

# **BHARATI VIDYAPEETH UNIVERSITY, PUNE**

## **(INDIA)**

### **BACHELOR OF SCIENCE (B.SC.) (CBCS 2018 COURSE)**

#### **Under: The Faculty of Sciences (To be implemented from June 2018)**

The Bachelor of Science (B.Sc.) degree of three years integrated choice based credit and grading system (CBCS-2018) course is being implemented from the academic year 2018- 2019. Thus, first year B.Sc. CBCS-2018 course will commence from 2018-2019 and will be implemented in successive years.

#### **1. Aims of Bachelor Degree program in Physics - (B.Sc. Physics):**

The aims and objectives of our UG educational programs in sciences in general and Physics in particular should be structured to

- Create the facilities and environment in all the educational institutions to consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Physics, to develop broad and balanced knowledge and understanding of physical concepts, principles and theories of Physics.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
- Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
- Expose the student to the vast scope of Physics as a theoretical and experimental science with applications in solving most of the problems in nature
- Emphasize the discipline of Physics to be the most important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.
- To emphasize the importance of Physics as the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

In view of opening the new windows in higher education and research and opening job opportunities at all levels from technicians to innovator scientists and engineers, the undergraduate program is offered in our universities.

### **1.1 Nature and extent of Bachelor Degree program in Physics:**

The UG programs in Physics builds on the basic Physics taught at the +2 level in all the schools in the country. Ideally, the +2 senior secondary school education should aim and achieve a sound grounding in understanding the basic Physics with sufficient content of topics from modern Physics and contemporary areas of exciting developments in physical sciences to ignite the young minds. The curricula and syllabi is framed and implemented in such a way that the basic connection between theory and experiment and its importance in understanding Physics should be apparent to the student. This is very critical in developing a scientific temperament and urge to innovate, create and discover in Physics. Unfortunately the condition of our school system in most parts of the country lacks the facilities to achieve the above goal and it is incumbent upon the college/university system to fill the gaps in the knowledge creation of our young minds created by the lack of infrastructural and academic resources of our school system and strengthen their understanding in all the subjects through the UG programs specially in Physics. All the courses are of three year duration spread over six semesters after the higher secondary (+2) level Physics course.

### **1.2 Graduate attributes in Physics:**

Some of the characteristic attributes of a graduate in Physics are

- **Disciplinary knowledge and skills:** Capable of demonstrating
  - (i) Good knowledge and understanding of major concepts, theoretical principles and experimental findings in Physics and its different subfields like Astrophysics and Cosmology, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and other related fields of study, including broader interdisciplinary subfields like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology etc.

(ii) Ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Physics.

- **Skilled communicator:** Ability to transmit complex technical information relating all areas in Physics in a clear and concise manner in writing and oral ability to present complex and technical concepts in a simple language for better understanding.
- **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Physics.
- **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to the issues and problems in the field of Physics, and planning, executing and reporting the results of a theoretical or experimental investigation.
- **Team player/worker:** Capable of working effectively in diverse teams in both classroom, laboratory, Physics workshop and in industry and field-based situations.
- **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
- **Digitally Efficient:** Capable of using computers for simulation studies in Physics and computation and appropriate software for numerical and statistical analysis of data, and employing modern e-library search tools like Infilbnet, various websites of the renowned Physics labs in countries like the USA, Europe, Japan etc. to locate, retrieve, and evaluate Physics information.
- **Ethical awareness / reasoning:** The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work.
- **National and international perspective:** The graduates should be able to develop a national as well as international perspective for their career in the chosen field of the

academic activities. They should prepare themselves during their most formative years for their appropriate role in contributing towards the national development and projecting our national priorities at the international level pertaining to their field of interest and future expertise.

- **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development in all areas of Physics.

### **1.3 Qualification descriptors for a UG programs in Physics:**

The graduates should be able to:

Demonstrate

- (i) A fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and applications, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology;
  - (ii) Procedural knowledge that creates different types of professionals related to different areas of study in Physics outlined above, including research and development, teaching and government and public service;
  - (iii) Skills in areas related to specialization area relating the subfields and current developments in the academic field of Physics.
- Use knowledge, understanding and skills required for identifying problems and issues relating to Physics, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources from various Physics laboratories of the world, and their application, analysis and evaluation using methodologies as appropriate to Physics for formulating new theories and concepts.
  - Communicate the results of studies undertaken accurately in a range of different contexts using the main concepts, constructs and techniques of Physics. Develop communication abilities to present these results in technical as well as popular science meetings organized in various universities and other private organizations.

- Ability to meet one's own learning needs, drawing on a range of current research and development work and professional materials, and interaction with other physicists around the world.
- Apply one's knowledge of Physics and theoretical and laboratory skills to new/unfamiliar contexts to identify and analyse problems and issues and solve complex problems in Physics and related areas with well-defined solutions.

Demonstrate Physics-related technological skills that are relevant to Physics-related job trades and employment opportunities.

#### **1.4 Program Specific Learning Outcomes a for UG programs in Physics:**

Students will be able to

- Acquire a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics
- Procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service
- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles
- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describe the physical world
- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected
- Get ability of problem-solving skills that are required to solve different types of Physics-related problems, investigative skills, communication skills, analytical skills, ICT skills and personal skills
- The ability to identify the potential ethical issues in work-related situations
- Promote safe learning and working environment

## **2. Aims of Bachelor's degree programme in Chemistry:**

The aim of bachelor's degree programme in chemistry is intended to provide:

- Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
- To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
- To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.
- To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.
- To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

### **2.1 Nature and extent of the B.Sc Chemistry Programme:**

Chemistry is referred to as the science that systematically study the composition, properties, and reactivity of matter at atomic and molecular level. The scope of chemistry is very broad. The key areas of study of chemistry comprise Organic chemistry, Inorganic Chemistry, Physical Chemistry and Analytical Chemistry. Organic chemistry deals with study of substances containing carbon mostly; inorganic chemistry deals with study of all other elements/compounds/substances and their chemical properties. Physical chemistry deals with applications of concepts, laws to chemical phenomena. Analytical chemistry, in general, deals

with identification and quantification of materials. Thus, the degree programme in chemistry also intended to cover overlapping areas of chemistry with physics, biology, environmental sciences. Further, a broad range of subjects such as industrial chemistry, environmental chemistry, etc., has also been introduced which can be helpful for students/faculty members to broaden the scope of their studies and hence applications from job prospective point of view. Therefore, as a part of efforts to enhance employability of graduates of chemistry, the curricula also include learning experience with industries and research laboratories as interns

This modified syllabus has been drafted to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/ introduced in this framework, including Physics, Mathematics, Biology and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Chemistry graduate is given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the employability of graduates, a number of skill development courses are also introduced in this framework.

## **2.2 Attributes of a Chemistry Graduate:**

Attributes of chemistry graduate under the outcome-based teaching-learning framework may encompass the following:

- **Core competency:** The chemistry graduates are expected to know the fundamental concepts of chemistry . These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Chemistry graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.
- **Critical thinking:** Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various socio-cultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problem-solving philosophical approaches that are pertinent across the disciplines;
- **Analytical reasoning:** Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other *a priori* reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decision-making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

### 2.3 Qualification Descriptors for Graduates in B.Sc. Chemistry:

The qualification description for B.Sc. programme in Chemistry includes:

- Systematic and fundamental understanding of chemistry as a discipline. ii).Skill and related developments for acquiring specialization in the subject.



- Identifying chemistry related problems, analysis and application of data using appropriate methodologies.
- Applying subject knowledge and skill to solve complex problems with defined solutions.
- Finding opportunity to apply subject-related skill for acquiring jobs and self-employment.
- Understanding new frontiers of knowledge in chemistry for professional development.
- Applying subject knowledge for solving societal problems related to application of chemistry in day to day life.
- Applying subject knowledge for sustainable environment friendly green initiatives.
- Applying subject knowledge for new research and technology.

#### **2.4 Programme Specific Learning Outcomes in B.Sc. Chemistry:**

The B.Sc. programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work and exposes them to techniques useful for applied areas of scientific study. Some of the programme specific learning outcomes are:

- Gain the knowledge of Chemistry through theory and practicals.
- Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
- Create an awareness of the impact of chemistry on the environment, society and development outside the scientific community.
- Find out the green route for chemical reaction for sustainable development.
- To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
- Identify chemical formulae and solve numerical problems.
- Use modern chemical tools, Models, Chem-draw, Charts and Equipments.
- Understand good laboratory practices and safety.
- Develop research oriented skills.
- Make aware and handle the sophisticated instruments/equipments.

### **3. Aims of Bachelor's Degree Programme in Botany:**

The broad aims of Bachelor's degree programme in Botany are:

- To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered, rather than didactic monologues on mere theoretical aspects
- To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

#### **3.1 Nature and extent of the B.Sc. degree Programme in Botany:**

Botany, as traditionally delimited epistemologically, is the broad discipline encompassing various subjects involved with the study of plants. Emphasis has been shifted to modern science at the cost of traditional botany. This shift is discussed at various forums. There is need to balance the traditional botany and upcoming modern computational and applied approach.

In view of above, adequate balance of topics is proposed displaying latest APG IV based phylogenetic systematics of plants covering higher plants, lower plants, aquatic (fresh and marine water) plants, nature/ field study, functional aspects of various cellular processes of plants, molecular genetics and modern tools i.e. tissue culture, genetic engineering and computational studies are required to be introduced at undergraduate level.

This modified syllabus has been drafted to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/introduced in this framework, including Chemistry, Mathematics and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Botany graduate is given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the employability of graduates, a number of skill development courses are also introduced in this framework.

### 3.2 Graduate Attributes in a Bachelor's Degree programme in Botany Botany:

- **Core competency:** The botany graduates are expected to know the fundamental concepts of botany and plant science. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Botany graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience
- **Critical thinking:** Botany graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.
- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problem solving philosophical approaches that are pertinent across the disciplines; Occam's razor for instance.
- **Analytical reasoning:** Graduates are expected to formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc. in fallacious arguments.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other a priori reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital

tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.

- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

### **3.3 Qualification Descriptors for a Bachelor's Degree programme in Botany:**

The qualification descriptors for a Bachelor's degree in Botany may include following:

- To demonstrate a systematic, extensive and coherent knowledge and understanding of academic fields of study as a whole and its applications and links to disciplinary areas of the study; including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of Botany;
- To demonstrate procedural knowledge that creates different types of professionals in the field of Botany like in research and development, teaching government and public services e.g. conservationist, plant explorer, ecologist, horticulturist, plant biochemist, genetics, nursery manager, molecular biologist, plant pathologist, taxonomist, farming consultant and environmental consultant. Further application of knowledge can enhance productivity of several economically important product/botanicals. Knowledge of Botany is also necessary for the development and management of forests, parks, wastelands and sea wealth
- Developing skills and ability to use knowledge efficiently in areas related to specializations and current updates in the subject
- Demonstrate comprehensive knowledge about plants, current research, scholarly and professional literature of advanced learning areas of Botany
- Use knowledge understanding and skills for critical assessment of wide range of ideas and problems in the field of Botany

- Communicate the results of studies in the academic field of Botany using main concepts, constructs and techniques.
- Apply one's knowledge and understanding of Botany to new/unfamiliar contexts and to identify problems and solutions in daily life.
- Apply one's knowledge and understanding of Botany to new/unfamiliar contexts and to identify problems and solutions in daily life.

### **3.4 Programme Specific Learning Outcomes for a Bachelor's Degree programme in Botany:**

The programme learning outcomes relating to B.Sc. degree programme in Botany:

- Stewardship responsibility.
- Hands on expertise in Botanical sciences and its applied branches.
- Entrepreneurship skill development.
- Focus on taking up research and teaching opportunities.
- Acquire skills related to specialization areas within Botany as well as within subfields of Botany and have hands on expertise in life sciences.
- Promote career and job opportunities in both Govt. and private sectors.
- Develop foundation for higher study in botany.
- Facilitate for taking up and shaping successful carrier in botany.
- Identify different species of plants and understand their characteristics along with uses.
- Develop the entrepreneurial skills in the field of applied botany.
- Understand how plants are classified and identified.
- Demonstrate knowledge of basic botanical principles.
- Use appropriate information with a critical understanding.
- Learn basic laboratory and analytical skills.
- Demonstrate competence in handling and statistical analysis of data gained from practical.
- Learn communication and IT skills, including the collation and statistical analysis of data, citing and referencing work appropriately, communicating using a range of formats.

#### **4. Aims of Bachelor's degree programme in Microbiology:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide ranging contexts which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

#### **4.1 Nature and extent of the B.Sc.(Microbiology) Programme:**

The undergraduate programme in Microbiology is the first level of college or university degree in the country as in several other parts of the world. After obtaining this degree, a microbiologist may enter into the job market or opt for undertaking further higher studies in the subject. After graduation the students may join industry, academia, public health and play their role as microbiologists in a useful manner contributing their role in the development of the welfare society. Thus the undergraduate level degree in microbiology must prepare the students for all these objectives. Thus the LOCF curriculum developed has a very wide range covering all aspects of Microbiology with reasonable depth of knowledge and skills so to as to diversify them in various specialties of the subject and play their role professionally as expected of them. It is also imperative that microbiologists are evaluated in a manner appropriate to assess their proper development as Microbiologists. The current LOCF in Microbiology has been designed in keeping all these important points in mind.

#### **4.2 Graduate Attributes in Microbiology:**

As mentioned earlier B.Sc. degree in Microbiology is the first college/university level degree in the country as in several parts of the world. The students graduating in this degree must have through understanding of basic knowledge or understanding of the fundamentals of Microbiology as applicable to wide ranging contexts. They should have the appropriate skills of Microbiology so as to perform their duties as microbiologists. They must be able to analyze the problems related to microbiology and come up with most suitable solutions. As microbiology is an interdisciplinary subject the students might have to take inputs from other area of expertise. So the students must develop the spirit of team work. Microbiology is a very dynamic subject

and practitioners might have to face several newer problems. To this end, the microbiologists must be trained to be innovative to solve such newer problems. Several newer developments are taking place in microbiology.

The students are trained to pick up leads and see the possibility of converting these into products through entrepreneurship. To this end, the students are made to interact with industry experts so that they may be able to see the possibility of their transition into entrepreneurs.

They are also made aware of the requirements of developing a Microbiology enterprise by having knowledge of patents, copyrights and various regulatory processes to make their efforts a success. Besides attaining the attributes related to the profession of Microbiology, the graduates in this discipline should also develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory work and ethics followed for scientific publishing of their research work in future. The students graduating in microbiology should also develop excellent communication skills both in the written as well as spoken language which are must for them to pursue higher studies from some of the best and internationally acclaimed universities and research institutions spread across the globe.

#### **4.3 Qualification Descriptors:**

The following may serve as the important qualification descriptors for a UG degree in Microbiology:

1. Knowledge of the diverse places where microbiology is involved.
2. Understanding of diverse Microbiological processes.
3. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc.
4. Moderately advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc.
5. Generation of new knowledge through small research projects
6. Ability to participate in team work through small microbiology projects.
7. Ability to present and articulate their knowledge of Microbiology.
8. Knowledge of recent developments in the area of Microbiology.
9. Analysis of data collected through study and small projects.
10. Ability to innovate so as to generate new knowledge.

11. Awareness how some microbiology leads may be developed into enterprise.
12. Awareness of requirements for fruition of a microbiology-related enterprise.

#### **4.4 Programme Learning Outcomes of B.Sc. Microbiology course:**

A candidate who is conferred an UG degree i.e. B.Sc. degree in microbiology needs to have acquired/developed following competencies during the programme of the study:

1. Acquired knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.
2. Demonstrate key practical skills/competencies in working with microbes for study and use in the laboratory as well as outside, including the use of good microbiological practices.
3. Competent enough to use microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/ studies etc.
4. Developed a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems.

#### **5. Eligibility for Admission:**

1. Higher Secondary School Certificate Examination (10+2) of the Maharashtra State Board or its equivalent examination of any other statutory Board/University with English and with any three Science subjects such as (i) Physics (ii) Chemistry (iii) Biology (iv) Mathematics (v) Geography (vi) Geology etc
2. Higher Secondary School Certificate Examination (10+2) with English and with any one of the following vocational subjects in technical group of +2 levels.
3. Diploma in Pharmacy, Diploma in Engineering (polytechnic) or its equivalent examination recognized by MBTE, Mumbai or its equivalent of any other statutory Board or University.



| <b>Subject code</b> | <b>Subject</b>  |
|---------------------|---|
| 79                  | Auto Electrical   |
| A1                  | Electrical Maintenance                                  |
| A2                  | Mechanical Maintenance                                  |
| A4                  | General Civil Engg.                                     |
| C2                  | Electronics   |
| C3                  | Chemical Plant Operation                                |
| C5                  | Elementary Laboratory Technology                        |
| D9                  | Computer Science  |
| J1/J2/J3            | Electronics Technology                                  |
| J4/J5/J6            | Maintenance & Repairs of Electrical Domestic Appliances |
| K1/K2/K3            | Auto Engg. Technician                                   |
| P1/P2/P3            | Medical Lab. Technician                                 |
| P4/P5/P6            | X-ray Technician  |
| P7/P8/P9            | Ophthalmic Technician                                   |
| T1/T2/T3            | Repair, Maintenance & Rewinding of Electrical Motors.   |

## 6. Admission process:

1. Admissions will be given as per the selection procedure/policies adopted by the college, in accordance with conditions laid down by Bharati Vidyapeeth University, Pune.
2. Reservation and relaxation will be as per the Government rules and Bharati Vidyapeeth University, Pune.

7. **Intake Capacity:** The intake capacity of the course will be 120 seats every year.

## 8. Course Structure and scheme of credits of B.Sc.Course:

### 8.1 F. Y. B. Sc. (Sem. I and II):

Core selective groups (Select any one group from the following)

Group I :- Physics, Chemistry, Mathematics and Statistics (PCMS)

Group II :- Physics, Mathematics, Statistics and Computer Application (PMSCA)

Group III :- Physics, Chemistry, Botany and Zoology (PCBZ)

Group IV :- Chemistry, Botany, Zoology and Microbiology (CBZM)

Group V: - Chemistry, Zoology, Microbiology and Geography (CZMG)

## Semester I

(From the Academic Year 2018-19)

| Subject Type       | Code   | Title of the paper  | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|--------|---|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |        |   |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |        | <b>Physics</b>  |           |         |          |                                   |                           |       |
|                    | P - 11 | Mechanics & Properties of Matter                            | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | P- 12  | Modern Physics  | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | P - 13 | Practical course – I  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Chemistry</b>  |           |         |          |                                   |                           |       |
|                    | C-11   | Physical and Inorganic Chemistry – I                        | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | C-12   | Organic and Inorganic Chemistry – I                         | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | C -13  | Practical course – I  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Botany</b>   |           |         |          |                                   |                           |       |
|                    | B –11  | Plant diversity and utilization of plants – I               | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | B –12  | Cell biology  | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | B- 13  | Practical course - I  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Zoology</b>  |           |         |          |                                   |                           |       |
|                    | Z – 11 | Animal systematic and Functional Anatomy of Non-chordates-I | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | Z –12  | Cell Biology and Genetics                                   | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | Z- 13  | Practical course - I  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Microbiology</b>   |           |         |          |                                   |                           |       |
|                    | MB- 11 | Introduction to Microbiology                                | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | MB- 12 | Structure of Prokaryotes and Eukaryotes                     | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | MB- 13 | Practical course - I  | 04        | 02      | 06       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Mathematics</b>  |           |         |          |                                   |                           |       |
|                    | M-11   | Algebra   | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | M-12   | Calculus  | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | M- 13  | Practical course - I  | 04        | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type       | Code  | Title of the paper                                    | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|-------|---|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |       |   |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |       | <b>Statistics</b>                                     |           |         |          |                                   |                           |       |
|                    | S-11  | Descriptive Statistics- I                             | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | S-12  | Discrete Probability and Probability Distributions –I | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | S- 13 | Practical course - I                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Geography</b>                                      |           |         |          |                                   |                           |       |
|                    | G -11 | Physical Geography - I                                | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | G -12 | Climatology - I                                       | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | G- 13 | Practical course - I                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Computer Application</b>                           |           |         |          |                                   |                           |       |
|                    | CA-11 | Computer Fundamentals                                 | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | CA-12 | Programming in C -I                                   | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | CA-13 | Practical course - I                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |

**B.Sc. Sem. II**  
**(From the Academic Year 2018-19)**

| Subject Type       | Code   | Title of the paper                    | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|--------|---------------------------------------|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |        |                                       |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |        | <b>Physics</b>                        |           |         |          |                                   |                           |       |
|                    | P - 21 | Kinetic Theory & Thermodynamics       | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | P -22  | Electricity & Magnetism               | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | P - 23 | Practical course - II                 | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Chemistry</b>                      |           |         |          |                                   |                           |       |
|                    | C-21   | Physical and Inorganic Chemistry – II | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | C-22   | Organic and Inorganic Chemistry - II  | 03        | 03      | 03       | 40                                | 60                        | 100   |
|                    | C- 23  | Practical Course-II                   | 04        | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type       | Code  | Title of the paper                                    | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|-------|---|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |       |   |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |       | <b>Botany</b>   |          |         |          |                                   |                           |       |
|                    | B-21  | Plant diversity and utilization of plants – II        | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | B-22  | Industrial Botany-I                                   | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | B-23  | Practical course – II                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Zoology</b>  |          |         |          |                                   |                           |       |
|                    | Z-21  | Functional Anatomy of Chordates-I                     | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | Z-22  | Applied zoology (Vermiculture and Sericulture)        | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | Z-23  | Practical course – II                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Microbiology</b>                                   |          |         |          |                                   |                           |       |
|                    | MB-21 | Microbial Nutrition, Growth and control               | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | MB-22 | The diversity of Microbial World                      | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | MB-23 | Practical course – II                                 | 04       | 02      | 06       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Mathematics</b>                                    |          |         |          |                                   |                           |       |
|                    | M-21  | Analytical Geometry                                   | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | M-22  | Integral Calculus and Differential Equations          | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | M-23  | Practical course – II                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Statistics</b>                                     |          |         |          |                                   |                           |       |
|                    | S-21  | Descriptive Statistics-II                             | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | S-22  | Discrete Probability and Probability Distributions-II | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | S-23  | Practical course – II                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Geography</b>                                      |          |         |          |                                   |                           |       |
|                    | G-21  | Physical Geography – II                               | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | G-22  | Oceanography  | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                    | G-23  | Practical course – II                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type                    | Code   | Title of the paper                     | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|---------------------------------|--|--|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                                 |  |  |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>              |  | <b>Computer Application</b>            |          |         |          |                                   |                           |       |
|                                 | CA-21  | Operating Environment                  | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                                 | CA-22  | Programming in C -II                   | 03       | 03      | 03       | 40                                | 60                        | 100   |
|                                 | CA-23  | Practical course – II                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Skill Enhancement Course</b> | <b>This course is compulsory for all the students.</b> |  |          |         |          |                                   |                           |       |
|                                 | UG-SEC-21  | Renovable Energy And Energy Harvesting | 02       | 02      | 02       | 20                                | 30                        | 50    |

## 8.2 S.Y. B. Sc. (Sem. III and IV) :

Core selective groups (Select any one group from the following)

Group I : Physics, Chemistry and Mathematics (PCM)

Group II : Physics, Mathematics and Statistics (PMS)

Group III : Physics, Mathematics and Computer Application (PMCA).

Group IV : Mathematics, Statistics and Computer Application (MSCA)

Group V : Chemistry, Botany and Zoology (CBZ)

Group VI : Chemistry, Botany and Microbiology (CBM)

Group VII : Chemistry, Zoology and Microbiology (CZM)

Group VIII : Botany, Zoology and Microbiology (BZM)

Group IX : Zoology, Microbiology and Geography (ZMG)

### **B.Sc. Sem. III**

**(From the Academic Year 2019-20)**

| Subject Type       | Code   | Title of the paper               | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|--------|----------------------------------|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |        |                                  |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |        | <b>Physics</b>                   |          |         |          |                                   |                           |       |
|                    | P - 31 | Mathematical Methods for Physics | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | P- 32  | Optics                           | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | P - 33 | Practical course - III           | 04       | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type       | Code  | Title of the paper                                      | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|-------|---|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |       |   |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |       | <b>Chemistry</b>  |          |         |          |                                   |                           |       |
|                    | C-31  | Physical and Analytical Chemistry – I                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | C-32  | Organic and Inorganic Chemistry - III                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | C-33  | Practical Course-III                                    | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Botany</b>   |          |         |          |                                   |                           |       |
|                    | B-31  | Plant anatomy and Embryology                            | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | B-32  | Angiosperm Taxonomy                                     | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | B-33  | Practical course - III                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Zoology</b>  |          |         |          |                                   |                           |       |
|                    | Z-31  | Functional Anatomy of Non-chordates-II and Biodiversity | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | Z-32  | Histology of Mammals                                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | Z-33  | Practical course - III                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Microbiology</b>                                     |          |         |          |                                   |                           |       |
|                    | MB-31 | Microbial Metabolism                                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | MB-32 | Bacterial Genetics                                      | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | MB-33 | Practical course - III                                  | 04       | 02      | 06       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Mathematics</b>                                      |          |         |          |                                   |                           |       |
|                    | M-31  | Calculus of Several Variables                           | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | M-32  | Group Theory and Differential Equations                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | M-33  | Practical course - III                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |       | <b>Statistics</b>                                       |          |         |          |                                   |                           |       |
|                    | S-31  | Probability Distributions And Statistical Inference-I   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | S-32  | Probability Distribution And Statistical Methods- I     | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                    | S-33  | Practical course – III                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type           | Code       | Title of the paper                                     | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|------------------------|------------|--|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                        |            |  |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>     |            | <b>Geography</b>                                       |           |         |          |                                   |                           |       |
|                        | G- 31      | Human Geography-I                                      | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | G- 32      | Biogeography - I                                       | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | G- 33      | Practical course - III                                 | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b>     |            | <b>Computer Application</b>                            |           |         |          |                                   |                           |       |
|                        | CA-31      | Advanced C Concepts - I                                | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | CA-32      | Digital Electronics I                                  | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | CA-33      | Practical course - III                                 | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> |            | <b>Any one of the following.</b>                       |           |         |          |                                   |                           |       |
|                        | ENG-31     | English –I   | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | MAR-32     | Marathi – I  | 04        | 04      | 03       | 40                                | 60                        | 100   |
| <b>SEC*</b>            |            | <b>This course is compulsory for all the students.</b> |           |         |          |                                   |                           |       |
|                        | UG- SEC-31 | Medical Dignostics                                     | 02        | 02      | 02       | 20                                | 30                        | 50    |

\*SEC: Skill Enhancement Course

**B.Sc. Sem. IV**  
(From the Academic Year 2019-20)

| Subject Type       | Code   | Title of the paper                     | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|--------|--|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |        |  |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |        | <b>Physics</b>                         |           |         |          |                                   |                           |       |
|                    | P - 41 | Waves & Oscillations                   | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | P - 42 | Electronics                            | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | P - 43 | Practical course – IV                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Chemistry</b>                       |           |         |          |                                   |                           |       |
|                    | C-41   | Physical and Analytical Chemistry – II | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | C-42   | Organic and Inorganic Chemistry - IV   | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | C- 43  | Practical Course-IV                    | 04        | 02      | 03       | 40                                | 60                        | 100   |

| Subject Type       | Code   | Title of the paper                                     | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--------------------|--------|--|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                    |        |  |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b> |        | <b>Botany</b>  |           |         |          |                                   |                           |       |
|                    | B –41  | Plant Biotechnology                                    | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | B –42  | Plant Physiology                                       | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | B -43  | Practical course - IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Zoology</b>   |           |         |          |                                   |                           |       |
|                    | Z –41  | Functional Anatomy of chordates-II                     | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | Z - 42 | Physiology of Mammals                                  | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | Z- 43  | Practical course - IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Microbiology</b>                                    |           |         |          |                                   |                           |       |
|                    | MB-41  | Principles of Disease, Epidemiology and Immunology     | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | MB 42  | Applied Microbiology                                   | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | MB-43  | Practical course - IV                                  | 04        | 02      | 06       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Mathematics</b>                                     |           |         |          |                                   |                           |       |
|                    | M-41   | Vector Calculus  | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | M-42   | Complex variables                                      | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | M–43   | Practical course - IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Statistics</b>                                      |           |         |          |                                   |                           |       |
|                    | S-41   | Probability Distributions And Statistical Inference-II | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | S-42   | Probability Distribution And Statistical Methods-II    | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | S-43   | Practical course - IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Geography</b>                                       |           |         |          |                                   |                           |       |
|                    | G- 41  | Human Geography-II                                     | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | G– 42  | Biogeography - II                                      | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | G- 43  | Practical course - IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b> |        | <b>Computer Application</b>                            |           |         |          |                                   |                           |       |
|                    | CA-41  | Advanced C Concepts –II                                | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | CA-42  | Digital Electronics II                                 | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                    | CA-43  | Practical course – IV                                  | 04        | 02      | 03       | 40                                | 60                        | 100   |



| Subject Type                                 | Code                             | Title of the paper    | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--|----------------------------------|-----------------------|----------|---------|----------|-----------------------------------|---------------------------|-------|
|  |                                  |                       |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Elective Course</b>                       | <b>Any one of the following.</b> |                       |          |         |          |                                   |                           |       |
|  | ENG-41                           | English –II           | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | MAR-42                           | Marathi - II          | 04       | 04      | 03       | 40                                | 60                        | 100   |
| <b>Ability Enhancement Compulsory Course</b> |                                  |                       |          |         |          |                                   |                           |       |
|  | UG-AECC-41                       | Environmental Science | 02       | 02      | 02       | 20                                | 30                        | 50    |

### 8.3 T. Y. B. Sc. (Sem. V and VI):

The student should select any one subject from the core group which he / she has opted at S.Y.B.Sc. (Semester III and IV) as Principle subject.

#### **B.Sc. Sem. V** (From the Academic Year 2020-21)

| Subject Type           | Code                             | Title of the paper              | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|------------------------|----------------------------------|---------------------------------|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                        |                                  |                                 |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>     |                                  | <b>Physics</b>                  |          |         |          |                                   |                           |       |
|                        | P-51                             | Mathematical Methods in Physics | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-52                             | Quantum Mechanics               | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-53                             | Solid State Physics             | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-54                             | Advanced Electronics            | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-55                             | Classical Mechanics             | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-56                             | Practical Course – V            | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | P-57                             | Practical Course – VI           | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | P-58                             | Practical Course - VII          | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |                                 |          |         |          |                                   |                           |       |
|                        | P-59A                            | Elements of Materials Science   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-59B                            | Medical Electronics             | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | P-59C                            | Digital Electronics I           | 04       | 04      | 03       | 40                                | 60                        | 100   |

| Subject Type           | Code   | Title of the paper                         | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|------------------------|--------|--|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                        |        |  |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>     |        | <b>Chemistry</b>                           |          |         |          |                                   |                           |       |
|                        | C-51   | Physical Chemistry –I                      | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-52   | Inorganic Chemistry – I                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-53   | Organic Chemistry – I                      | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-54   | Analytical Chemistry – I                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-55   | Industrial Chemistry - I                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-56   | Practical Course – V                       | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | C-57   | Practical Course – VI                      | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | C-58   | Practical Course - VII                     | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> |        | <b>Any one of the following.</b>           |          |         |          |                                   |                           |       |
|                        | C-59A  | Environment Chemistry-I                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-59B  | Nuclear Chemistry-I                        | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | C-59C  | Polymer Chemistry-I                        | 04       | 04      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b>     |        | <b>Botany</b>                              |          |         |          |                                   |                           |       |
|                        | B –51  | Biology of lower cryptogams(Algae & Fungi) | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B –52  | Biology of seed plants (Angiosperms)       | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B –53  | Plant pathology and Plant protection       | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B –54  | Genetics and Biostatistics                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B –55  | Molecular biology and Biochemistry         | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B-56   | Practical Course – V                       | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | B -57  | Practical Course – VI                      | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | B - 58 | Practical Course - VII                     | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> |        | <b>Any one of the following.</b>           |          |         |          |                                   |                           |       |
|                        | B-59A  | Aerobiology                                | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B-59B  | Medico Botany                              | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | B-59C  | Conservation of Medicinal Plants           | 04       | 04      | 03       | 40                                | 60                        | 100   |

| Subject Type           | Code                             | Title of the paper                                     | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|------------------------|----------------------------------|--|----------|---------|----------|-----------------------------------|---------------------------|-------|
|                        |                                  |  |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>     |                                  | <b>Zoology</b>   |          |         |          |                                   |                           |       |
|                        | Z- 51                            | Developmental Biology                                  | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z -52                            | Genetics and evolution                                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z -53                            | Applied Zoology- Apiculture and Inland fisheries       | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z -54                            | Parasitology   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z -55                            | Ecology and environmental pollution                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z-56                             | Practical Course – V                                   | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | Z -57                            | Practical Course – VI                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | Z - 58                           | Practical Course - VII                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                           |       |
|                        | Z-59A                            | Biochemistry and Molecular Biology                     | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z-59B                            | Comparative anatomy of Chordates and Micro- techniques | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | Z -59C                           |  | 04       | 04      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b>     |                                  | <b>Microbiology</b>                                    |          |         |          |                                   |                           |       |
|                        | MB-51                            | Medical Microbiology                                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-52                            | Clinical Pathology                                     | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-53                            | Virology   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-54                            | Genetics of Prokaryotes                                | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-55                            | Enzyme Kinetics and Regulation                         | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB -6                            | Practical Course – V                                   | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | MB-57                            | Practical Course – VI                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
|                        | MB-58                            | Practical Course - VII                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                           |       |
|                        | MB-59A                           | Food and diary Microbiology                            | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-59B                           | Applied Microbiology-I                                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
|                        | MB-59C                           | Advance Techniques in Microbiology-I                   | 04       | 04      | 03       | 40                                | 60                        | 100   |

| Subject Type           | Code                   | Title of the paper                                | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|------------------------|------------------------|---|-----------|---------|----------|-----------------------------------|---------------------------|-------|
|                        |                        |   |           |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>     |                        | <b>Mathematics</b>                                |           |         |          |                                   |                           |       |
|                        | M-51                   | Real Analysis- I                                  | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M-52                   | Abstract Algebra – I                              | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M-53                   | Discrete Mathematics – I                          | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M-54                   | Differential Geometry-I                           | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M-55                   | Computer Programming and Applications –I          | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M -56                  | Practical Course – V                              | 04        | 02      | 03       | 40                                | 60                        | 100   |
|                        | M-57                   | Practical Course – VI                             | 04        | 02      | 03       | 40                                | 60                        | 100   |
| M- 58                  | Practical Course - VII | 04  | 02        | 03      | 40       | 60                                | 100                       |       |
| <b>Elective Course</b> |                        | <b>Any one of the following.</b>                  |           |         |          |                                   |                           |       |
|                        | M– 59A                 | Mechanics(statics)                                | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M – 59B                | Operation Research-I                              | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | M – 59C                | Special Functions-I                               | 04        | 04      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b>     |                        | <b>Statistics</b>                                 |           |         |          |                                   |                           |       |
|                        | S-51                   | Distribution Theory - I                           | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S-52                   | Statistical Inference - I                         | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S-53                   | Sampling Methods and Design of Experiments- I     | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S-54                   | Applied Statistics(A)-I                           | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S-55                   | Applied Statistics(B)-I                           | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S- 56                  | Practical Course – V                              | 04        | 02      | 03       | 40                                | 60                        | 100   |
|                        | S-57                   | Practical Course – VI                             | 04        | 02      | 03       | 40                                | 60                        | 100   |
| S- 58                  | Practical Course - VII | 04  | 02        | 03      | 40       | 60                                | 100                       |       |
| <b>Elective Course</b> |                        | <b>Any one of the following.</b>                  |           |         |          |                                   |                           |       |
|                        | S – 59A                | Computer Programming. ‘C’ Programming (Turbo C)-I | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S – 59B                | Principles of Computer Science-I                  | 04        | 04      | 03       | 40                                | 60                        | 100   |
|                        | S – 59C                | Statistical Ecology                               | 04        | 04      | 03       | 40                                | 60                        | 100   |

| Subject Type                                 | Code        | Title of the paper                                     | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                           |       |
|--|-------------|--|----------|---------|----------|-----------------------------------|---------------------------|-------|
|  |             |  |          |         |          | Continuous Internal Assessment IA | University Examination UE | Total |
| <b>Core Course</b>                           |             | <b>Geography</b>                                       |          |         |          |                                   |                           |       |
|  | G -51       | World Regional Geography-I                             | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-52        | Geography of India-I                                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-53        | Resources and environment-I                            | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-54        | Economic Geography-I                                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-55        | Applied Geography-I                                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-56        | Practical Course – V                                   | 04       | 02      | 03       | 40                                | 60                        | 100   |
|  | G-57        | Practical Course – VI                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
|  | G- 58       | Practical Course - VII                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b>                       |             | <b>Any one of the following.</b>                       |          |         |          |                                   |                           |       |
|  | G-59A       | Geography of Water Resources-I                         | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-59B       | Geography of Soils-I                                   | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | G-59C       | Population Geography-I                                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
| <b>Core Course</b>                           |             | <b>Computer Application</b>                            |          |         |          |                                   |                           |       |
|  | CA-51       | Operating System-I                                     | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-52       | Visual basic. Net programming-I                        | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-53       | Software Engineering -I                                | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-54       | Database Management System-I                           | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-55       | Data and File structure-I                              | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-56       | Practical Course – V                                   | 04       | 02      | 03       | 40                                | 60                        | 100   |
|  | CA-57       | Practical Course – VI                                  | 04       | 02      | 03       | 40                                | 60                        | 100   |
|  | CA-58       | Practical Course - VII                                 | 04       | 02      | 03       | 40                                | 60                        | 100   |
| <b>Elective Course</b>                       |             | <b>Any one of the following.</b>                       |          |         |          |                                   |                           |       |
|  | CA-59A      | Computer Networks-I                                    | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-59B      | Internet Programming-I                                 | 04       | 04      | 03       | 40                                | 60                        | 100   |
|  | CA-59C      | Theoretical computer science-I                         | 04       | 04      | 03       | 40                                | 60                        | 100   |
| <b>Ability Enhancement Compulsory Course</b> |             | <b>This course is compulsory for all the students.</b> |          |         |          |                                   |                           |       |
|  | UG-AEC C-51 | Soft skills  | 02       | 02      | 02       | 20                                | 30                        | 50    |

**B.Sc. Sem. V**  
**(From the Academic Year 2020-21)**

| Subject Type           | Code  | Title of the paper                   | Hrs/ Week | Credits | Exam Hrs | Maximum Marks                     |                            |       |
|------------------------|-------|--------------------------------------|-----------|---------|----------|-----------------------------------|----------------------------|-------|
|                        |       |                                      |           |         |          | Continuous Internal Assessment IA | University Examination UEX | Total |
| <b>Core Course</b>     |       | <b>Physics</b>                       |           |         |          |                                   |                            |       |
|                        | P-61  | Classical Electrodynamics            | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-62  | Atomic and Molecular Physics         | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-63  | Nuclear Physics                      | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-64  | Computational Physics                | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-65  | Thermodynamics & Statistical Physics | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-66  | Practical Course – VIII              | 04        | 02      | 03       | 40                                | 60                         | 100   |
|                        | P-67  | Practical Course – IX                | 04        | 02      | 03       | 40                                | 60                         | 100   |
|                        | P-68  | Practical Course - X                 | 04        | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> |       | <b>Any one of the following.</b>     |           |         |          |                                   |                            |       |
|                        | P-69A | Renewable Energy sources             | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-69B | Physics of Nano Materials            | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | P-69C | Digital Electronics II               | 04        | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     |       | <b>Chemistry</b>                     |           |         |          |                                   |                            |       |
|                        | C-61  | Physical Chemistry-II                | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-62  | Inorganic Chemistry-II               | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-63  | Organic Chemistry-II                 | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-64  | Analytical Chemistry-II              | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-65  | Industrial Chemistry-II              | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-66  | Practical Course – VIII              | 04        | 02      | 03       | 40                                | 60                         | 100   |
|                        | C-67  | Practical Course – IX                | 04        | 02      | 03       | 40                                | 60                         | 100   |
|                        | C-68  | Practical Course - X                 | 04        | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> |       | <b>Any one of the following.</b>     |           |         |          |                                   |                            |       |
|                        | C-69A | Environment Chemistry-II             | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-69B | Nuclear Chemistry-II                 | 04        | 04      | 03       | 40                                | 60                         | 100   |
|                        | C-69C | Polymer Chemistry-II                 | 04        | 04      | 03       | 40                                | 60                         | 100   |

| Subject Type           | Code                             | Title of the paper   | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                            |       |
|------------------------|----------------------------------|--|----------|---------|----------|-----------------------------------|----------------------------|-------|
|                        |                                  |  |          |         |          | Continuous Internal Assessment IA | University Examination UEX | Total |
| <b>Core Course</b>     |                                  | <b>Botany</b>  |          |         |          |                                   |                            |       |
|                        | B –61                            | Biology of higher cryptogams (Bryophytes & Pteridophytes ) | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B –62                            | Biology of seed plants (Gymnosperms & Paleobotany)         | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B –63                            | Environmental Botany                                       | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B –64                            | Palynology & Plant breeding                                | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B –65                            | Industrial botany II                                       | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B-66                             | Practical Course – VIII                                    | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | B -67                            | Practical Course – IX                                      | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | B- 68                            | Practical Course - X                                       | 04       | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                            |       |
|                        | B-69A                            | Horticulture & Gardening                                   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B-69B                            | Pharmacognosy  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | B-69C                            | Seed Technology  | 04       | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     |                                  | <b>Zoology</b>   |          |         |          |                                   |                            |       |
|                        | Z – 61                           | General Embryology   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z – 62                           | Toxicology   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z – 63                           | Biological Techniques                                      | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z – 64                           | Functional Anatomy of Chordates-III                        | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z – 65                           | Economic Entomology  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z-66                             | Practical Course – VIII                                    | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | Z -67                            | Practical Course – IX                                      | 04       | 02      | 03       | 40                                | 60                         | 100   |
| Z - 68                 | Practical Course - X             | 04   | 02       | 03      | 40       | 60                                | 100                        |       |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                            |       |
|                        | Z-69A                            | Biotechnology  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z-69B                            | Biostatistics  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | Z-69C                            | Biodiversity and wild Life                                 | 04       | 04      | 03       | 40                                | 60                         | 100   |

| Subject Type           | Code   | Title of the paper                             | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                            |       |
|------------------------|--------|--|----------|---------|----------|-----------------------------------|----------------------------|-------|
|                        |        |  |          |         |          | Continuous Internal Assessment IA | University Examination UEX | Total |
| <b>Core Course</b>     |        | <b>Microbiology</b>                            |          |         |          |                                   |                            |       |
|                        | MB-61  | Chemotherapy and Biomedical Instrumentation.   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB 62  | Immunology                                     | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB 63  | Biotechnology                                  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB 64  | Genetics of Eukaryotes and Gene Manipulation   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB 65  | Microbial Metabolism and Biochemical Evolution | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB-66  | Practical Course – VIII                        | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | MB-67  | Practical Course – IX                          | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | MB-68  | Practical Course - X                           | 04       | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> |        | <b>Any one of the following.</b>               |          |         |          |                                   |                            |       |
|                        | MB-69A | Agricultural and Environmental Microbiology.   | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB-69B | Applied Microbiology-II                        | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | MB-69C | Advanced Techniques in Microbiology-II         | 04       | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     |        | <b>Mathematics</b>                             |          |         |          |                                   |                            |       |
|                        | M-61   | Real Analysis- II                              | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-62   | Abstract Algebra – II                          | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-63   | Discrete Mathematics –II                       | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-64   | Differential Geometry-II                       | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-65   | Computer Programming and Applications –II      | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-66   | Practical Course – VIII                        | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | M-67   | Practical Course – IX                          | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | M- 68  | Practical Course - X                           | 04       | 02      | 03       | 40                                | 60                         | 100   |



| Subject Type           | Code                             | Title of the paper                                 | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                            |       |
|------------------------|----------------------------------|--|----------|---------|----------|-----------------------------------|----------------------------|-------|
|                        |                                  |  |          |         |          | Continuous Internal Assessment IA | University Examination UEX | Total |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                            |       |
|                        | M-69A                            | Operation Research-II                              | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-69B                            | Mechanics(Dynamics)                                | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | M-69C                            | Special Functions-II                               | 04       | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     | <b>Statistics</b>                |  |          |         |          |                                   |                            |       |
|                        | S-61                             | Distribution Theory - II                           | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-62                             | Statistical Inference - II                         | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-63                             | Sampling Methods and Design of Experiments-II      | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-64                             | Applied Statistics(A)-II                           | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-65                             | Applied Statistics(B)-II                           | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-66                             | Practical Course – VIII                            | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | S-67                             | Practical Course – IX                              | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | S-68                             | Practical Course - X                               | 04       | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |  |          |         |          |                                   |                            |       |
|                        | S-69A                            | Computer Programming. 'C' Programming (Turbo C)-II | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-69B                            | Principles of Computer Science-II                  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | S-69C                            | Medical Statistics                                 | 04       | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     | <b>Geography</b>                 |  |          |         |          |                                   |                            |       |
|                        | G-61                             | World Regional Geography-II                        | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G-62                             | Geography of India-II                              | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G-63                             | Recourses and Environment-II                       | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G-64                             | Economic Geography-II                              | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G-65                             | Applied Geography-II                               | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G-66                             | Practical Course – VIII                            | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | G-67                             | Practical Course – IX                              | 04       | 02      | 03       | 40                                | 60                         | 100   |
| G-68                   | Practical Course - X             | 04   | 02       | 03      | 40       | 60                                | 100                        |       |

| Subject Type           | Code                             | Title of the paper               | Hrs/Week | Credits | Exam Hrs | Maximum Marks                     |                            |       |
|------------------------|----------------------------------|----------------------------------|----------|---------|----------|-----------------------------------|----------------------------|-------|
|                        |                                  |                                  |          |         |          | Continuous Internal Assessment IA | University Examination UEX | Total |
| <b>Elective Course</b> | <b>Any one of the following.</b> |                                  |          |         |          |                                   |                            |       |
|                        | G - 69A                          | Geography of Water Resources-II  | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G- 69B                           | Geography of Soils-II            | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | G- 69C                           | Population Geography-II          | 04       | 04      | 03       | 40                                | 60                         | 100   |
| <b>Core Course</b>     | <b>Computer Application</b>      |                                  |          |         |          |                                   |                            |       |
|                        | CA-61                            | Operating System-II              | 03       | 03      | 03       | 40                                | 60                         | 100   |
|                        | CA-62                            | Visual basic. Net programming-II | 03       | 03      | 03       | 40                                | 60                         | 100   |
|                        | CA-63                            | Software Engineering-II          | 03       | 03      | 03       | 40                                | 60                         | 100   |
|                        | CA-64                            | Database Management System-II    | 03       | 03      | 03       | 40                                | 60                         | 100   |
|                        | CA-65                            | Data and File structure-II       | 03       | 03      | 03       | 40                                | 60                         | 100   |
|                        | CA 66                            | Practical Course-VIII            | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | CA-67                            | Practical Course-IX              | 04       | 02      | 03       | 40                                | 60                         | 100   |
|                        | CA-68                            | Practical Course-X               | 04       | 02      | 03       | 40                                | 60                         | 100   |
| <b>Elective Course</b> | <b>Any one of the following.</b> |                                  |          |         |          |                                   |                            |       |
|                        | CA- 69A                          | Computer Networks-II             | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | CA- 69B                          | Internet Programming-II          | 04       | 04      | 03       | 40                                | 60                         | 100   |
|                        | CA- 69C                          | Theoretical computer science-II  | 04       | 04      | 03       | 40                                | 60                         | 100   |

### 9. Scheme of Teaching:

| Class     | Subjects  | Work Load / Week |          |       |           |
|-----------|-----------|------------------|----------|-------|-----------|
|           |           | Theory           | Tutorial | Total | Practical |
| F.Y.B.Sc. | <b>13</b> | 2                | 1        | 03    | 04        |
| S.Y.B.Sc. | <b>11</b> | 3                | 1        | 04    | 04        |
| T.Y.B.Sc  | <b>10</b> | 3                | 1        | 04    | 04        |

## 10. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

## 11. UNIVERSITY TERMS:

The dates for the commencement and conclusion of the First and the Second terms shall be fixed by the University authorities. The terms can be kept by students, who have registered their names with the University.

## 12. SCHEME OF EXAMINATION:

The Assessment of Regular students of Bachelor of Science (B.Sc.) course in the academic session 2016-17 and thereafter shall be based on

- (a) University Examinations (UE),
- (b) Continuous Internal Assessment (IA),
- (c) Choice Based Credit System (CBCS), and
- (d) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average system (CGPA)

For each core and elective paper of 100 marks, there will be Continuous Internal Assessment of 40 marks and the University Examination of 60 marks/3 hours duration at the end of each semester. The 04 credit will be given to a student who secures at least 40% of marks allotted to each paper. A candidate who does not pass the examination in any subject or subjects in one semester will be permitted to reappear in such failed subject or subjects along with the papers of following semesters.

The Continuous Internal Assessment (IA) for each paper will be of 40 marks. The Continuous Internal Assessment may be in the forms as follows:

|   |          |
|---|----------|
| a) Attendance                                 | 10 Marks |
| b) Home Assignment/Tutorial/Test/Presentation | 15 Marks |
| c) Mid Semester Examination                   | 15 Marks |

## 13. STANDARD OF PASSING:

For all courses, both UE and IA constitute separate heads of passing. In order to pass in such courses and to earn the assigned credits, a student must obtain a minimum grade point of 5.0 (40% marks) at UE and also a minimum grade point of 5.0 (40% marks) at IA.

Even a student fails in IA, he/she shall be declared 'pass' in the course provided he/she obtains a minimum of 25% in IA and GPA for the course is at least 6.0 (50% in aggregate). The GPA for a course will be calculated only if the student passes at the UE.

A student who fails at UE in a course has to reappear only at UE as a backlog candidate and clear the head of passing. Similarly, a student who fails in a course at IA has to reappear only at IA as a backlog candidate and clear the head of passing.

The 10-point scale Grades and Grade Points according to the following table.

| Range of Marks (Out of 100)     | Grade | Grade Point |
|---------------------------------|-------|-------------|
| $80 \leq \text{Marks} \leq 100$ | O     | 10          |
| $70 \leq \text{Marks} < 80$     | A+    | 9           |
| $60 \leq \text{Marks} < 70$     | A     | 8           |
| $55 \leq \text{Marks} < 60$     | B+    | 7           |
| $50 \leq \text{Marks} < 55$     | B     | 6           |
| $40 \leq \text{Marks} < 50$     | C     | 5           |
| Marks < 40                      | D     | 0           |

The performances at UE and IA will be combined to obtain the Grade Point Average (GPA) for the course. The weighteg for performance at UE and IA shall be 60% and 40% respectively.

GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to grade point, which will be the GPA

#### 14. FORMULA TO CALCULATE GRADE POINTS (GP):

Suppose that 'Max' is the maximum marks assigned for an examination or evaluation based on which GP will be computed. In order to determine the GP, Set  $x = \text{Max} / 10$  (since we have adapted 10-point system). Then GP is calculated by the formulas shown as below.

| Range of Marks at the evaluation | Formula for the Grade Point |
|----------------------------------|-----------------------------|
| $8x \leq \text{Marks} \leq 10x$  | 10                          |
| $5.5x \leq \text{Marks} < 8x$    | Truncate (Marks/x) +2       |
| $4x \leq \text{Marks} < 5.5x$    | Truncate (Marks/x) +1       |

Two kinds of performance indicators, namely, the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA) shall be computed at the end of each term. The SGPA measures the cumulative performance of a student in all the courses in a particular semester, while the CGPA measures the cumulative performance in all courses since his/her enrolment to the course. The CGPA of learner when he/she completes the programme is the final result of the learner.

The SGPA is calculated by the formula  $\text{SGPA} = \frac{\sum C_k \times GP_k}{\sum C_k}$ , where  $C_k$  is the credit-value assigned to a course and  $GP_k$  is the GPA obtained by the student in the course. In the above, the sum is taken over all the courses that the student has undertaken for the study during the semester, including those in which he/she might have failed or those for which he/ she remained absent. The SGPA shall be calculated up to two decimal place accuracy.

The CGPA is calculated by the formula  $CGPA = \frac{\sum C_k \times GP_k}{\sum C_k}$ , where  $C_k$  is the credit-value assigned to a course and  $GP_k$  is the GPA obtained by the student in the course. In the above, the sum is taken over all the courses that the student has undertaken for the study from the time of his/her enrolment to the course and also during the semester for which CGPA is calculated, including those in which he/she might have failed or those for which he/she remained absent. The CGPA shall be calculated up to two decimals place accuracy.

**The Formula to compute equivalent percentage marks for specified CGPA:**

|                  |                        |                                |
|------------------|------------------------|--------------------------------|
| % Marks (CGPA) = | $10 \times CGPA - 10$  | if $5.00 \leq CGPA \leq 6.00$  |
|                  | $5 \times CGPA + 20$   | if $6.00 \leq CGPA \leq 8.00$  |
|                  | $10 \times CGPA - 20$  | if $8.00 \leq CGPA \leq 9.00$  |
|                  | $20 \times CGPA - 110$ | if $9.00 \leq CGPA \leq 9.50$  |
|                  | $40 \times CGPA - 300$ | if $9.50 \leq CGPA \leq 10.00$ |

**15. AWARD OF HONOURS:**

A student who has completed the minimum credits specified for the programme shall be declared to have passed in the programme. The final result will be in terms of letter grade only and is based on the CGPA of all courses studied and passed. The criteria for the award of honours are given below.

| Range of CGPA               | Equivalent Range of Marks (%)   | Final Grade | Performance Descriptor | Final Class                  |
|-----------------------------|---------------------------------|-------------|------------------------|------------------------------|
| $9.50 \leq CGPA \leq 10.00$ | $80 \leq \text{Marks} \leq 100$ | O           | Outstanding            | First Class with Distinction |
| $9.00 \leq CGPA \leq 9.49$  | $70 \leq \text{Marks} < 80$     | A+          | Excellent              |                              |
| $8.00 \leq CGPA \leq 8.99$  | $60 \leq \text{Marks} < 70$     | A           | Very Good              | First Class                  |
| $7.00 \leq CGPA \leq 7.99$  | $55 \leq \text{Marks} < 60$     | B+          | Good                   | Higher Second Class          |
| $6.00 \leq CGPA \leq 6.99$  | $50 \leq \text{Marks} < 55$     | B           | Average                | Second Class                 |
| $5.00 \leq CGPA \leq 5.99$  | $40 \leq \text{Marks} < 50$     | C           | Satisfactory           | Pass Class                   |
| CGPA Below 5.00             | Marks Below 40                  | F           | Fail                   | Fail                         |

A candidate shall be permitted to precede further from the First Semester up to Fourth Semester irrespective of his/her failure in any of the Semester examinations subject to the condition that the candidates should register for all the backlog subjects of earlier semesters along with current (subsequent) semester subjects. However, he/she should have cleared all the papers at F.Y.B.Sc. Semester I & II when he/she is admitted to T.Y.B.Sc. Semester V.

**16. GRACING:**

The gracing shall be done as per existing rules of the University.

**17. VERIFICATION AND REVALUATION:**

There is provision for verification and revaluation of the result. A student can apply for the verification and revaluation of the result within two weeks from the declaration of the results with the prescribed fee. The verification and revaluation shall be done as per the existing rules of the University.

### 18. FORMAT OF THE TRANSCRIPT:

The student will be given a transcript indicating his/her performance at the end of every semester examination. The transcript shall be given as per the following table along with other necessary details:

| Course No.  | Course Name | No. of Credits | University Examination |             | Internal Assessment |             | Grade Point Average  | Result |
|---|-------------|----------------|------------------------|-------------|---------------------|-------------|----------------------|--------|
|   |             |                | Grade                  | Grade Point | Grade               | Grade Point |                      |        |
| 1   |             |                |                        |             |                     |             |                      |        |
| 2   |             |                |                        |             |                     |             |                      |        |
| 3   |             |                |                        |             |                     |             |                      |        |
| 4   |             |                |                        |             |                     |             |                      |        |
| 5   |             |                |                        |             |                     |             |                      |        |
| 6   |             |                |                        |             |                     |             |                      |        |
| Total Cumulative Credits Completed  |             |                | SGPA                   |             | CGPA                |             | Equivalent Marks (%) |        |
|   |             |                |                        |             |                     |             |                      |        |
| <u>Note:</u> GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to Grade Point, which will be the GPA. |             |                |                        |             |                     |             |                      |        |

### 19. GRADE/CLASS IMPROVEMENT SCHEME (GIS/CIS):

The rules regarding the improvement of the Grade/Class of B.Sc. course will be as per notification of Bharati Vidyapeeth University which is as follows:

1. The candidate who has passed UG and PG degree examinations of this university with the final grade/class as shown in column no. 1 and who desires to improve the grade/class as shown in column no. 2 below will be permitted at his/her option to appear for the same examination without being required to keep any terms.

| Column no. 1   | Column no. 2  |
|--|---|
| Final grade: 'C' or 'B' or 'B+' or 'A' or 'A+' as the case may be  | 'B' or 'B+' or 'A' or 'A+' or 'O' as the case may be  |
| OR   | OR  |
| Final class: 'Pass Class' or 'Second Class' or 'Higher Second Class' or 'First Class' as the case may be | 'Second Class' or 'Higher Second Class' or 'First Class' or 'First Class with Distinction' as the case may be |

2. For improvement of final grade/class, the candidate will be required to apply and allowed to appear only for the theory examinations.
3. A candidate shall have to reappear for minimum 1/3 and/or maximum of all the theory papers at a time, on which the final grade/class is awarded. Candidate should ensure that the examination time table for the subject he is appearing will not clash.

4. Performance of the candidates reappearing for the subject less than 1/3 of the total theory examinations mentioned above will not be considered. However, his/her appearance will be counted as an attempt.
5. If the candidate, who has reappeared for the final year examination under the provisions for his/her final grade/class, is successful in improving his/her final grade/class by such reappearance, he/she will have to surrender to the university the original degree and the grade sheet that he/she had obtained in that course/subject. Unless original degree and the grade sheet are returned to the university by the candidate, the new degree certificate and the grade sheet cannot be issued to the candidate. In the revised degree certificate/ grade sheet to be given to the candidate a mention will be made of the fact that he/she improved his/her grade/class under class improvement attempt.
6. A candidate appearing for the improvement of the final grade/class shall not be entitled to get benefit of any other rules/orders of the university regarding condonation /grace marks.
7. A candidate appearing for the improvement of the final grade/class shall not be entitled to get any prize/medal/scholarship/award etc.
8. A candidate who has reappeared for the above examination/s under the provision fails to improve his/her final grade/class; his/her performance at such reappearance at such reappearance shall be ignored.
9. If the candidate makes no improvement in the final grade/class, then earlier performance will be retained.
10. A candidate will be allowed to reappear for the examination for improvement of the final grade/class within a period of three years from the date of his/her passing the degree examination.
11. The candidate will be given maximum of three attempts for the improvement of his/her final grade/class.
12. The candidate who desires to apply for improvement of the final grade/class should submit his/her application form for improvement of the final grade/class from the College/School of Distance Education, Study Centre through which he/she has undergone the course. Form should be submitted for improvement before **31<sup>st</sup> August** for the October/November examination and **28<sup>th</sup> February** for April/May examination sessions. No form for improvement of the final grade/class shall be accepted after the prescribe dates for the respective/corresponding examination sessions.
13. Revised grade/class sheet will be issued with remark Under '**Grade/Class Improvement Scheme**' (GIS/CIS).

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