārya, and Mādhavācārya

[प्राचीन भारतीय कला, संगीत, आणि नृत्याचा इतिहास. नटराज हा भारतीय कलेचा एक अद्वितीय प्रतीक. साहित्य क्षेत्रात अगस्त्य,

(6 hours)

CBCS Syllabus Under NEP-2020 F. Y. B. Sc. /M. Sc. -I Department of Chemistry

घोषा, वाल्मिकी, पतंजली, गार्गी, वेदवाल्मीकि, लोपा मुद्रा, मैत्रेयी आणि बोधायन यांचे कार्य. विज्ञान आणि वैद्यक क्षेत्रात चरक, सुश्रुत, जीवक, नागार्जुन, कणाद, पतंजली, कौटिल्य, पाणिनी, तिरुवल्लुवर, आदि शंकराचार्य, भास्कराचार्य आणि माधवाचार्य यांचे योगदान..]

UNIT-III: Ancient Science, Astronomy, and Mathematics (6 hours),

Āryabhaṭa and Varāhamihira's contributions, concepts like matter, life, and gravity, technological advancements like Sage Agastya's battery model, the velocity of light, and Vimāna aeronautics. Vedic cosmology, Bhāratīya Kāla-gaṇanā, Kerala School for Mathematics and Astronomy, history and culture of astronomy, celestial bodies such as the sun, earth, moon, eclipses, earth's spherical nature and rotation, archaeoastronomy, mathematical concepts zero, pi, number system, Pythagoras theorem, and Vedic mathematics.

[आर्यभट्ट आणि वराहमिहिरांचे योगदान, पदार्थ, जीवन, आणि गुरुत्वाकर्षण या संकल्पनांचे महत्त्व, संगणकीय प्रगती, जसे की सेज अगस्त्यांच्या बॅटरी मॉडेल, प्रकाशाची वेगता, आणि विमान वायुयान, वैदिक ब्रह्मांडशास्त्र, भारतीय काल-गणना, केरळ संख्याशास्त्र आणि खगोलशास्त्राचा इतिहास व संस्कृती, सूर्य, पृथ्वी, चंद्र, ग्रहण, पृथ्वीच्या गोलाकार आणि घुमट, पुरातत्त्वशास्त्र, शून्य, पाई, संख्या प्रणाली, पायथागोरसचा प्रमेय, आणि वैदिक गणित.]

UNIT-IV: Ancient Engineering, Technology, and Architecture (6 hours)

Urban planning and sophisticated drainage systems : Mohenjo-daro and Harappa. Rock-cut architecture : Ajanta and Ellora caves, temple designs found in Khajuraho and Konark. Stepwells (Baolis): water management systems. metallurgical techniques for metal extraction and artifact crafting. Textile technology such as weaving and dyeing. Scientific instruments used for astronomical observations and calculations. Bhāskarācārya and his contributions to mathematics. Trade and Commercein Ancient India.

[नगर योजना आणि प्रगत निर्जलीकरण प्रणाली: मोहनजो-दारो आणि हरप्पा. शिलाचित्र कला: अजंता आणि एलोरा लेण्यांची चालक शैली, खजुराहो आणि कोणार्कमधील मंदिर डिझाइन. पायराडी (बावली): पाण्याचे व्यवस्थापन प्रणाली. धातूची शैली: धातू निकालण्याची आणि अभिजात वास्तुकला. कापडी तंत्रज्ञान जसे की बुनणे आणि रंगणे. खगोलशास्त्रात वापरलेले वैज्ञानिक उपकरण आणि गणना. भास्कराचार्य आणि त्यांचा गणितातील योगदान. प्राचीन भारतातील व्यापार आणि वाणिज्य.]

UNIT-V: Life, Environment, and Health in Ancient India (6 hours)

Ancient Indian Religions : Hinduism, Buddhism, Jainism, Sikhism : Teachings and Philosophies, Ancient agricultural practices, crop cultivation techniques, and innovations. Comprehensive healthcare systems integrating Āyurveda, yoga, and other traditional practices. Surgical techniques and procedures practiced in ancient India

[प्राचीन भारतीय धर्म: हिंदूधर्म, बौद्धधर्म, जैनधर्म, सिखधर्म: शिक्षण आणि दर्शन, प्राचीन कृषि प्रथा, फसल उत्पादन तंत्रज्ञान आणि नवीन उपक्रम. आयुर्वेद, योग आणि इतर पारंपरिक व्यवस्थांच्या संयुक्त स्वास्थ्यव्यवस्था. प्राचीन भारतातील क्षैत्रजन्य तंत्रज्ञान आणि प्रक्रिया.]

Text books:

- 1. Histrory of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata(2014).
- 2. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,

Reference Books:

- 1. A History of Ancient and Early Medieval India: From the Stone Age to the 12th Century" by Upinder Singh:
- 2. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
- 3. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
- 4. "Indian Art and Culture" by Nitin Singhania, McGraw Hill

GE/OE Basket for Science Students

Sem.-II

- 1. Basic Course in stock market
- 2. Entrepreneurial Skill Development-I
- 3. Indian Constitution and Political Process
- 4. Introduction to GIS
- 5. Psychology of adjustment and stress
- 6. Business Communication.
- 7. Corporate social responsibility

Sem.-II

- 1. Advance course in stock market
- 2. Entrepreneurial Skill Development-II
- 3. Practical on Indian Constitution and Political Process
- 4. Practical on GIS
- 5. Psychological Interpersonal Relationship
- 6. E-Commerce
- 7. Basics of hardware and networking

Question Paper Pattern Courses Related to Chemistry

Marks: 35		Time: 2 Hour		
Instructions to the Candidate:				
1. All questions are compulsory.				
2. Figures to right indicate full marks				
3 Use of Log table and scientific calculator is allowed				
Ouestion-1 Solve Any five of the following Three def type two tricky 5 Marks				
Question 1	(Short Answers)	questions and two	Jiviarks	
	i.	questions problem type (if		
	ii.	applicable)		
	iii.			
	iv.			
	v.			
	vi.			
	vii.			
Question-2	A. Solve any two of the following	Note or Describe type	6 Marks	
	i. 	questions		
	11. 			
	III. P Solve the following	Drohlam type or trialy	1 mortes	
	D. Solve the following Single question of four marks or	reasoning type of theky	4 11181 KS	
	two questions of 2 marks	reasoning type question		
Ouestion-3	A. Solve any two of the following	Write Note / Differentiate	6 Marks	
	i.	type questions		
	ii.			
	iii.			
	B. Solve the following	Problem type or Derive	4 marks	
	Single question of four marks or	equation or Tricky		
	two questions of 2 marks.	discussion type question		
Question-4	Solve Any four of the following	Application type,	10	
	i. 	Justification type question		
	II. :::			
	111. iv			
	V.			