



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce



Learning Outcomes based Curriculum Framework

(LOCF)

For

F.Y.B.Sc. Botany (Major)

Undergraduate Programme

Under NEP Guidelines

From

Academic year

2023 - 24

Vision & Mission

Mission:

- Equip the student with knowledge and skills of their chosen vocation,
- Inculcate values.
- Provide them opportunities for all, round growth and prepare them for life.

Vision:

- To equip the students with advanced knowledge and skills in their chosen vocation.
- To provide value-based education and opportunities to students.
- To help them to face challenges in life.
- To nurture a scientific attitude, temperament and culture among the students.
- To continually review, develop and renew the approach to build India of the Founder's dream.

Goals and Objectives:

- To build a strong Academia-Industry bridge.
- To provide flexibility in the courses offered and proactively adapt to the changing needs of students and the society.
- To establish a centre for multidisciplinary activities.
- To mould individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.

Board of studies in Botany

Undergraduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Mrs. Supriya Janbandhu	Chairman	K. J. Somaiya College of Science and Commerce
Subject Expert nominated by Vice-Chancellor			
1	Dr. Nisha Muni	Associate Professor	R. J. College Ghatkopar
Subject experts			
1	Dr. Ajit Kengar	Professor	Kelkar –Vaze College
2	Dr. Smita Jadhav	Associate Professor	Kirti College
3	Dr. Satnam Sing Sohal	Associate Professor	M.D College
Representative from Industry/corporate sector/allied area			
1	Dr. Kshitij Satardekar	Scientist	Colgate India Ltd
Student representative			
1.	Mr.Abhijit Singh	Student	K.J.Somaiya college of science and commerce
Faculty of the specialisation			
1	Dr. Ajit Katdare	Associate Professor	K.J.Somaiya college of science and commerce
2	Dr. Meena Patankar	Assistant Professor	K.J.Somaiya college of science and commerce
3	Dr. Ketan Thatte	Assistant Professor	K.J.Somaiya College of Science and Commerce

Foreword

Autonomy reflects efforts for excellence in academic performances, capability of self-governance and enhancement in the quality of education. In the year 2012, the UGC and University of Mumbai conferred the Autonomous Status to K. J. Somaiya College of Science and Commerce. Post this recognition and having several accolades to our credit, we made significant changes to our existing syllabi to reflect the changing business, industrial and social needs. A holistic education that provides opportunities to gain and share knowledge, experiment and develop beyond curriculum, is offered at our College.

Autonomous college carries a prestigious image for the students and the teachers and we have made a collaborative attempt to maintain a high level of quality in the standard of education that we impart. Structured feedback obtained from the students, alumni and the experts from the industry and the changes suggested by them were duly incorporated in the syllabi. The Board of Studies constituted for each department meets to carry out in depth discussions about different aspects of the curriculum taking into cognizance the recent trends in the discipline

The IQAC team has facilitated the conduct of a number of workshops and seminars to equip the faculty with the necessary skill set to frame the syllabi and competencies to deliver the same. Training was also provided to employ innovative evaluation methods pertaining to higher cognitive levels of revised Bloom's taxonomy. This ensured the attainment of the learning outcomes enlisted in the syllabus. Audits are conducted to critically review the practices undertaken in teaching, learning and evaluation. Innovative learning methodologies such as project-based learning, experiential learning and flip- class learning practiced by a committed fleet of faculty, supported by several hands have been our unique outstanding propositions. All efforts have been made to nurture the academic ambitions as well as the skills in co-curricular activities of the most important stakeholder i. e. student.

With sincere gratitude, I acknowledge the constant support and guidance extended by Shri Samir Somaiya, President- Somaiya Vidyavihar, and all the esteemed members of the Governing board and Academic council of the College. I also would like to acknowledge the Heads of the Departments and all the faculty members for their meticulous approach, commitment and significant contribution towards this endeavour for academic excellence.

Dr. Pradnya Prabhu

Principal



Acknowledgement

At the outset, I would like to thank our Principal Dr. Pradnya Prabhu for her support and encouragement throughout the process of curriculum restructuring. I am also grateful to all the esteemed members of the Board of Studies, for their valuable inputs.

Above all, I am deeply indebted to all the vibrant colleagues in the Department of Botany for the long and arduous work they have put in during the compiling of the improved syllabus.

Mrs. Supriya Janbandhu

Chairperson

Board of Studies in Botany

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Preamble

The revised syllabus will be effective from the academic year 2023-24. Autonomy has given us the flexibility to frame the syllabus with a blend of Classical and Applied Botany which will open an array of opportunities in Higher Studies. Skill based courses have been incorporated which will benefit the learners to develop entrepreneurial skills. Successful completion of these courses will provide employability to the learners. It has been prepared according to the unique requirements of Botany students in focus.

The content caters to the current changing needs of the stakeholders, specifically pertaining statistics and computation skills. In this revision, the student will be introduced to the Interdisciplinary approach of learning. The syllabus has been made more relevant by addition of latest topics pertaining to Botany, so as to encourage core competencies and discovery-based learning. Learners will be taught topics through experiential learning also. Choice has been given for a skill-based core course in both semesters to engage them in the learning process. Elective courses will have more of a practical component over theory. Skill based course will ignite the conscience about global issues amongst the learner to become a sensitive citizen.

As the term suggests, LOCF works with curriculum aim and framework, learning goals and objectives at its focal point. It uses foundations of already existing examples of effective learning, teaching and assessments. Also, it allows the liberty of constant updating with reference to the current needs of the hour. This syllabus has been drafted to enable the learners to prepare them for future employment in various fields including academics and competitive examinations.

1. Introduction

The B.Sc. Botany programme is developed by keeping in mind the interest of learners to explore the field of Botany. The framework helps to maintain the standard of Botany degrees/programmes through periodic programme review within a broad framework of agreed/expected graduate attributes, qualification descriptors, programme learning outcomes and course-level learning outcomes. The BSc programme is planned in such a way that it allows flexibility and innovation in programme design, syllabi development, teaching-learning process and quality assessment of students' learning levels.

This curriculum framework is developed on the principles of student centric learning pedagogy. The platform intends to empower graduates with the skills required for pursuing Botany -related careers, higher education in Botany and allied subjects.

Various graduate attributes are emphasized in this framework such as critical thinking, basic psychology, scientific reasoning, moral ethical reasoning, etc. While designing this framework, an important aspect considered was the measurable teaching-learning outcome to ensure employability of the graduates. Implementation of modern pedagogical tools and concepts such as flip-class, hybrid learning, MOOCs and other e-learning platforms are suggested through this framework. The framework also focuses on issues relevant to India and also of the rest of the world;

Every course is designed in such a way that students get decent exposure to each topic by keeping an equilibrium between these topics and thus creating interest to pursue further education in the field of Botany. It covers the basic concepts of Botany to establish a strong foundation of the subject and helps students to explore the subject more.

The practical sessions will help the students to gain sufficient skills in chemical analysis, preparations, solvent extraction, chromatography, as well as quantitative analysis. Students are also encouraged to improve their scientific writing skills through various assignments. The research-based project work in the curriculum ensures team building attitude within students and utilizes every aspect of the team members in the success of any project. The project evaluation method is designed in such a way that it helps in creating a strong background for the research, skills to generate systematic reports and create effective presentation.

2. Learning Outcome based Curriculum Framework

LOCF focuses on curriculum framework, curriculum aims, learning targets and objectives. The curriculum framework also provides examples of effective learning, teaching and assessment practices. As the curriculum development is a collaborative and an on-going enhancement process, the LOCF instructs periodic reviews and revisions of the curriculum in accordance with the ever changing needs of students, teachers and society.

The framework describes how students are given exposure towards core knowledge of the subject, specialization, choice based learning and other skill enhancement courses ensuring development of an integrated personality and employability. The template defines expected outcomes for the programme like core competency, communication skills, critical thinking, affective skills, problem-solving, analytical, reasoning, research-skills, teamwork, digital literacy, moral and ethical awareness, leadership readiness along with specific learning course outcomes at the starting of each course. The Learning Outcomes based Curriculum Framework (LOCF) for B.Sc. Botany will certainly be a valuable document in the arena of outcome-based curriculum design.

2.1 Nature and extent of B.Sc. Botany

Degree programme in Botany is designed to include cutting edge and core topics in a perfect balance. The scope of individual topics varies with the nature of specific Botany branch. In our endeavor to improve the employability of graduates of the Botany programme, the curriculum offers courses on business skills. The B.Sc. Botany programme is of three years duration. Each year is divided into two semesters. The total number of semesters are six. The teaching and learning in the B.Sc. Botany programme will involve theory classes (lectures) and practicals.

The curriculum will be taught through formal lectures with the aid of power-point presentations, audio and video tools and other teaching aids can be used as and when required. Wherever possible RBPT approach will be adopted to make the process of learning more learner-centric. ICT-based teaching-learning tools will be incorporated through which even the mundane aspects could be made more interesting and relevant.

2.2 Programme Education Objectives (PEOs)

The overall aims of bachelor's degree programme in Botany are to:

1. Create a great learning environment for students to inculcate deep interests in Subject.
2. Provide choice-based learning to students.
3. Empower students by providing appropriate tools of analysis to address issues and problems in the field of Botany.
4. Help students to develop the ability to use their knowledge and skills to handle the specific theoretical and applied problems in Botany.
5. Encourage students to pursue advanced studies related to Botany by creating a strong and profound base of fundamental concepts.
6. Assist students to develop an array of generic skills which are helpful in creating employment and business opportunities.

3. Graduate Attributes in Botany

Attributes expected from the graduates of B.Sc. Botany Programme are:

Every student shall have following on completion of a programme:

GA 1: Disciplinary Knowledge – Depth of core and disciplinary knowledge

GA 2: Resourceful and Responsible – Ability to motivate, capable of handling independent work

GA 3: Learning and Research skills – Equipped to seek knowledge and to continue learning throughout their lives.

GA 4: Global Awareness – An understanding of international traditions and practices both within and beyond their discipline.

GA 5: Reflective Learning – Set aspirational goals for continuous personal and professional growth.

GA 6: Communication skills - The ability to communicate effectively with society and convince people to take a conversational approach.

GA 7: Self-Directed Learning - Acquisition of knowledge and ability to troubleshoot through first-hand experience with real life scenarios.

4. Qualification descriptors

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- a UG certificate is awarded to students who opt to exit after completing 1 year (2 semesters) of study in the chosen fields of study with having secured 44 credits and in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.
- a UG diploma is awarded to students who opt to exit after 2 years (4 semesters) of study with having secured 88 credits and in addition, they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.
- a bachelor's degree is awarded after a 3-year (6 semesters) programme of study in major discipline with having secured 132 credits and minimum credit requirements as follows

Sr. No.	Category of Courses	Minimum credit requirements
1	Major Core Course	48
2	Minor Stream Course	20
3	Discipline Specific Elective Course	06
4	Ability Enhancement Course	08
5	Skill Enhancement Course	06
6	Value Education Course	04
7	Vocational Skill Course	08
8	Indian Knowledge System	02
9	Co-curricular Course	20

10	Open Elective Course	10
Total		132

- After completing the requirements of three year Bachelor's degree, candidate who meet the minimum CGPA of 7.5 shall be allowed to continue studies in the fourth year of undergraduate program to pursue and complete Bachelor's degree with honours/research (subject to change).
- a 4-year bachelor's degree (honours) is awarded after eight semesters programme of study with having secured 176 credits and minimum credit requirements as follows:

Sr. No.	Category of Courses	Minimum credit requirements
1	Major Core Course	76
2	Minor Stream Course	24
3	Discipline Specific Elective Course	14
4	Ability Enhancement Course	08
5	Skill Enhancement Course	06
6	Value Education Course	04
7	Vocational Skill Course	08
8	Indian Knowledge System	02
9	Co-curricular Course	24
10	Open Elective Course	10
Total		176

- They should do a research project or dissertation under the guidance of a faculty member of the University/College. The research project/dissertation will be in the major discipline. The

students who secure 176 credits, including 12 credits from a research project/dissertation, are awarded UG Degree with Research.

The 4-year bachelor's degree programme is considered a preferred option since it would provide the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student.

Upon successful completion of the programme, students receive B.Sc. degree in Botany. B.Sc. Botany graduates of this department are expected to demonstrate the extensive knowledge of various concepts of botany and its application thus contributing in research, development, teaching, government and public sectors. This programme will establish a foundation for students to further pursue higher studies in Botany.

The list below provides a synoptic overview of possible career paths provided by an undergraduate training in Botany:

1. Academics
2. Research
3. Geneticist
4. Researcher
5. Ecologist
6. Botanist
7. Farming consultant
8. Plant biochemist
9. Greenhouse Manager or nursery manager
10. Environmental consultant
11. Horticulturist
12. Plant Protection Officer

Job Roles for B.Sc. Botany graduate:

After graduation one can seek a professional career as:

1. Lab chemist
2. R & D division

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3. Production officer
 4. Quality control and Quality assurance
 5. Academist
 6. Environment analyst
 7. Project fellow
 8. Entrepreneur
 9. Civil services
 10. Competitive exams

Higher Education options for B.Sc. Botany graduate:

1. M.Sc. by papers in Botany, Nutraceutical, Bioanalytical sciences, Life sciences, Biotechnology, Environmental Science, Horticulture, Forestry
2. M.Sc. by Research
3. Integrated M.Sc.-Ph.D.
4. PG Diploma in advance instrumental analysis/drug design/Intellectual Property rights/ Clinical research/ Cosmetology/ Aroma therapy, etc
5. Courses in management - Human resources, Agricultural management.
6. B.Ed

The learners who complete three years of full-time study of an undergraduate programme of study will be awarded a Bachelor's degree in Botany.

5. Programme Learning Outcomes (PLOs)

After the successful completion of modules in different courses of B.Sc. Botany the learner will be able to:

PLO I: Categorize the plant into respective Groups.

PLO II: Utilize various analytical techniques for validation.

PLO III: Organize and analyze the data generated through experiments using computer softwares.

PLO IV: Evaluate the interaction between various biomolecules and the internal cellular environment.

PLO V: Recommend strategies to mitigate environmental degradation.

PLO VI: Prioritize the conservation and management of biodiversity.

PLO VII: Improved skill set required to perform practical techniques in Botany.

PLO VIII: Analyze the effect of climate change and anthropological activities on biodiversity.

PLO IX: Propose the strategies for conservation of biodiversity with NGO's.

PLO X: Competent to formulate basic plant-based products in the pharmaceutical and cosmeceutical industry.

PLO XI: Validate the processes of Plant Tissue Culture and post-Harvest Technology.

PLO XII: Investigate the mechanism of the biological system with respect to genetics and biochemistry.

5.1 Course Mapping

Semester	PSO	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
	Course												
I	MJ I		√					√			√		
	MJ II						√		√	√			
	MN I												
	SEC												
	VEC												
	IKS												
II	MJ I		√		√		√	√	√	√			
	MJ II		√				√	√					
	MN I												
	SEC												
	VEC												

6. Structure of B.Sc. Botany programme

The curriculum framework is designed around the choice-based credit system (CBCS). The programme consists of three years UG having six semesters (two semesters per year) or four years UG (Honours) having eight semesters (two semesters per year). To acquire a degree in B.Sc. Botany a learner must study

Semester	MJ	DSE	SEC	VEC	MN	AEC	VEC	IKS	CC	FP	INT/ APT	OE	Total
I	6	-	-	-	6	4	2	-	2	-	-	2	22
II	6	-	-	-	6	3	2	1	2	-	-	2	22
III	6	-	3	2	4	1	-	1	2	-	-	3	22
IV	6	-	3	2	4	-	-	-	2	2	-	3	22
V	12	-	-	-	-	-	-	-	-	2	8	-	22
VI	12	6	-	4	-	-	-	-	-	-	-	-	22

BSc with Honours – 22 credits in Sem VII and VIII

BSc with Research – 22 credits in Sem VII and VIII

To acquire a degree in B.Sc. chemistry a learner must study

1. Major Core Courses (MJ):

- A course which is required to be opted by a candidate as a major core course. The course designed under this category aims to cover the basics that a student is expected to imbibe in that particular subject or discipline.
- Students may be allowed to change major within the broad discipline at the end of the second semester by giving her/him sufficient time to explore interdisciplinary courses during the first year.
- There are twenty four Major Core courses (MJ), two each, in semesters I to IV; and four each in semesters V and VIII.
- Each Major Core Courses is compulsory.

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- e) Each Major Core Course from semester I to VI is comprised of 2 credits for theory ie. 30 hours; 2 lectures of each 1 hr per week and 1 credit for practical of two hours per week in every semester.
 - f) Each Major Core Course from semester VII and VIII is comprised of 2 credits for theory ie. 30 hours; 2 lectures of each 1 hr per week and 1.5 credit for practical of three hours per week in every semester.
 - g) The purpose of fixing major core papers is to ensure that the institution follows a minimum common curriculum so as to adhere to common minimum standards with other universities/institutions.

2. Minor Stream Course (MN):

- a) A course is chosen by a candidate from interdisciplinary stream as a minor course. Minor Stream course helps a student to gain a broader understanding beyond the major discipline.
- b) Students who take a sufficient number of courses in interdisciplinary area of study other than the chosen major will qualify for a minor in that discipline.
- c) Students may declare the choice of the minor stream course at the end of the second semester after exploring various courses.
- d) There are two each Minor stream course (MN), in semesters I and II. This Minor stream is comprised of 2 credits for theory ie. 30 hours; 2 lectures of each 1 hr per week and 1 credit for practical of two hours per week in every semester.
- e) There is one each Minor stream course (MN) in semester III and IV. This Minor stream is comprised of 2 credits for theory ie. 30 hours; 2 lectures of each 1 hr per week and 2 credits for practical of four hours per week in every semester.
- f) Each Minor stream Courses is compulsory.

3. Ability Enhancement Courses (AEC)

- a) The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills, that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity.
- b) Students are required to achieve competency in a Modern Indian Language (MIL) and in the English language with special emphasis on language and communication skills.
- c) There are five AE courses in spread over three semesters (I to III).

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- d) Each student is supposed to take two AE in semester I - English language and Modern Indian language of 2 credits each.
 - e) There are two AE in semester 2 - English language of two credits and Modern Indian language of 1 credit.
 - f) There is one AE in semester 3 - Modern Indian language of 1 credit.

4. Value Education Courses (VEC)

- a) The course seeks to equip students with the ability to apply the acquired knowledge, skills, attitudes and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living.
- b) The VEC courses offered are:
 - VEC 1- Environmental Science I (2 credits) (Semester 1),
 - VEC II- Environmental Science II (2 credits) (Semester II).

5. Co-Curricular courses (CC):

- a) They are designed to provide skill-based knowledge and contain both lab/hands on training/field work.
- b) The main purpose of these courses is to provide life skills in hands-on mode to increase employability.
- c) There are two CC each in semester I to III – NCC (compulsory 1 credit course) and Other one from Music/Sports training program/Yoga/ Study Circle
- d) There are three CC each in semester IV – NCC (compulsory 1 credit course), second one from Music/Sports training program/Yoga/ Study Circle of 1 credit and third one is Field project of 2 credits.
- e) There are two CC semester V – Internship/ Apprenticeship (8 credit) and Field project (2 credit)

6. Open Elective (OE)

- a) They are designed to provide multidisciplinary education.
- b) Students can opt for one interdisciplinary Open Elective Course (OE) in each of the semester I and II of two credit each.

c) Students can opt for one interdisciplinary Open Elective Course (OE) in each of the semester III and IV of three credit each.

d) Open courses are offered in cognate disciplines by different departments in the college.

7. Indian Knowledge System (IKS)

a) They are designed to recognize the rich heritage of ancient and eternal Indian knowledge and thought as a guiding principle.

b) Students can opt for one General IKS in semester II – Indian cultural Heritage of one credit.

c) There is one IKS based on major subject in semester III of 1 credit.

8. Skill Enhancement Course (SEC):

a) They are designed to provide skill-based knowledge pertaining to the Major course to the learner.

b) The main purpose of these courses is to provide life skills in hands on mode to increase employability.

c) There are Two skill enhancement courses offered. Each student is supposed to take one SEC in each semester III and IV of 3 credit each (2 credit theory and 1 credit practical).

9. Discipline Specific Elective Courses (DSE):

a) Elective courses offered under the major course subject of study.

b) There are two discipline specific elective courses (DSE), offered in semesters VI of 2 credits theory and 1 credit practical.

c) There is one discipline specific elective course (DSE), offered in semesters VII and VIII each of 2 credits theory and 2 credit practical.

d) There is one advance level disciplinary course – Research Methodology of 4 credits offered in semester VII.

10. Vocational Skill Course (VSC)

a) Vocational courses are designed to provide practical, hands-on training, competencies, and proficiency to students, ultimately enhancing their skills and employability.

b) These courses are tailored to prepare individuals for specific careers and industries.

c) There are two VSC offered one each in semester III to IV, each one is of two credits.

d) There is one VSC offered in semester VI of 4 credits.

11. On Job Training (OJT)

a) On Job training of 4 credits is offered in semester VIII to enhance the specific skills and competencies required for a particular job

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- b) OJT bridges the gap between theory and practical application, promoting a deeper understanding of concepts.

12. Field Projects/ Internship/ Apprenticeship/ Community Engagement.

- a) Field projects require students to participate in field-based learning activity generally under the supervision of an expert of the given external entity.
- b) The curricular component of ‘community engagement and service’ will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.
- c) Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

6.1 Content

Sr. No	Semester	Course number	Course Code	Course title
1	I	MJ I	23US1BOMJ1PLD1	Plant Diversity -I
2		MJ II	23US1BOMJ2PLD2	Plant Diversity -II
3		MJ P	23US1BOMJP	Based on MJ I and MJ II
4		MN I		Course from chemistry/ Zoology
5		MN II		Course from chemistry/ Zoology
6		MN P		Based on MN I and MN II
7		AEC I		Communication in English Level 1
8		AEC II		Modern Indian Language Level 1 (Hindi/Marathi)
9		VEC		Environmental Science I
10		CC I		NCC
11		CC II		Music/Yoga/Sports Training Program Level 1/ Study Circle
12		OE		Social Media Advertising/ Introduction to microeconomics
13	II	MJ I	23US2BOMJ1FAF	Forms and function
14		MJ II	23US2BOMJ2EPR	Ecology and plant resource

15		MJ P	23US2BOMJP	Based on MJ I and MJ II
16		MN I		Course from chemistry/ Zoology
17		MN II		Course from chemistry/ Zoology
18		MN P		Based on MN I and MN II
19		AEC I		Communication in English Level II
20		AEC II		Modern Indian Language Level II (Hindi/Marathi)
21		VEC		Environmental Science - II
22		IK		Indian Cultural Heritage
23		CC I		NCC
24		CC II		Music/Yoga/Sports Training Program Level 1/ Study Circle
25		OE		Indian Finance system and budget/ Brand Management

6.2 Credit distribution for B.Sc. Botany

Semester	Course number	Course title	Credits		
			Theory	Practical	Total
I	MJ I	Plant Diversity -I	2	1	3
	MJ II	Plant Diversity -II	2	1	3
	MN I	Course from chemistry/ Zoology	2	1	3
	MN II	Course from chemistry/ Zoology	2	1	3
	AEC I	Communication in English Level 1	2		2
	AEC I	Modern Indian Language Level 1	2		2
	VEC	Environmental Science I	2		2
	CC I	NCC	1		1
	CC II	Music/Yoga/Sports Training Program Level 1/ Study Circle	1		1
	OE	Social Media Advertising/ Introduction to microeconomics	2		2
Total					22
II	MJ I	Forms and function	2	1	3
	MJ II	Ecology and plant resource	2	1	3
	MN I	Course from chemistry/ Zoology	2	1	3
	MN II	Course from chemistry/ Zoology	2	1	3

AEC I	Communication in English Level II	2		2
AEC II	Modern Indian Language Level II	1		1
VEC	Environmental Science - II	2		2
IKS	Indian Cultural Heritage	1		1
CC I	NCC	1		1
CC II	Music/Yoga/Sports Training Program Level 1/ Study Circle	1		1
OE	Indian Finance system and budget/ Brand Management	2		2
Total				22

6.3 Semester Schedule

Semester	Major Core Courses (MJ)	Minor Stream Courses (MN)	Ability Enhancement Courses (AEC)	Value Education Course (VEC)	Indian Knowledge System (IKS)	Co-Curricular Course (CC)	Open Elective (OE)
I	1] Plant Diversity –I 2] Plant Diversity – II	1] MN I Course from chemistry/ Zoology 2] MN II Course from chemistry/ Zoology	1] AEC I Communication in English Level I 2] AEC II Modern Indian Language Level I	Environment Science I	-	1] NCC II] Music/ Yoga/ Sports Training Program Level 1/ Study Circle	Social Media Advertising/ Introduction to microeconomics
II	1) Forms and functions 2] Ecology and Plant resource	1] MN I Course from chemistry/ Zoology 2] MN II Course from chemistry/ Zoology	1] AEC I Communication in English Level II 2] AEC II Modern Indian Language Level II	Environment Science II	Indian Cultural Heritage	1] NCC II] Music/ Yoga/ Sports Training Program Level 1/ Study Circle	Indian Finance system and budget/ Brand Management



6.4 Course Learning Objective

The three-year undergraduate Botany programme is designed to familiarize students with significant developments in Botany. The objective of structured syllabus in Botany is to make the concepts and basics of Botany clear and interesting to students and also to ensure the development of vertical growth in the subject. The idea behind this is to enable students to develop analytical skills and critical thinking. It is our attempt that students achieve this objective through systematic reading and class lectures and through feedback on their written work-assignments, project/research papers, presentations, discussions, debates, etc. our intention is to enable students to formulate cogent arguments, presenting the necessary evidence to establish these, based on a training in Botany.

7. Detailed B.Sc. Botany Syllabus

F. Y. B.Sc. Syllabus with effect from the Academic year 2023–2024

Syllabus - F. Y. B.Sc. Botany

Course No.	Course Title	Course Code	Credits	Periods (1 Hr.)	Module	Lectures per module (60 min)	Examination		
							Internal Marks	External Marks	Total Marks
I	Plant Diversity - I	23US1B OMJ1P LD1	2	30	2	15	20	30	50
II	Plant Diversity -II	23US1B OMJ2P LD2	2	30	2	15	20	30	50
		23US1B OMJP	2	60			CIA		50
I	Forms and Function	23US2B OMJ1F AF	2	30	2	15	20	30	50
II	Ecology and Plant resource	23US2B OMJ2E PR	2	30	2	15	20	30	50
		23US2B OMJP	2	60			CIA		50

F.Y. B. Sc. (BOTANY) SEMESTER I

Core Course- I

COURSE TITLE: Plant Diversity - I

COURSE CODE: 23US1BOMJ1PLD1 [CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Differentiate various life forms based on external morphology. 2. Classify the organisms to respective groups. 3. Interpret the evolutionary features of organisms. 4. Illustrate the internal structure of various life forms using microscopy. 5. Correlate significance of bacteria, algae and fungi with human welfare. 6. Connect the impact of environmental change on the existence of biodiversity. 7. Narrate the transitory stages of non-vascular plants to vascular plants with reference to terrestrial habitat. 		
Module 1	Microbiology and Phycology	[15L]
<p>Learning Objectives:</p> <p>The module is intended to</p> <ol style="list-style-type: none"> i. To overview general and reproductive features of bacteria and algae. ii. To explore the economic importance of bacteria. 		
<p>Learning Outcome:</p> <p>After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> i. Differentiate features of bacterial and algal cells and categorize the organism based on phylogeny. 		
1.1	<p>Bacteria –</p> <ol style="list-style-type: none"> 1.1.1 Shapes, size and arrangement of bacteria 1.1.2 Ultrastructure of bacteria 1.1.3 Reproduction in bacteria 1.1.4 Bacterial diversity in different habitats 1.1.5 Economic importance of bacteria 	<p>1</p> <p>3</p> <p>2</p> <p>1</p> <p>2</p>
1.2	<p>Algae –</p> <ol style="list-style-type: none"> 1.2.1 General characteristics of algae 	<p>1</p>

	1.2.2 Range of thallus in algae	2
	1.2.3 Structure , reproduction in <i>Zygnema</i>	2
	1.2.4 Economic importance of algae	0.5
	1.2.5 Single Cell Protein - Introduction and applications	0.5
References:		
<ul style="list-style-type: none"> ● Pelczar and Reid. General Microbiology ● Kale and Bhusari.General Microbiology ● Ananthanarayan.Basics of Microbiology ● Vasishta,B. R.Botany for Degree Students ● Smith,G. M. Cryptogamic Botany Vol. I ● Sharma,O. P. Textbook of Algae ● Gangulee and Kar.College Botany 		
Module 2	Mycology and Lichens	[15L]
Learning Objectives:		
This module is intended to:		
<ol style="list-style-type: none"> i. To review general and reproductive features of fungi and lichens. ii. To explore the interrelation with the environment and lichens. 		
Learning Outcome:		
After the successful completion of the module, the learner will be able to:		
<ol style="list-style-type: none"> i. Develop an understanding of fungi and lichens and compare their adaptive strategies. 		
2.1	Fungi	
	2.1.1 General characters of fungi	1
	2.1.2 Structure and reproduction in <i>Rhizopus</i> .	2
	2.1.3 Economic importance of Fungi-Positive and Negative aspects	2
	2.1.4 Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance	1
	2.1.5 General symptoms of plant diseases	1
2.2	Lichens	
	2.2.1. Occurrence, Thallus structure and Reproduction	2
	2.2.2 Types of lichens based on Fungal partner, substratum, internal and external structure.	4
	2.2.3 Ecological and economic significance of lichens	2

References:

- Sharma, O. P. Textbook of Fungi
- Dubey, H. C. An Introduction of Fungi
- Vasishta, B. R. Botany for Degree Students
- Sarbhoy, A. K. Textbook of Mycology
- Gangulee and Kar. College Botany

Question paper Template

F.Y. B. Sc. (BOTANY) SEMESTER I

Major Stream Course- I

COURSE TITLE: Plant Diversity-I

COURSE CODE: 23US1BOMJ1PLD1 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	4	7	4	-	-	-	15
II	-	4	7	4	-	-	15
Total marks per question	4	11	11	4	-	-	30
% Weightage	13.33	36.66	36.66	13.33	-	-	100

F.Y. B. Sc. (BOTANY) SEMESTER I

Core Course- II

COURSE TITLE: Plant Diversity-II

COURSE CODE: 23US1BOMJ2PLD2 [CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Summarise general characteristics of Bryophyta and Pteridophyta. 2. Illustrate reproductive features of Bryophyta and Pteridophyta. 3. Comprehend economic and ecological importance of Bryophyta and Pteridophyta. 4. Differentiate between gymnosperms and angiosperms. 5. Identify the types of fossils. 		
Module 1	Bryophyta and Pteridophyta	[15L]
<p>Learning Objectives: The module is intended to</p> <ol style="list-style-type: none"> i. To configure general and reproductive features of Bryophyta and Pteridophyta. 		
<p>Learning Outcome: After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> i. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes and Pteridophytes. ii. Interpret the evolutionary journey of Bryophytes and Pteridophytes and their transition to the terrestrial habitat. 		
1.1	<p>Bryophyta</p> <ol style="list-style-type: none"> 1.1.1 General characters of Bryophytes. 1.1.2 Structure and Reproduction in <i>Riccia</i>. 1.1.3 Ecological and economic importance of Bryophyte 	<p>1</p> <p>4</p> <p>2</p>
1.2	<p>Pteridophyte</p> <ol style="list-style-type: none"> 1.2.1 General characters of Pteridophytes. 1.2.2 Structure, and Reproduction of <i>Nephrolepis</i>. 1.2.3 Economic importance of pteridophyte. 	<p>1</p> <p>5</p> <p>2</p>
<p>References:</p> <ul style="list-style-type: none"> • Vasishta, B. R. Botany for Degree Students 		

- Smith,G. M. Cryptogamic Botany Vol. I
- Saxena and Sarabhai.Textbook of Botany.Vol.II
- Gangulee and Kar.College Botany

Module 2

Gymnosperms and Paleobotany

[15L]

Learning Objectives:

This module is intended to:

- To compare the features of gymnosperms and angiosperms with reference to morphological and reproductive features of *Cycas*.
- To consolidate the process of fossilization and principle types of fossils.
- To prove the evolutionary relationship with prehistoric evidences.

Learning Outcome:

After the successful completion of the module, the learner will be able to:

- Categorize fossil specimens according to geological time scale.
- Recognise different Gymnosperms with industrial potential.

2.1	<p>Gymnosperm</p> <p>1.1.1 General characters of Gymnosperms. 2</p> <p>1.1.2 Similarity and differences between gymnosperms and angiosperms. 2</p> <p>1.1.3 Structure and Reproduction of <i>Cycas</i>. 4</p> <p>1.1.4 Economic importance of Gymnosperms 1</p>	
2.2	<p>Paleobotany</p> <p>1.2.1 Types of fossils: Petrification, Cast, Impression, Compression, Amber. 2</p> <p>1.2.2 Application of Fossil fuels, C14 dating. 4</p>	

References:

- Das Datta Gangulee. College Botany, Vol II
- Cheshter Arnold. Paleobotany
- Vashishtha. Gymnosperm.
- Sharma,O. P. Gymnosperm.

Question paper Template

F.Y. B. Sc. (BOTANY) SEMESTER I

Major Stream Course- I

COURSE TITLE: Plant Diversity-I

COURSE CODE: 23US1BOMJ1PLD1 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	4	7	4	-	-	-	15
II	-	4	7	4	-	-	15
Total marks per question	4	11	11	4	-	-	30
% Weightage	13.33	36.66	36.66	13.33	-	-	100

F. Y. B. Sc. (BOTANY)

SEMESTER I - Practical

COURSE CODE: 23US1BOMJP [Credit - 01]

Learning Objectives:		
The Practical is intended to		
<ol style="list-style-type: none"> 1. To overview general and reproductive features of cryptogams. 2. To distinguish bacteria based on staining characteristics. 		
Learning Outcome:		
After the successful completion of the practical, the learner will be able to:		
<ol style="list-style-type: none"> 1. Differentiate various types of bacteria. 2. Identify morphological, anatomicals, and reproductive features of cryptogams. 		
Core Course I	Plant Diversity -I	
1	Study of morphology of bacteria by Positive staining.	
2	Motility studies in bacteria by hanging drop technique.	
3	Screening of halophiles, alkalophiles and acidophiles from suitable samples.	
4	Study of Range of thallus in algae using specimen/ photomicrograph.	
5	Study of Life cycle of <i>Zygnema</i> and <i>Nostoc</i> using specimens/ photomicrograph.	
6	Economic importance of algae using specimen/ photomicrograph.	
7	Study of production of single cell protein.	
8	Study of life cycle of <i>Rhizopus</i> using specimen/ photomicrograph.	
9	Isolation of fungi using suitable material on PDA.	
10	Economic importance of fungi using specimen/ photomicrograph.	
11	Identification of types of lichens using specimen/ photomicrograph.	
12	Study of V S of thallus of lichen using permanent slide.	
13	Screening and identification of VAM fungi from suitable roots.	

14	With the help photomicrograph study of symptoms of plant diseases.	
Core Course II	Plant Diversity II	
1	Study of life cycle of <i>Riccia</i> using specimen/ photomicrograph.	
2	Economic importance of bryophytes using specimen/ Photomicrograph.	
3	Study of life cycle of <i>Nephrolepis</i> using specimen/ photomicrograph.	
4	Economic importance of pteridophytes using specimen/ Photomicrograph.	
5	Study of life cycle of <i>Cycas</i> using specimen/ photomicrograph.	
6	Economic importance of gymnosperms using specimen/ Photomicrograph.	
7	Identification of types of fossils using specimen/ photomicrograph.	

F.Y. B. Sc. (BOTANY) SEMESTER II

Core Course- I

COURSE TITLE: Forms and Function

COURSE CODE: 23US2BOMJ1FAF [CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Classify the plants to their respective family based on morphological characteristics. 2. Illustrate the internal morphology of plants. 		
Module 1	Angiosperms	[15L]
<p>Learning Objectives:</p> <p>The module is intended to</p> <ol style="list-style-type: none"> i. Describe the various morphological characteristics of flowers and its variations. ii. Classify the plants to respective families. 		
<p>Learning Outcome:</p> <p>After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> i. Classify plants as per Bentham and Hooker system and identify their economic importance. ii. Describe the various morphological characteristics of flowers. 		
1.1	1.1.1 Flower-thalamus, forms of thalamus, androphore, gynophore, androgynophore	1
	1.1.2 Complete and incomplete flower, Bisexual, unisexual staminate and pistillate	1
	1.1.3 Actinomorphic and zygomorphic	1
	1.1.4 Non Essential whorls - calyx - Functions, Variations - petaloid, pappus and spurred	1
	Corolla - Functions, Forms -Cruciform, tubular, salver shaped, Infundibuliform, Papilionaceous, ligulate and bilabiate	1
	1.1.5 Aestivation	
	1.1.6 Essential whorls - androecium - Parts of a stamen, T.S	1

	anther, Attachment - Basifixed, dorsifixed and versatile, adnate	1
	Union of stamens-Cohesion, adhesion, variation of stamens	
	Gynoecium - Parts of a carpel, functions and types of carpels	1
	1.1.7 Placentation - Types	1
1.2	Study of the following families according to Bentham and Hooker system of classification with special emphasis on morphological peculiarities and economic importance.	
	1.2.1 Malvaceae	2
	1.2.2 Rubiaceae	2
	1.2.3 Amaryllidaceae	2
References:		
<ul style="list-style-type: none"> • R. K. Sinha. Taxonomy of Angiosperms • Gangulee, Das, Dutta. College Botany volume I • V. S. S. Sambamurthy. Taxonomy of Angiosperms • Sutaria. Textbook of Systematic Botany 		
Module 2	Anatomy	[15L]
Learning Objectives:		
This module is intended to:		
i. To compare structure and function of plant tissues with reference to specific organs.		
Learning Outcome:		
After the successful completion of the module, the learner will be able to:		
i. Explain internal organization and functioning of various plant tissue systems.		
2.1	Tissue system in plants:	
	2.1.1 Introduction to various tissue systems in plants	3
	2.1.2 Types of vascular bundles	3
	2.1.3 Stomata (Dicot and Monocot - Graminaceous)	3
2.2	Study of primary structure of –	
	2.2.1 Dicot and Monocot root	3
	2.2.2 Dicot and Monocot stem	3
References:		
<ul style="list-style-type: none"> • Pijush Roy. Plant Anatomy. • Sinha, S K. The Textbook of Plant Anatomy • Pande, B. P. Plant Anatomy 		

Question paper Template

F.Y. B. Sc. (BOTANY) SEMESTER II

Major Stream Course- I

COURSE TITLE: Forms and Function

COURSE CODE: 23US2BOMJ1FAF [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	4	7	4	-	-	-	15
II	-	4	7	4	-	-	15
Total marks per question	4	11	11	4	-	-	30
% Weightage	13.33	36.66	36.66	13.33	-	-	100

F.Y. B. Sc. (BOTANY) SEMESTER II

Core Course- II

COURSE TITLE: Ecology and Plant Resource

COURSE CODE: 23US2BOMJ2EPR [CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Comment on adaptive features of plants with respect to specific ecological conditions. 2. Identify specific phytogeographical region of India. 3. Enlist various plants as a source of compounds used in day to day life. 		
Module 1	Ecology and Plant Geography	[15L]
<p>Learning Objectives: The module is intended to</p> <ol style="list-style-type: none"> i. Describe morphological and anatomical characteristics of plants with respect to ecological adaptations. 		
<p>Learning Outcome: After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> i. Illustrate ecological adaptations with respect to specific ecological conditions. 		
1.1	<p>Study of ecological adaptations based on morphology and anatomical features -</p> <ol style="list-style-type: none"> 1.1.1 Hydrophytes 1.1.2 Mesophytes 1.1.3 Halophytes 1.1.4 Xerophytes 1.1.5 Epiphytes 	<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>
1.2	Phytogeographical regions of India	5L
<p>References:</p> <ul style="list-style-type: none"> ● Odum E.P. (1978) Ecology. Oxford and IBS Publishing Co., New Delhi. ● Sharma P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut 		
Module 2	Plant resource and utilisation	[15L]
<p>Learning Objectives: This module is intended to:</p>		

- i. Discuss plants as a source of compounds used in day to day life.
- ii. Describe the source and importance of major and minor forest products.

Learning Outcome:

After the successful completion of the module, the learner will be able to:

- i. Enlist the plants as a source of various compounds.
- ii. Identify major and minor forest products.

2.1	Fiber industry- Jute, Cotton, Coir: Source, Processing and Uses	4
2.2	Major and Minor Forest products	5
2.3	Plant pigments- as a source of food colour, Dye	4
2.4	Conventional and Non-conventional sources, extraction and uses of Starch	2

References:

- <https://www1.gujaratuniversity.ac.in/data/pdfs/syllabus/B.Sc%20%20Botany%20Sem%201%20to%206%20%202017.pdf>
- http://telanganauniversity.ac.in/UG_CBCS_Bot_Syll.PDF

Question paper Template

F.Y. B. Sc. (BOTANY) SEMESTER II

Major Stream Course- II

COURSE TITLE: Ecology and Plant Resource

COURSE CODE: 23US2BOMJ2EPR [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	4	7	4	-	-	-	15
II	-	4	7	4	-	-	15
Total marks per question	4	11	11	4	-	-	30
% Weightage	13.33	36.66	36.66	13.33	-	-	100

F. Y. B. Sc. (BOTANY)

SEMESTER II - Practical

COURSE CODE: 23US2BOMJP [Credit – 01]

Learning Objectives:		
<ol style="list-style-type: none"> 1. Classify the plants to their respective family. 2. Interpret the internal structure of the dicot and monocot root and stem. 3. Describe plants as a source of various industrially important compounds. 4. Identify major and minor forest forest products. 		
Learning Outcome:		
After the successful completion of the practical, the learner will be able to:		
<ol style="list-style-type: none"> 1. Assign the plants to their respective family based on morphological characteristics. 2. Illustrate internal morphology of dicot and monocot root and stem. 3. Enlist and identify plants as a source of pigments, fibers, etc. 4. Perform extraction of fibers, pigments from plants. 5. Describe source and significance of major and minor forest produce. 		
Core Course I	Practical	
1	Study of flower morphology.	
2	Study of the following families with the help of fresh material Malvaceae Rubiaceae Amaryllidaceae	
3	Types of vascular bundles using specimen/ photomicrograph.	
4	Study of Monocot and Dicot stomata using specimen/ photomicrograph.	
5	Study of primary structure of Monocot root and Dicot root.	
6	Study of primary structure of Monocot and Dicot stem.	

Core Course II	Practical	
1	Study of morphological and anatomical characteristics of plants with respect to ecological adaptations Hydrophytes: Mesophytes, Halophytes, Xerophytes, Epiphytes	
2	Identification of plants as source of fibers using specimen/ photomicrograph	
3	Extraction of fibers from suitable plant material	
4	Extraction of food colour from the suitable plant material	
5	Extraction of starch from suitable plant material	
6	Identification of major and minor forest products using specimen/ photomicrograph	

8. Teaching learning process

The pedagogic methods adopted, involve direct lectures, tutorial discussions, as well as technology-supported presentations. We believe that education is interactive and all sessions between students and teachers are based upon reciprocity and respect.

1) The lectures (of 1 hr duration) delivered to one whole class at a time systematically deal with the themes of the syllabus. This constitutes the core of the teaching- learning process. The students are provided with bibliographic references and encouraged to go through at least some readings so that they could be more interactive and ask more relevant questions in the class. This also helps obtain knowledge beyond the boundaries of the syllabi.

2) Wherever needed, teachers use audio-video based technology devices (e. g. power point, YouTube videos) to make their presentations more effective. Some courses require that students see a documentary or feature film and course themes are structured so that discussions of these will further nuance the critical engagement of students with ideas introduced in their textual materials.

3) Remedial coaching, bridge courses are adopted to enhance the scope of learning for the learners. Remedial sessions are conducted to offer assistance on certain advanced topics. Bridge courses facilitate to develop a concrete basis for the topics to be learnt in the coming academic year.

9. Assessment Methods

Evaluation Pattern: Theory

- Assessments are divided into two parts: Mid Semester Examination (MSE) and End Semester Examination (ESE).
- The Mid Semester Examination shall be conducted by the College at the Mid of each semester (20 M) – Duration: 30 Min.
- The End Semester Examination shall be conducted by the College at the end of each semester. (30M) Duration: 1 hours

End Semester Examination Paper Pattern

Question No	Module	Marks with Option	Marks without Option
1	I	5 M x 5 Q = 25 M	3 M x 5 Q = 15 M
2	II	5 M x 5 Q = 25 M	3 M x 5 Q = 15 M

Each question will have six sub questions a, b, c, d, e, f and out of which any three should be answered.

Evaluation pattern: Practical

- Continuous Assessment for 50 Marks throughout entire semester.
- 50 Marks Evaluation as per the following rubrics

Major Core Course	CIE	Experimental Report	Viva	Total
MJ I	15 M	5 M	5 M	25 M
MJ I	15 M	5 M	5 M	25 M

10. Programme and Course Code Format

The course is coded according to following criteria:

1. First two numbers in each course code indicates year of implementation of syllabus (23-year of implementation is 2023-24)
2. Third letter 'U' designates undergraduate
3. Fourth letter 'S' designate Science discipline and the digit followed is for semester number (S1 – 1st Semester)
4. Letter 'BO' is for Botany discipline (BO- Botany). This forms the programme code 23USBO. For the further course codes programme code is amended as follows
5. To represent Major Core Course (MJ) followed by course number digit (1/2/3/4) and three lettered code representing the title of the course.
6. To represent Minor Stream Course (MN) followed by course number digit (1/2/3/4) and three lettered code representing the title of the course.
7. For Ability enhancement course code, (AE) alphabets followed by a digit (1/2) followed by 'FOC'- Foundation course, 'EVS'-Environmental science are used.
8. For Value Added course code, (VA) alphabets followed by a digit (1/2) followed by 'FOC'- Foundation course, 'EVS'-Environmental science are used.
9. For Indian Knowledge System course code, (IK) alphabets followed by a digit (1/2) followed by 'ICH'- Indian Cultural Heritage is used.
10. For Co-curricular course code, (CC) alphabets followed by a digit (1/2).
11. For Open Elective course code, (OE) alphabets followed by a digit (1/2).
12. 'P' followed by digit indicates practical course number. (Practical course number will be added for semesters only where there is more than one course.