



डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा

विभाग शैक्षिक विभाग

संचिका संख्या

सहायक कुलसचिव/कुलसचिव/कुलपति,

कृपया स्कूल ऑफ लाइफ साइंस संस्थान, खन्दारी आगरा में Department of Forestry की एकेडेमिक कमेटी की बैठक दिनांक 22.05.2022 की पाठ्यक्रम सम्बन्धी संस्तुतियों को विद्या परिषद् एवं कार्य परिषद् में अनुमोदन हेतु प्रस्तुत किया गया है।

यदि आप सहमत हो तो उक्त ^{संस्तुत} पाठ्यक्रम सम्बन्धी संस्तुतियों को विद्या परिषद् के समक्ष प्रस्तुत करने की अनुमति प्रदान करना चाहें।

AR
31/5

M. Singh
30.5.22

AK.
30.5.22

Munesh
30/05/2022

प्रभारी(शैक्षिक)

For Academic Council
for approval & Dismissal

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31/5/22

ARC(Acad)
AR
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Regishee

(1)

DR. BHIMRAO AMBEDKAR UNIVERSITY
DEPARTMENT OF FORESTRY
School Of Life Sciences, Khandari Campus, Agra.

Dated: 24 May, 2022

To

The Assistant Registrar (Academic)
Dr. Bhimrao Ambedkar University,
Agra.

Sir,

Please find enclosed herewith the minutes of the meeting of Academic Committee of the Department of Forestry held on May 22, 2022. It is requested that it may please be placed before the Academic Council / Executive Council for approval at the earliest.

Thanking you

Yours faithfully,


B.S. Sharma
Dean

Encls. :

1. Minutes of the Academic Committee
2. Ordinances of the B.Sc. (in Faculty of Life Science) Appendix- 1
3. Syllabus for B.Sc. (In Faculty of Life Science) Subject Forestry, Appendix- 2
3. Syllabus for Minor Subject, Appendix -3
4. Syllabus for Co- curricular Courses of B.Sc. (In Faculty of Life Science) Appendix -4
5. Syllabus for Vocational Courses of B.Sc. (In Faculty of Life Science) Appendix -5
6. List of vocational courses Appendix -6

(2)

**DEPARTMENT OF FORESTRY
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA**

ATTENDANCE SHEET

Date: 22nd May 2022

Time: 03:00 PM

Meeting: Academic Committee of Department of Forestry

Members of the Committee:

1. Prof. Rajendra Sharma (Retd)
Dr. Bhimrao Ambedkar University, Agra
2. Dr. Monika Jain
Dept. of Natural Resource Management
Banda university of Agriculture and Technology, Banda
3. Dr. Rohan D'Souza
Department of Botany, St. John's College, Agra
4. Dr. Rajneesh Kumar Agnihotri, Department of Botany
Dr. Bhimrao Ambedkar University, Agra
5. Prof. Bhupendra Swarup Sharma, Dean Life Sciences,
Dr. Bhimrao Ambedkar University, Agra

Rajendra
22/5

Monika
22/5/22

Rohan
22/5/22

Bhupendra
22/5/22

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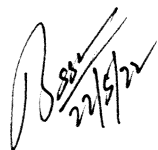
**DEPARTMENT OF FORESTRY
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA**

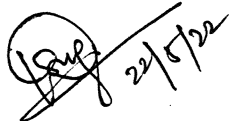
MINUTES

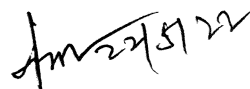
The minutes of the meeting of the Academic Committee of Department of Forestry held in the Department of Forestry of the Dr. Bhimrao Ambedkar University, Agra on 22nd May 2022 at 03:00 PM. The following members were present:

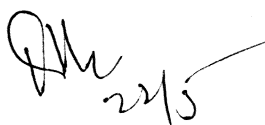
1. Prof. Rajendra Sharma (Retd)
Dr. Bhimrao Ambedkar University, Agra
2. Dr. Monika Jain
Dept. of Natural Resource Management
Banda university of Agriculture and technology, Banda
3. Dr. Rohan D'Souza
Department of Botany, St. John's College, Agra
4. Dr. Rajneesh Kumar Agnihotri, Department of Botany
Dr. Bhimrao Ambedkar University, Agra
5. Prof. Bhupendra Swarup Sharma, Dean Life Sciences,
Dr. Bhimrao Ambedkar University, Agra

1. The Academic Committee considered and approved of Ordinances of the B.Sc. (In Faculty of Life Science) course based on Choice Based Credit System (CBCS) as per NEP 2020. (Appendix – 1)
2. The Academic Committee considered and approved the Syllabus of Forestry Subject for B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 2)
3. The Academic Committee considered and approved the Subject Combinations (Three) for B.Sc. (In Faculty of Life Science) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 1)
4. The Academic Committee considered and approved the B.Sc. Syllabus of Minor/elective Subject for other Faculty based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023) (Appendix – 3).


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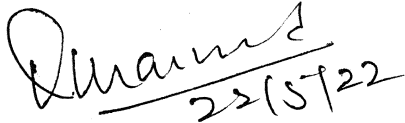

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5. The Academic Committee considered and approved the Syllabus for Co- curricular courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 4)

6. The Academic Committee considered and approved the Syllabus for Vocational courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 5)


7. The Academic Committee authorized the Dean, Faculty of Life Science to prepare the syllabus of vocational courses other than approved in item no. 6 for B.Sc. (In Faculty of Life Science) from the available list of vocational courses approved by the University (Appendix-6)

8. The Academic Committee considered and approved the fee structure of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020 (To be implemented from the academic session 2022-2023. Tuition fees 10000/- per semester (20000/- per year) and other fees (examination, enrollment, sports and cultural activities etc.) as per University norms.

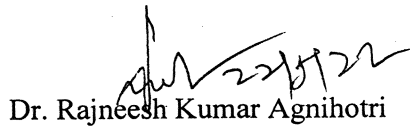

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Prof. Rajendra Sharma (Retd),
Dr. Bhimrao Ambedkar University,
Agra

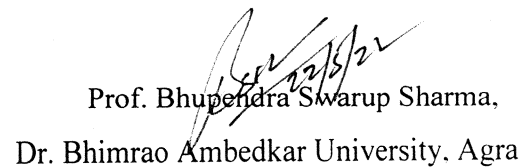
Dr. Monika Jain
Banda


22/5/22

Dr. Rohan D'Souza
St. John's College, Agra


22/5/22

Dr. Rajneesh Kumar Agnihotri
Dr. Bhimrao Ambedkar University, Agra


22/5/22

Prof. Bhupendra Swarup Sharma,
Dr. Bhimrao Ambedkar University, Agra



DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA
FACULTY OF LIFE SCIENCE
DEPARTMENT OF FORESTRY
ORDINANCES OF
BACHELOR OF SCIENCE (B.Sc.)
(IN FACULTY OF LIFE SCIENCE)
(Based on Choice Based Credit System)
(UNDER NEP, 2020)

1. The title of the B.Sc. course shall be B.Sc. (in Faculty of Life Science). The Course shall be conducted by the Department of Forestry under the Faculty of Life Science, Dr. Bhimrao Ambedkar University, Agra.
2. The under graduate degree programme shall be initiated with six semesters (3 years) B. Sc. (in Faculty of Life Science) and can be extended up to eight semester (4 year) B. Sc. Research (in Faculty of Life Science). The B.Sc. (in Faculty of Life Science) programme will be based on Choice Based Credit System (CBCS). Each semester shall consist of minimum 90 working days.
3. The course shall be run in the self-finance mode. Fee structure for the course will be decided by the Academic Committee/Board of Studies of the Department or as per the University norms. The Examination fees and other fees per semester/annual will be paid by the student as per University Norms.
4. The Department of Forestry shall run B. Sc. course with Forestry (Major course) and six other Major courses/ subjects of the Faculty of Life Science in following combinations:
 - A. Forestry, Botany, Biotechnology
 - B. Forestry, Microbiology, Biochemistry
 - C. Forestry, Zoology, Environmental Science
5. Faculty of the Department shall be responsible/ committed to teach all the students of the other Departments (School of Life Sciences, University Campus) of Faculty of Life Science who has taken Forestry as a Major Course.
6. Bachelor of Science shall consist of following
 - A. For I, II, III and IV Semester (1st and 2nd year), there shall be:
 - a. Three Major courses of own faculty in each semester,
 - b. Three Practical (3 Major Courses of own faculty) in each semester,
 - c. One minor/elective course of other faculty (once in a year),
 - d. One vocational course in each semester,
 - e. One co-curricular course in each semester.

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B. For V and VI Semester (3rd year), there shall be

- a. Two Major courses of own faculty in each semester,
- b. Two Practical (2 Major Courses) in each semester,
- c. One co-curricular course in each semester.
- d. One Industrial/Summer Training/ Survey/ Minor Project in each semester.

C. For VII and VIII Semester (4th year), there shall be

- a. One Major Course of own faculty in each semester.
- b. One Practical (1 Major Courses) in each semester
- c. One minor/elective course of other faculty (once in a year)
- d. One Industrial/Summer Training/ Survey/ Research Project in each semester.

7. To start with, not more than 30 students shall be admitted in the First Semester of B. Sc. (in Faculty of Life Science) in the concern department, there will be only 10 seats in each combination.

8. Types of Courses –

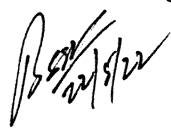
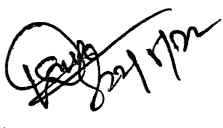
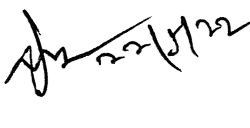

A. Core (Major) Course:- Core (Major) course is a course which is compulsory for a student to study, if s/he has chosen that subject as Major. Each Major course will be of 4 credits (each paper of theory) and 2 credits (practical).

B. Elective (Minor) Course:- Elective (Minor) course is a course which can be chosen from a pool of elective courses offered in the programme. It can be a major course of other subject. Each Elective (minor) course will be of 4 credits (each paper of theory).

C. Vocational / Skill development Course: These courses will be offered by the Departments/Colleges in different Faculties as value added courses for enhancing employability. They will be of two types' Individual nature and progressive nature. There will be a capping on the maximum number of students in a particular course as specified by the department/colleges concerned. Each Vocational / skill development course will be of 3 credits.

Online courses / MOOCs: The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Course offered in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal. Online papers credit maximum of 20 % of the total credits required for that course could be earned in minor/elective papers from this mode and those credits have to be added by the University in their SGPA/ CGPA.

D. Co-curricular Course: These courses will be offered by the Departments/Institutes in different Faculties of the University as value added courses for overall personality development in first six semesters. They will be fixed for each semester as prescribed in regulations / guidelines of University New education Policy (NEP). They will be **qualifying** in nature and their grades will not be added in CGPA.

- 7
- E. **Credited Value-Added Course:** These courses add value through enhanced employability skills and have credits assigned to them and may be offered through Vocational and Co-curricular courses. These courses will be counted for calculation of SGPA/CGPA. Credit Value-added course will be of 3 credits.
- F. **Non-credited Value-Added Course:** These courses may be offered to add value through enhanced employability skills but do not have credits assigned to them. The performance in these courses shall not be counted for computation of 'SGPA' and 'CGPA'.

G. Major and Minor Research Project:

- a. All students of the B.Sc. shall have to complete a minor research project in 3rd year (V and VI semester each) and a Major research project in 4th year (VII and VIII semester each)
- b. Topic for Minor project will have to be selected from any of the two major subjects of 3rd year.
- c. Topic of Major research project will have to be selected from major subject of 4th year.
- d. The Minor/Major research project may be interdisciplinary in nature. The research project may also be undertaken as industrial training/summer training/ internship/survey work/ etc.
- e. Each project shall be completed under the supervision of a teacher of the concern Department and/or co-supervision of a competent person of any industry/ company/ technical institute/ research institute etc.
- f. At the end of 3rd /4th year the student shall submit a combined project report of the research project undertaken in the two respective semesters (V and VI semester for 3rd year and VII and VIII semester for 4th year). This shall be evaluated by the supervisor and an external examiner appointed by the Vice Chancellor of the University on the recommendation of Dean of Faculty. The maximum marks for the same shall be 100.
- g. The grade for research project based on the marks out of 100 shall be mentioned in the marksheet of 3rd year students, but the same shall not be considered in calculation of CGPA.
- h. The Research project of 4th year shall be of 4 credits in each semester. The grade based on marks obtain in the project shall be mentioned in the marksheet and shall also be considered in calculation of CGPA.

9. Admission Criteria: The minimum qualification for admission to the Bachelor of Science (in Faculty of Life Science) shall be:

- a. A certificate of successfully completing class XII/Intermediate or 10+2 in science or equivalent from any Board recognized by the State or Central Government.
- b. The admission of Indian Nationals shall be based on entrance test or academic merit or a combination of the two and reservation /weightage in admission shall be as per University as well as UP Govt. rules. However, Foreign Nationals applying for admission through authorized channels shall be eligible for direct admission with a maximum capping as per University norms.
- c. Admission in the course will be finalized by the Dean/Admission Committee of the Faculty of Life Science.



10. A. Program Duration and Credit Requirements:

- a. The under graduate degree programme shall be initiated with six semesters (3 years) B. Sc. (in Faculty of Life Science) and can be extended up to eight semester (4 year) B. Sc. Research (in Faculty of Life Science). The B.Sc. (in Faculty of Life Science) programme will be based on Choice Based Credit System (CBCS). Each semester shall consist of minimum 90 working days.
- b. The maximum duration for completing the **Certificate in Faculty** is 1 year (46 Credits), **Diploma in Faculty** is 2 years (92 Credits), Bachelor of faculty is 3 years(132 Credits) and B. Sc. Research in Faculty is 4 years(184 Credits). These will be consecutive academic years.

B. Distribution and Requirements of Credits for B. Sc. (in Faculty of Life Science) Programme is:

a. B. Sc. 1st year (I and II Semester) will be of 46 credits.

- I. Teaching of 03 Major Courses of Theory in each semester (I & II Semester) = 12 + 12 credits = 24 credits
- II. Practical work of 03 Major Courses in each semester (I & II Semester) = 6 + 6 credits = 12 credits
- III. Teaching of 01 Minor Course Theory (I or II semester) = 4 credits
- IV. 01 Vocational Course in each semester (I & II Semester) = 3+ 3 credits = 6 credits
- V. 01 Co-curricular in each semester (I & II Semester) = qualifying

• Certificate in Faculty will be awarded after completing two semesters (One Year) comprising total 46 Credits.

b. B. Sc. 2nd year (III and IV Semester) will be of 46 credits.

- I. Teaching of 03 Major Courses of Theory in each semester (III & IV Semester) = 12 + 12 credits = 24 credits
- II. Practical work of 03 Major Courses in each semester (III & IV Semester) = 6 + 6 credits = 12 credits
- III. Teaching of 01 Minor Course Theory (III & IV Semester) = 4 credits
- IV. 01 Vocational Course in each semester (III & IV Semester) = 3+ 3 credits = 6 credits
- V. 01 Co-curricular in each semester (III & IV Semester) = qualifying

• Diploma in Faculty will be awarded after completing four semesters (Two Years) comprising total 92 Credits.

c. B. Sc. 3rd year (V and VI Semester) will be of 40 credits.

- I. Teaching of 02 Major Courses (2 Theory in each course) in each semester (V&VI Semester) = 16 + 16 credits = 32 credits
- II. Practical work of 02 Major Courses(01 Practical in each course) in each semester (V&VI Semester) = 4+4credits = 8credits
- III. 01 Co-curricular in each semester (V& VI Semester) = qualifying
- IV. 01 Industrial/Summer Training/ Survey/ Minor Project in each semester (V& VI Semester) = qualifying

• Bachelor in Science (in Faculty of Life Science) will be awarded after completing all 6 semesters (3 years) comprising total 132 credits.

d. B. Sc. 4th year (VII and VIII Semester) will be of 52 credits.

- I. Teaching of 01 Major Course (4 Theory in course) in each semester (VII&VIII Semester) = 16 + 16 credits = 32 credits
- II. Teaching of 01 Minor Course Theory (VII or VIII semester) = 4 credits
- III. Practical work of 01 Major Courses in each semester (VII & VIII Semester) = 4 + 4 credits = 08 credits
- IV. 01 Industrial/Summer Training/ Survey/ Research Project in each semester(VII & VIII Semester) = 4 + 4credits = 8credits

• B. Sc. Research (in Faculty of Life Science) will be awarded after completing all 8 semesters (4 years) comprising total 184 credit.

• The B. Sc. (in Faculty of Life Science) Programme shall be spread over 6 semesters (3 years). Total marks assigned for this programme shall be 4200 and credits earned will be 132 and comprise of three different components viz: i) Teaching ii) Practical and (iii) Industrial/Summer Training/ Survey/ Research Project

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C. Distribution of Maximum Marks for B. Sc. (in Faculty of Life Science) Programme is:

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a. B. Sc. 1st year (I & II Semester) will be of 1500 marks.

- I. Teaching of 03 Major Courses of Theory in each semester (I & II Semester) = 300 + 300 marks = 600 marks
 - II. Practical work of 03 Major Courses in each semester (I & II Semester) = 300 + 300 marks = 600 marks
 - III. Teaching of 01 Minor Course Theory (I or II semester) = 100 marks
 - IV. 01 Vocational Course in each semester (I & II Semester) = 100 + 100 marks = 200 marks
 - V. 01 Co-curricular in each semester (I & II Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 1st year (I & II Semester) = 1500 marks

b. B. Sc. 2nd year (III & IV Semester) will be of 1500 Marks.

- I. Teaching of 03 Major Courses of Theory in each semester (III & IV Semester) = 300 + 300 marks = 600 marks
 - II. Practical work of 03 Major Courses in each semester (III & IV Semester) = 300 + 300 marks = 600 marks
 - III. Teaching of 01 Minor Course Theory (III & IV Semester) = 100 Marks
 - IV. 01 Vocational Course in each semester (III & IV Semester) = 100 + 100 Marks = 200 Marks
 - V. 01 Co-curricular in each semester (III & IV Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 2nd year (III & IV Semester) = 1500 marks

c. B. Sc. 3rd year (V & VI Semester) will be of 1200 Marks.

- i. Teaching of 02 Major Courses (2 Theory in each course) in each semester (V & VI Semester) = 400 + 400 = 800 Marks
 - II. Practical work of 02 Major Courses (01 Practical in each course) in each semester (V & VI Semester) = 200 + 200 = 400 Marks
 - III. 01 Co-curricular in each semester (V & VI Semester) = 100 marks (not included in CGPA; qualifying only)
 - IV. 01 Industrial/Summer Training/ Survey/ Minor Project in each semester (V & VI Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 3rd year (V & VI Semester) = 1200 marks

d. B. Sc. 4th year (VII & VIII Semester) will be of 1300 Marks.

- I. Teaching of 01 Major Course (4 Theory in course) in each semester (VII & VIII Semester) = 400 + 400 = 800 Marks
 - II. Teaching of 01 Minor Course Theory (VII or VIII semester) = 100 Marks
 - III. Practical work of 01 Major Courses in each semester (VII & VIII Semester) = 100 + 100 = 200 Marks
 - IV. 01 Industrial/Summer Training/ Survey/ Research Project in each semester (VII & VIII Semester) = 100 + 100 = 200 Marks
- Total Marks of B. Sc. 4th year (VII & VIII Semester) = 1300 marks

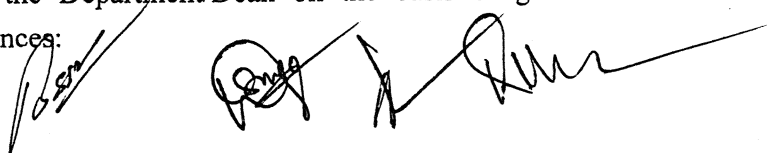
- The B. Sc. (in Faculty of Life Science) Programme shall be spread over 6 semesters (3 years). Total marks assigned for this programme shall be 4200 and credits earned will be 132 and comprise of three different components viz: i) Teaching ii) Practical and (iii) Industrial/Summer Training/ Survey/ Research Project

11. Course Structure

The course structure and course outlines of B. Sc. (in Faculty of Life Science) programme shall be as per the respective regulations recommended by the respective Academic Committee/ Board of Studies of the Department and ratified by the competent authority.

12. Attendance Requirement

Students with less than 75% attendance shall not be eligible to appear in the End of Semester Examination (Every candidate will be required to have 75% attendance of the prescribed number of periods in each paper/ Practical). However, not more than 15 % Exemption in the prescribed number of attendance may be granted by the Vice-Chancellor on the recommendation of the Head of the Department/Dean on the basis of genuine reason or in case of following circumstances:



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- a. The student should be a sportsman or sports woman who has participated in games up to the level of National/ Inter-University/ Camps/ Tournaments and Youth Welfare Activities.
 - b. In spite of exemptions clarified above it will be compulsory for a candidate to have attended at least 60% prescribed number of periods.

13. Examinations and Assessment /Evaluation

A. Continuous Internal Evaluation (CIE)

- a. Continuous Internal Evaluation (CIE) of all the theory courses/ papers, major/ minor/ Co-curricular, will carry Maximum Marks 25.
- b. Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.
- c. Continuous Internal Evaluation (CIE) in Practical papers: shall be based on One Practical Tests/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.
- d. Continuous Internal Evaluation (CIE) will be conducted by the concerned teacher(s)/HOD.
- f. The evaluated answer books/quiz papers/ etc. and related material should be preserved in the Department for one year from the date of result declaration.
- g. The teacher will have to submit total marks out of M.M. 25 of Continuous Internal Evaluation (CIE) to the University online or as per University rules.

B. End Semester Examination

After 90 working days of teaching in a semester, the date sheet of End Semester Examination shall be approved by the Vice Chancellor on the recommendation of the Dean (Faculty of Life Science).

The question paper will be bilingual i.e. printed in Hindi and English. (Except Language papers) The End Semester examinations will be held at the end of each semester, in these examinations, all the theory papers / major/ minor courses/ will carry Maximum Marks 75 each. The examination duration will be of Three hours, or as per University Norms/ rules.

- a. First, Second, Third and Fourth Semester shall have three Theory Papers (3 Major Courses) of 75 marks each and three Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc. (as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE).
One Practical examination of each major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.
- b. Fifth and Sixth semester shall have four Theory Papers (2 Major Courses) of 75 marks each and four Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE).



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One Practical examination of each major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.

- c. Seventh and Eighth semester shall have four Theory Papers (1 Major Courses) of 75 marks each and four Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/Presentation etc. (as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE).

One Practical examination of a major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.

One Research Project will be completed in each semester of IV year and have 100 marks each (4 Credits).

- d. Each theory paper of the Major /Minor Courses shall be divided into three sections; **Section-A** (10 very Short answer type question/MCQ/Fill in the Blank/One word answer of 2 marks each; all questions are compulsory), **Section-B** (attempt 5 questions out of 8 questions of 7 marks each ; each answer should not be less than 50 words) and **Section-C** (attempt 2 questions out of 4 long essay type questions of 10 marks each; each answer should not be less than 200 words).

All the questions should be spread uniformly over the entire syllabus. The students shall have to answer the questions in three hours, which shall be the duration of the question paper.

- e. The Panel of examiners for paper setting, evaluation of answer books, practical and project etc. of end semester examination external examiner as well as internal examiner shall be appointed by the Vice Chancellor on the recommendation of the Dean (Faculty of Life Science).

- f. The practical examination at the end of each Semester shall be conducted by a Board of two examiners (one external and one internal examiner) will be of 75 Marks and six hours duration, based on prescribed courses taught during the Semester.

The marks of practical examination shall be submitted in the University or uploaded on University website as per the prevailing arrangement.

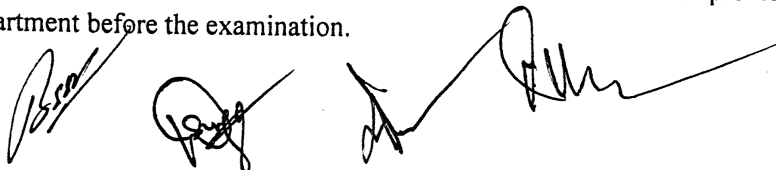
- g. The Remuneration, TA/DA of University Examinations will be made as per the existing rules and regulations of the University.

- h. The total marks in a paper of major, minor courses and practical will be awarded to a student out of 100 marks, with Continuous Internal Evaluation and end semester exam put together. But a student will have to secure minimum 26 marks out of 75 in end semester exam and minimum 9 marks out of 25 in Continuous Internal Evaluation.

- i. A student must get at least 35% marks in each theory paper and Continuous Internal Evaluation separately in each Semester for being eligible for promotion to the next Semester. Further, he/she must get at least 35% marks in the practical examination. To pass the course the candidate should secure at least 35% marks in the aggregate.

- j. In special circumstances, the examination may also be conducted in objective type. In which out of 100 questions, the candidate will have to solve 75 questions. The duration of said examination will be 2:00 hours.

- k. All the answer sheets and other material related to the examination will be provided by the University to the department before the examination.



- 12
- l. The evaluation work related to the End Semester Examination will be done by the University under centralized evaluation system or as per University rules.
 - m. Marks obtained in all subjects will be converted to comparative (credit point/grade) as per University norms for CBCS system.

C. End Semester Examination of Vocational Course

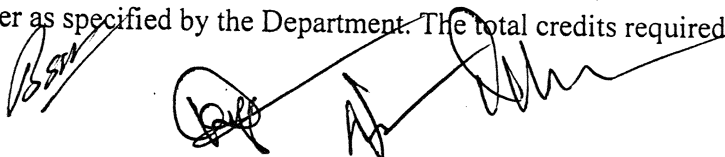
- a. The Vocational Course Examination will be of 100 marks. The Vocational subject (training based) will be of 60 marks and Vocational theoretical (learning based) paper will be of 40 marks, out of 100 marks. The examination pattern of the vocational subject will be as follows -
 - i. At the end of the respective semester, the Department will conduct exam of paper (training based) and paper (learning based) separately at their own level.
 - ii. For the evaluation of training based paper of vocational subject, the Department will appoint a joint team of trainers/training associate from skill partner (contracted by the MOU) and a teacher from the faculty at the internal level.
 - iii. For the examination of theory work, a question paper of 40 marks will have to be prepared by the Department through the concerned teacher/HOD in consultation with the training associate. This question paper will consist of 05 descriptive type questions, which the student will have to answer in a maximum of 75 words per question. The stipulated duration of the exam will be 1:00 hrs.

D. End semester examination of Compulsory Co-Curricular Course

End semester examination of Compulsory Co-Curricular Courses will be based on multiple choice questions Printed question booklet with OMR sheet provided by the University of 75 Marks having 100 questions. Candidate will have to attempt any 75 questions. For each question, 01 Mark will be awarded for the correct answer, there will be no provision of negative marking for wrong answers. The prescribed duration for the said examination will be 02:00 hours.

14. Minor Courses

- a. To ensure multidisciplinary, the student will have to study one minor course/ elective paper of other faculty with three major courses of own faculty.
- b. There shall be no prerequisite qualification to choose a minor subject.
- c. A student shall have to study one minor subject in B. Sc. 1st and 2nd year.
- d. Student may study and qualify the above mentioned minor subject in any one semester of 1st year (I or II semester) and 2nd year (III or IV semester).
- e. Minor/elective course shall be allotted by Department based on availability of seats at the beginning of the semester and fill in the Examination form.
- f. Student will have to opt for a minor / elective course offered by Department, from the subjects available at the Institutes/departments of the Khandari Campus, Dr. Bhimrao Ambedkar University Agra. Classes and examinations for minor / elective course shall be run simultaneously with their major courses/subjects.
- g. The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Minor/Elective Course offered in the semester as specified by the Department. The total credits required for that course could




be earned in Minor Course /Elective paper from this mode and those credits have to be added by the University in their SGPA/ CGPA on the submission of certificate. (13)

- h. Student may complete minor course /elective paper from SWAYAM, MOOCS etc. by recognized Central or state government body, or UGC, or University during the period of B. Sc., it will be considered as one Minor paper of four credits. His marks/grades will be awarded according to the decision of Equivalence committee on the submission of the certificate.

15. Vocational Courses

- a. Students shall choose the course as per the choices offered by the Department. He/She will also have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Course in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal.
- b. A Memorandum of Understanding : Department are required to sign the MOUs at the local level. Department will contact nearby industries, I.T.I., Polytechnics, Engineering Colleges, Artisans, Registered Enterprises, Specialists for conducting vocational courses. In order to connect with Government run Vocational Courses/Training/Internships, Departments will coordinate with the concerned Institutions. The safety of a student in workplace should be considered while signing the MOU. All possible efforts should be made to pay student honorarium, as per rules, to students during their training/internship.
- c. **Time Table for vocational course:** Training/internship could be done during holidays or after Class hours. Alternatively, a day in a week may be fixed for this activity.
- d. **Seat Allocation for vocational course:** The number of seats in each course must be decided by the Department in consultation with the skill partner.
- e. **Examination :**
- i. Theory examination (1 credit) will be conducted by the Department, while the training/internship examination (2 credit) will be conducted by the skill partner or by the Department wherever the facility exists.
 - ii. Skill partner/Department may evaluate the skills of the student either on the basis of the work done during the training/internship or on the basis of offline/online examination.
 - iii. Department will upload the marks on the portal in time after obtaining theory and skill marks.
 - iv. The details of the Vocational Course will be entered in the marksheet/degree issued by the University.
 - v. In addition to it, department and skill partner may issue a joint certificate to the student.
- f. **Syllabus**
- i. The course structure of each vocational course for B. Sc. (in Faculty of Life Science) shall be as per the respective Regulations recommended by the respective Board of Studies/Academic Committee of the Department and ratified by the competent authority.



- (14)
- ii. In different vocational courses the ratio of the General Theory to Skill/ Training/Internship/Lab will be 40:60, and for such courses the arrangements to sign MOU with the skill partners will be made by the Department.
 - iii. The theory component shall be of one credit (15 hours) and the skill component shall be of two credits (30 hours per credit). Thus the vocational course will be a 3 credit course comprised of 15 hours of theory (1 credit) and 60 hours of training/internship/lab (2credits).

g. Nature of the Syllabus

Syllabus shall be of two types:

- Individual Nature- A syllabus that would be completed in one semester.
- Progressive Nature—The complexity/specialization of syllabus would increase with each semester but will be complete in itself in each semester.

h. Credit

A student will have to earn a minimum of three credits from vocational courses in each semester, which means six credits every year. Students may choose a vocational course with more than required credits and deposit them, but in a year six credits/in two years 12 credits will be used to obtain certificate/diploma/degree.

16. Compulsory Co-curricular Courses

- a. One co-curricular course has to be qualified in each semester up to third year (total six courses in six semesters). These courses are only qualifying in nature and the marks of these courses will be assigned corresponding grades and mentioned on marks-sheet, they will not be counted in the calculation of SGPA/CGPA. Thus they are also known as non-credit courses.
- b. Number of lectures (Hours) in each course: 30
- c. Continuous Internal Evaluation (CIE) shall be based on One MCQ Test/Quizzes (as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.
- d. End Semester Examination of co-curricular course (100 MCQ, 2 hours): 75 marks (no negative marking). Each question will carry 1 marks.
- e. Minimum passing marks of these courses will be 40 (Continuous Internal Evaluation and final semester exam put together).
- f. **The sequence of teaching co-curricular courses semester-wise is as follows:**
 - i. First Semester : Food Nutrition and Hygiene
 - ii. Second Semester : First Aid and Health
 - iii. Third Semester : Human Values and Environmental Studies
 - iv. Fourth Semester : Physical Education and Yoga
 - v. Fifth Semester : Analytic Ability and Digital Awareness
 - vi. Sixth Semester : Communication Skill and Personality Development.

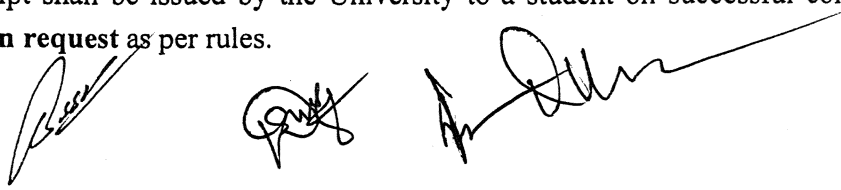
Or as per University norms/rules.

17. Examination, Promotion and Reappearing Rules:

- a. A student obtaining grades 'P' to 'O' (grade point 4 or higher) in any course shall be considered PASS in that course.
- b. For non-credit courses 'Satisfactory' (grades 'P' to 'O') or 'Unsatisfactory' (Grade 'F' or 'AB') shall be indicated instead of the letter grade and these will not be counted for the computation of SGPA/CGPA.
- c. All students shall be promoted automatically from odd to even semesters but for promotion from even to odd semester i.e. from current year to next year She/He should have earned at least 75% credits of all the credits of current year. She/He may be promoted in this manner till VI Semester (III year). Further promotion (to VII semester) may not be allowed till she/he clears all the previous semester credits.
- d. Student who fails or want to improve in theory paper/(s) (End Semester examination) or test/(s) (Continuous Internal Evaluation) shall be given permission to reappear in that paper along with the next following batch. The chance to reappear shall be given only in not more than two courses in one Semester. The candidate shall, however be promoted to the next Semester. No separate examination will be conducted for such candidate.
- e. A Student may be allowed to re-register for a semester, within the maximum stipulated time period allowed to complete the program, provided he/she satisfies one of the following conditions. In such a case there shall be fresh assessment of Continuous Internal Evaluation and End Semester examination:
 - i. The student declares fail.
 - ii. The student did not appear in the semester examination or he/she was not granted permission to appear in the examination.
 - iii. The student has been detained by the University and subsequently has been permitted to take re-admission.
- f. If a candidate fails to appear in practical examination, a special practical examination can be conducted for the candidate on the deposition of fees as prescribed by the University as a special practical examination fees.
- g. A student may appear as an Ex-student in the End semester examination provided that he /she has completed all the Continuous Internal Evaluation (CIE) and Practical Examinations but failed in more than two courses or totally absent in all the End semester examination.
- h. Those Students who reappear in any course/s in any semester or re-register for a semester shall have to pay the prescribed fee (Tution, Examination and Other fees).
- i. Cases of use of unfairmeans in the examination shall be dealt with as per the rules and regulations of the University.
- k. Challenge evaluation shall be permitted as per rules/orders of the University.
- l. Grade Card:**

A grade card shall be issued by the University to each student at the end of every semester.
- m. Transcript:**

A Transcript shall be issued by the University to a student on successful completion of the program **on request** as per rules.



n. Withholding of Grade Card/Transcript

The Grade Card/Transcript of a student shall be withheld if he/she has not paid his/her dues, or if there is a case of indiscipline pending against him/her.

- o.** The formula of conversion of CGPA to equivalent percentage of marks will be as per the University rules.

18. Exit option and award of B.Sc. (in Faculty of Life Science)

- a.** In case the student wishes to leave after completion of one year of B. Sc. (in Faculty of Life Science) programme, He/she shall be eligible for award of Certificate in Faculty, provided the student fulfils the following conditions:
 - i.** Has pursued the prescribed courses of study and has earned 46 credits as prescribed under the relevant regulations within four academic years.
 - ii.** Obtained a minimum CGPA of 4.0
 - iii.** Paid all the dues of the University.
 - iv.** No disciplinary proceedings are pending against him/her.
 - v.** Any other condition, as notified by the competent authority of the University.
- b.** In case the student wishes to leave after completion of two years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a Diploma in Faculty, provided the Student fulfils the following conditions:
 - i.** Has pursued the prescribed courses of study and has earned 92 credits as prescribed under the relevant regulations within three academic years after earning certificate.
 - ii.** Obtained a minimum CGPA of 4.0
 - iii.** Paid all the dues of the University.
 - iv.** No disciplinary proceedings are pending against him/her.
 - v.** Any other condition, as notified by the competent authority of the University.
- c.** In case the student wishes to leave after completion of three years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a Bachelor's Degree in Faculty, provided the student fulfils the following conditions:
 - i.** Has pursued the prescribed courses of study and has earned 132 credits as prescribed under the relevant regulations within three academic years after diploma infaculty.
 - ii.** Obtained a minimum CGPA of 4.0
 - iii.** Paid all the dues of the University.
 - iv.** No disciplinary proceedings are pending against him/her.
 - v.** Any other condition, as notified by the competent authority of the University.
- d.** On completion of four years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a B. Sc. Research in faculty, provided the student fulfils the following conditions:
 - i.** Has pursued the prescribed courses of study and has earned 184 credits as prescribed under the relevant regulations after Bachelor's degree.
 - ii.** Obtained a minimum CGPA of 4.0
 - iii.** Paid all the dues of the University.





(17)

iv. No disciplinary proceedings are pending against him/her.
v. Any other condition, as notified by the University.

e. Students holding a Certificate or Diploma can apply for lateral entry (with same subjects and combination provided by Department) into the second /third year respectively of B. Sc. (in Faculty of Life Science) Programme through the laid down admission process for the purpose as notified by the University.

19. Interpretation clause

In case of any issue of interpretation arising during the course of implementation of these Ordinances or in case of any unforeseen circumstance, decision of the Vice Chancellor shall be final.

20. In case of misbehavior, indiscipline, the student may be expelled from the Department or given some other punishment recommended by the Dean, of Faculty of Life Science/HOD of Department/Proctor of the University. The decision of the Unfair means Committee of the University is final in the case of cheating and using unfair means by the student in any examination. All cases of expulsion shall be referred to the Vice-Chancellor for final approval. Each student shall pay tuition, examination and other fees per semester/annual and as per University Orders.

22. Anything, not covered under the Ordinance (*vide supra*) shall be decided by the Academic Committee of the Department without prejudice to the powers of The Academic Council, Executive Council, The Admission Committee, and The Examination Committee of The University. The Academic Committee shall be responsible for courses, syllabus of B. Sc. (in Faculty of Life Science) or any other degree.

23. Conversion of CGPA to equivalent percentage of Marks as per University norms are given below-

Percentage of Marks = (CGPA*10) equivalent

A. The following percentage to Letter Grade/ Grade Points conversion scheme will be followed

Percentage	Equivalent Letter Grade	Equivalent Grade Point
>=95%	O	10
>=85% and <95%	A+	9
>=75% and <85%	A	8
>=65% and <75%	B+	7
>=55% and <65%	B	6
>=45% and <55%	C	5
>=35% and <45%	P	4
<35%	F	0
NA	AB	0

(Handwritten signatures and dates: 22/1/2022)

B. Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

a. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

$$SGPA (S_i) = \sum(C_i \times G_i) / \sum C_i$$

where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.

b. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(C_i \times S_i) / \sum C_i$$

where S_i is the SGPA of the i th semester and C_i is the total number of credits in that semester. The SGPA and CGPA shall be given upto 2 decimal points without rounding off. For example, if the SGPA / CGPA is 5.2434, the final CGPA will be 5.24. Similarly, if the SGPA / CGPA is 52.498 then also the final CGPA to be reflected in the transcript will be 5.24.

C. Grade Point Requirement / Minimum Standard

a. A student, in order to be eligible for the award (i) passed all the prescribed courses as laid down and completed the minimum credit requirement of the programme already defined in the ordinance; (ii) she/he has obtained a CGPA of 4.0 at the end of the programme.

b. The grade points - division mapping for UG programs will be as follows —

Grade Point Range	Division
≥ 6.0 and above	First
≥ 4.5 and < 6.0	Second
≥ 4.0 and < 4.5	Third
< 4.0	Fail

c. A student shall be deemed to have cleared a course only if (i) he/she has in the internal assessment and has secured an overall grade at least 'P' or higher and (ii) if she/he has secured a grade at least 'P' or higher in the end- semester examination (for courses having end-semester examination). A student obtaining Grade 'F' shall be considered fail and will be required to reappear in the examination.

d. If a student fails to clear a selected course then he/she shall be allowed to clear another similar credit course in lieu thereof or the same course.

e. In case a student earns extra credits by clearing courses in addition to the minimum prescribed for the programme, all the courses and their grades will reflect in the grade sheet. However, for the purposes of calculating the Cumulative Grade Point Average (CGPA) in the final semester, only his/her best grades will be taken into account such that the minimum credit requirements for the programme are fulfilled.

f. For awarding medals or for declaring the toppers in the course if the student gets the same CGPA, it should be resolved by considering the number of times at student has obtained higher SGPA

but if it is not resolved even at this stage, the number of times a student has obtained higher grades in a paper like O, A+ etc should be taken into account in rank ordering of the students in a programme. However in case of further discrepancies the final decision lies at the discretion of the Head of the Department/ Controller of Examination/Examination Committee.

g. Transcript (Format) based on the above recommendations on letter grade, grade points and SGPA and CGPA may be used for each semester and a consolidated transcript indicating the performance of all semesters in the final semester transcript of the course.

D. Illustration of Calculation of SGPA

Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
Course 1	4	A	8	4*8=32
Course 2	4	A+	9	4*9=36
Course 3	3	B	6	3*6=18
Course 4	2	C	5	2*5=10
Course 5	4	F	0	4*0=0
Total (ΣCi) = 17				Total (Σ(Ci x Gi)) = 96

Thus SGPA = 96/17 = 5.64

E. Illustration of calculation of CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 17 SCPA: 5.64	Credit: 20 SGPA: 6.08	Credit: 22 SGPA: 4.9	Credit: 22 SGPA: 7.22

Thus, CGPA = (5.64*17 + 6.08* 20 + 4.9*22 + 7.22 *22)/81=5.97

Hence, equivalent percentage = (5.97*10)=59.7

And the division will be Second.

F. In co curricular courses a student has to score 40 (Forty) % marks for clearing it. Grades will be indicated in the grade sheet but they will not be counted for evaluating CGPA.

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SYLLABUS OUTLINE

B.Sc. (in Faculty of Life Science)

(Appendix-2)

SUBJECT: FORESTRY

Under National Education Policy-2020

SEMESTER WISE PAPER TITLES WITH DETAILS

20

Semester	Course code	Paper title	*CIE	End semester examination	Total	Credits	Teaching hours
B. Sc. 1st YEAR /Certificate Course in Elementary Forestry							
I	FORB101T	Introduction to Forestry & Nursery Technology	25	75	100	4	60
	FORB102P	Plant Identification technology & Nursery Technology	25	75	100	2	60
II	FORB201T	Forest Ecology , Wild Life Management & Ecotourism	25	75	100	4	60
	FORB202P	Forest Ecology measurements , Biodiversity indices ,visit of protected area	25	75	100	2	60
B. Sc. 2nd YEAR / Diploma in Plantation Forestry							
III	FORB301T	Principles of Silviculture, Plantation Forestry	25	75	100	4	60
	FORB302P	Principles of Silviculture, Plantation Forestry	25	75	100	2	60
IV	FORB401T	Forest Botany and Taxonomy, Ethnomedicine & Phytochemistry of Medicinal and Aromatic Plants	25	75	100	4	60
	FORB402P	Commercial Botany & Phytochemical Analysis	25	75	100	2	60
B. Sc. 3rd YEAR / Degree in Bachelor of Science (In Faculty of Life Sciences)							
V	FORB501T	Forest Mensuration & Remote Sensing and GIS	25	75	100	4	60
	FORB502T	Principles of Agroforestry & Forest statistics & Experimental Designs.	25	75	100	4	60
	FORB503P	Forest Mensuration & Biometry, Agroforestry D&D, Remote Sensing and GIS, Experimental Designs.	25	75	100	2	60
VI	FORB601T	Forest Protection , Tree improvement & Biotechnology, Application of biotechnology in Forestry	25	75	100	4	60
	FORB602T	Forest Utilization(Timber and Non-Timber) and Forest Economics	25	75	100	4	60
	FORB603P	Collection of Timber and Non-Timber and Forest Economics & Project Evaluation, Micro-Propagation Techniques.	25	75	100	2	60

* CIE= CONTINUOUS INTERNAL EVALUATION; T = THEORY; P= PRACTICAL

22/5/22

22/5/22

22/5/22

SUBJECT: FORESTRY**Subject prerequisites:**

1. To study Forestry, a student must have had the subject learnt at 10+2 level. The candidate should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Forestry /Agriculture/Environment/Biotechnology) or- PCM (Physics, Chemistry and Maths) or any other science subject.
2. Keen interest in plants and forest-related research, Potential in mathematics, biology, agriculture, environment and biotechnology.
3. Skills and aptitude for scientific study and research
4. Creativity and good comprehension while working on scientific procedures and research
5. Computer aptitude.

Programme outcomes (POs):

Transformed curriculum shall develop educated outcome-oriented candidature, fostered with discovery-learning, equipped with practice & skills to deal practical problems and versed with recent pedagogical trends in education including e-learning, flipped class and hybrid learning to develop into responsible citizen for nation-building and transforming the country towards the future with their Knowledge gained in the field of forestry professional and use knowledge in research and technology.

PO 1	CBCS syllabus with a combination of general and specialized education shall introduce the concepts of breadth and depth in learning
PO 2	Shall produce competent forestry researcher & worker who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence the prevailing paradigm of agriculture, industry, healthcare and environment to provide sustainable development.
PO 3	Will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solution, improve practical skills, enhance communication skill, social interaction, increase awareness in judicious use of plant resources by recognizing the ethical value system.
PO 4	The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry along with graduate preparation for national as well as international competitive examinations, especially ICAR- NET , UPSC Civil Services Examination, IFS, FCI, BSI, ICFRE-FRI , BANKING (AAO), NABARD etc.
PO 5	Certificate and diploma courses are framed to generate self- entrepreneurship and self-employability, if multiunit option is opted i. e. nursery development, paper making etc.
PO 6	Lifelong learning be achieved by drawing attention to the vast world of knowledge of forest and environment their domestication.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

B.Sc. 1st Year/ CERTIFICATE COURSE IN ELEMENTARY FORESTRY

FIRST YEAR	PO 1	This Programme imparts knowledge on various fields of forestry through teaching, interactions and practical classes.
	PO 2	The students will have a basic understanding of forestry and will be able to take up employment in government and private companies..
	PO 3	This syllabus has been drafted to enable the learners to prepare them for self-entrepreneurship and employment in various fields including academics.
	PO 4	The candidate will be able to identify the problems and solve them.
	PO 5	Assessment of various forestry problems and develop methods for their suggest solutions.

B.S.C. 2nd YEAR/ DIPLOMA IN PLANTATION FORESTRY

SECOND YEAR	PO 1	It will impart basic knowledge and skill of forestry in the students.
	PO 2	It will inculcate the forestry knowledge and practical skill among the students for diagnosis and analysis of existing problems in the fields of forest and environmental development.
	PO 3	It will impart the professional knowledge of forestry in students and can be so that can be absorbed in different sectors, i.e., private, public, NGOs and other organization.
	PO 4	The student will be able to use forestry knowledge in the management of forest resources and development of forest stands through their knowledge and practical skills.
	PO 5	After completion of PO 4 students will become forestry professional and use knowledge in research and technology

B.Sc. 3rd YEAR / DEGREE IN BACHELOR OF SCIENCE (IN FACULTY OF LIFE SCIENCES)

THIRD YEAR	PO 1	Understanding of Forest classification, evolution, ecology, plant interactions various Agro-forestry systems in India.
	PO 2	This course is suitable to produce expertise in conservation of protected area, National Park, Sanctuaries and Biosphere Reserves etc.
	PO 3	Understanding of various analytical techniques of plant sciences & knowledge of forest based industries.
	PO 4	knowledge and practical skills in the subject together with multi-dimensional and multidisciplinary approach
	PO 5	After completion of Forestry students are able to contribute to all these fields and therefore, are mainly employed with educational institutions, government or public sectors or companies in industries, such as agriculture or forestry, biotechnology, geological survey, environmental protection, genetic research, plant resources laboratories, plant health inspection services, Pulp and paper, Plywood industries,, nursery, fruit and so on.

Bev


Programme: Certificate		Year: 1 st	Semester: I
Subject: Forestry			
Course Code: FORB101T		Course Title: Introduction to Forestry & Nursery Technology	
Course outcomes: After the completion of the course the students will have a basic understanding of forestry and will be able to take up employment in government and private companies.			
Credits: 4		Core Compulsory	
Max. Marks CIE:25		Min. Passing Marks CIE:09	
Max. Marks End Semester Examination:75		Min. Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction and definition of forestry; Forest and plantation; Concept of forestry education; Brief history of forestry; Branches of forestry; Legal classification of forests: Reserved forest, protected forest, un-classified forest, village forest and community forest (van panchayat);		10
Unit II	Forest area and forest cover in the state, country and world; Category of forest on the basis of origin: Primary forest and secondary forest; Forest acts and policies; Importance of forests for community, environment, climate change and sustainable development.		10
Unit III	Forest composition; Basis of forest classification; Basic principles of silviculture: Introduction, definitions, objects, scope and importance;		10
Unit IV	Regeneration of forests: Afforestation and reforestation; Methods of regeneration;		10
Unit V	Relation of silviculture with other branches of forestry; Tree morphology, different forms and growth of trees, stem, root and other parts; mycorrhiza, lignotubers and root nodules; High forest, coppice forest, closed forest, open forest, normal forest and abnormal forest.		5
Unit VI	Introduction, importance and objectives of nursery; Classifications, nursery sites, area and seed bed; Methods of sowing, quality of seeds, time of sowing, shading, watering, damping off and their control measures.		5
Unit VII	Weeding and their controlled measures; Soil working and transplanting; Nursery material and tools; Plant containers; Potting media; Timing-out and culling.		5
Unit VIII	Green manuring; Organic compost/manure; Farm yard manure (FYM); Bio-fertilizers; Mycorrhiza and fertilizer application; Plant propagation: Macro-propagation and micro-propagation techniques. Green house/mist chamber; Hormones and stimulants for rooting.		5
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 1. Ecology and Environment by P. D.Sharma 2. Principles and Practices of Silviculture by L.S.Khanna 3. A text Book of Silviculture by A.P.Dwivedi 4. Forest Management by RamPrakash 5. Forest Mensuration, A.N.Chaturvedi 6. Theory and Practices of Silviculture by L.S.Khanna 7. Forest of Himalaya by JS Singh and SPSingh 8. Plantation Forestry in India by R.K.Luna 			
Suggested Continuous Evaluation Methods:			
<p>Total marks: 25 One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks</p>			

Programme: Certificate		Year: 1 st	Semester: I
Subject: Forestry			
Course Code: FORB102P		Course Title: Introduction to Forestry & Nursery Technology	
Course outcomes: After the completion of the course the students will be able to: <ol style="list-style-type: none"> To meet the growing demand of forestry and environmental professionals in natural resource-based industries, government sector and NGOs. Developing excellence in Forestry Education and Research in the country. 			
Credits: 2		Core Compulsory	
Max. Marks CIE:25		Min. Passing Marks CIE:09	
Max. Marks End Semester Examination:75		Min. Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2			
Practical	Suggested Lab /Virtual Experiment		Lectures
	<ol style="list-style-type: none"> Field visit in different forest sites. Identification of tree species and their local and botanical name. Introduction about instruments used in forestry (meter tape, Gunter chain, weighing machine, soil pH meter, soil thermometer, seed germinator, oven, balances.). Measurement of tree height, diameter, basal area, circumference. Nursery development, preparation of nursery layout, nursery beds, uses of different container, planting material seeds and vegetative parts, raising of plants of different tree species. 		60
Suggested Readings: <ol style="list-style-type: none"> <i>Ecology and Environment</i> by P. D.Sharma <i>Principles and Practices of Silviculture</i> by L.S.Khanna <i>A text Book of Silviculture</i> by A.P.Dwivedi <i>Forest Management</i> by RamPrakash <i>Forest Mensuration</i>, A.N.Chaturvedi <i>Theory and Practices of Silviculture</i> by L.S.Khanna <i>Forest of Himalaya</i> by JS Singh and SPSingh <i>Plantation Forestry in India</i> by R.K.Luna 			
Suggested Continuous Internal Evaluation (CIE) methods			
Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher(HOD) of 5 marks.			

Programme: Certificate		Year: 1 st	Semester: II
Subject: Forestry			
Course Code: FORB201T		Course Title: Forest Ecology, Wild Life Management & Ecotourism	
<p>Course outcomes: After the completion of the course the students will be able to:</p> <ol style="list-style-type: none"> In the country it is second major land resources but as per the National Forest Policy the forest should be 1/3rd (33%) forest area but the area is 10% less. To produce competent professional by imparting quality education to meet the industry requirements and for serving the societal needs. Conservation and Scientific Management of the natural resources of the state/country by training forestry students & Gain Knowledge about the economic values of this lower group of plant community 			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction and definition of ecology; Types of ecology; Forest ecology: Definition and its importance in forest ecosystem management; Introduction, structure and components of ecosystem; Types of ecosystem: Forest, grassland, desert and aquatic ecosystem; Ecological concept of ecosystem: Tropic structure, ecological pyramids, food chain, food web, and energy flow.		10
Unit II	Introduction, definition, scope and importance of biodiversity; Threats and conservation methods of biodiversity; Species composition, species diversity, forest population and forest community; Niche; Methods of forest vegetation analysis, biomass, productivity, litter fall, forest floor, biomass (standing state biomass), major nutrients (c, n, p, k), litter decomposition, nutrient cycling and nutrient use efficiency.		10
Unit III	Climatic factors: Light, atmospheric temperature, moisture, wind and their effects; Topographic factors: Altitude, slope, aspects and exposure and their effects; Edaphic factors: Soil, its formation, soil profile, physico-chemical properties of soil and their effects; Soil organic matter; C:N ratio; Mycorrhiza and its types; Soil microorganism; Biotic factors: Relation between plant and plant, plant and animal, plant and man and their influences; Competition, symbiotic association, parasites, epiphytes, climbers and weeds.		10
Unit IV	Forest composition, distribution and major forest type in India and world; Classification of forests (Champion and Seth, 1968); Forest area, forest cover, growing stock and carbon stock of forests in India (as per forest survey of India); Succession: Introduction, definition, causes and mechanism of succession; Types of succession and concept of climax.		10
Unit V	Participation of local people in ecotourism; Limitations and problems; World tourism organization; Problems with definition of ecotourism and criticisms; International organizations and NGOs promoting ecotourism; Sociological implications of eco-tourism.		5
Unit VI	Wild-life management- Definition, importance and concepts. Wild life management in relation to allied subjects, study of rare and threatened species, steps taken for their preservation.		5
Unit VII	Wild-life values and conflicts positive values Aesthetic, cultural, social etc. Introduction to biological and ecological base of management. Distribution and behavior including various environmental factors.		5
Unit VIII	Factor affecting animal population, concept of age and sex structure (Mortality and natality). Ecology of wild life. Field observations and investigations. Census, Management Techniques		5

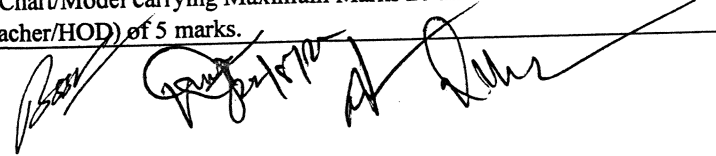
Suggested Readings:

1. *Ecology, Environmental Science and Conservation* by J.S. Singh, S.P. Singh and S. R. Gupta
2. *Ecology and Environment* by P. D. Sharma
3. *Fundamental of Ecology* by E.P. Odum
4. *Concept of Ecology* by E.J. Kormondy
5. *Ecology* by M.P. Arora
6. *Ecology* by S.N. Jha
7. *Concept of Modern Ecology* by P.C. Tewari
8. *Indian forestry* by K. Manikandan
9. *Eco-tourism and livelihood* by A.K. Bhattacharya
10. *Tourism, Environment and Man: Sustainable Tourism* by Brigadier and B.P. SKhati
11. *Tourism in india Challenges and Opportunities* by Ruchi Ramesh and Sudhir Kumar Singh
12. Gaston, K.J and Spicer, J.I. 2004. *Biodiversity: An Introduction*. Blackwell Publishing Company, USA.
13. Richard. B. Primack. 1998. *Essentials of conservation biology*. Sinauer Associates, Inc. USA.
14. Agarwal, S.K. 2002. *Biodiversity conservation*. Rohini Publishers, Jaipur.
15. Nautiyal, S and Kaul, A.K. 1999. *Forest Biodiversity and its conservation Practices in India*. Oriental Enterprises, Dehradun.
16. R. Umashaanker et.al. 2001. *Forest Genetic Resources*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
17. Ian. F. Spellberg. 1992. *Evaluation and Assessment for Conservation*. Chapman Hall, London, UK.
18. David, E.B. and Joel, T.C., 2003. *Monitoring Ecosystems*. Island Press, Washington, DC
19. Stanley, A.H., 2002. *Managing our wildlife resource*. Printice-Hall, USA.
20. Benson, E.E., 1999. *Plant conservation Biotechnology*. Taylor and Francis Ltd. London.
21. Agrawal, K.C., 2000. *Wildlife of India: Conservation and Management*. Nidhi Publishers, India
22. Dunbar, A.A., (Eds: Reprinted from BNHS). *The preservation of wildlife in India*. Daya Publishing House, New Delhi.
23. Sinha, P.C., 1998. *Wildlife and forest conservation*. Anmol Publication Pvt. Ltd, New Delhi.
24. Edward, O.G., 2004. *Ex situ plant conservation*. Island Press, Washington, DC

Suggested Continuous Evaluation Methods:**Total marks: 25**

One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks

Programme: Certificate	Year: 1st	Semester: II
Subject: Forestry		
Course Code: FORB202P	Course Title: Forest Ecology measurements , Biodiversity indices , visit of protected area	
Course outcomes: After the completion of the course the students will be able to Conservation and Scientific Management of the natural resources of the state/country by training forestry students.		
Credits: 2		Core Compulsory
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2		
Practical	Suggested Lab /Virtual Experiment	Lectures
	<ol style="list-style-type: none"> 1. To determine the minimum size of quadrates. 2. To determine density of tree species in forest. 3. To determine frequency of tree species in forest. 4. To determine abundance and A/F ratio of tree species in forest. 5. To determine relative density, relative frequency and relative dominance and Important Value Index (IVI) of tree species in forest. 6. To determine basal area of tree species in forest. 7. To draw the population structure of tree species in forest. 8. To determine species diversity in forest by Shannon-Weiner Index. 9. Comment and assignment on the above topics. 10. Visit the nearby eco- tourism sites. 11. Ecological census techniques- wild animal census. 	60
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 1. <i>Ecology, Environmental Science and Conservation</i> by J.S. Singh, S.P. Singh and S. R. Gupta 2. <i>Ecology and Environment</i> by P. D.Sharma 3. <i>Fundamental of Ecology</i> by E.P.Odum 4. <i>Concept of Ecology</i> by E.J.Kormondy 5. <i>Ecology</i> by M.P.Arora 6. <i>Ecology</i> by S.N.Jha 7. <i>Concept of Modern Ecology</i> by P.C.Tewari 8. <i>Indian forestry</i> by K.Manikandan 9. Gaston, K.J and Spicer, J.I. 2004. <i>Biodiversity: An Introduction</i>. Blackwell Publishing Company, USA. 10. Richard. B. Primack. 1998. <i>Essentials of conservation biology</i>. Sinauer Associates, Inc. USA. 11. Agarwal, S.K. 2002. <i>Biodiversity conservation</i>. Rohini Publishers, Jaipur. 12. Nautiyal, S and Kaul, A.K. 1999. <i>Forest Biodiversity and its conservation Practices in India</i>. Oriental Enterprises, Dehradun. 13. <i>Plantation Forestry</i> by R. KLuna 14. <i>Plantation Trees</i> by R.K.Luna 15. <i>Principles and practices of Silviculture</i> by L.S.Khanna 16. <i>Propagation Practice of Tree Improvement Indian Trees</i> By Ram Prakash, D.C. Chaudhary 17. <i>Plantation Forestry In tropics</i> by J.Evans 18. <i>Forestry in India</i> by A.P.Dwivedi 19. <i>A text book of Silviculture</i> by A.P.Dwivedi 20. <i>Principle and practice of silviculture</i> by L.S.Khanna 21. <i>A text book of silviculture</i> by A.P.Dwivedi 22. <i>Manual of silviculture</i> by W.M.Sunlich 		
Suggested Continuous Internal Evaluation (CIE) methods		
<p>Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.</p>		



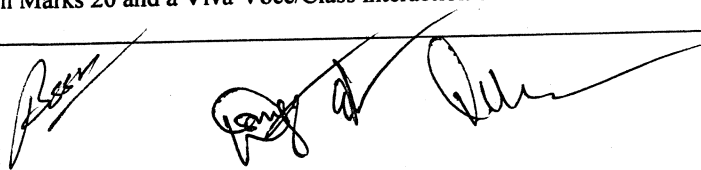
Programme: Diploma		Year: 2 nd	Semester: III
Subject: Forestry			
Course Code: FORB301T		Course Title: Principles of Silviculture, Plantation Forestry	
Course outcomes: After the completion of the course the students will be able to: <ol style="list-style-type: none"> It will impart the professional knowledge of forestry in students and can be so that can be absorbed in different sectors, i.e., private, public, NGOs and other organization. The student will be able to use forestry knowledge in the management of forest resources and development of forest stands through their knowledge and practical skills. 			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction, definition, and scope of silviculture; Objects of silviculture; Form and growth of trees; Tree morphology: stem, root system, form of roots, adaptability, mycorrhiza, lignotubers and root nodules; Tree growth: stages of growth, phenology, germination and establishment; Seasonal progress of growth; Height and diameter growth.		10
Unit II	Forest Regeneration: Introduction, definition and types of regeneration; Natural regeneration: Definition, methods of natural regeneration (from seeds and vegetative parts); Seed production; Seed dispersal; Seed germination; Seedling establishment; Germination by root suckers and coppice;		10
Unit III	Artificial regeneration: Definition and objectives; Essential preliminary considerations (choice of species, site selection, composition of plantation, choice of sowing, planting staff and labour); mechanization operations (soil preparation, ploughing, harrowing, ridging, pit digging, transport of items, protection from fire and irrigation); Assisted Natural Regeneration (ANR).		
Unit IV	Forest types of India; Classification of silviculture systems, management; Clear felling system, shelter wood system, uniform system, group system, irregular shelter wood system, strip system, selection system, group selection system, accessory system, coppice system and coppice selection system and coppice with standard system.		10
Unit V	Silviculture of importance tree species; Silvicultural characteristics; Phenology and regeneration; Growth, management and economic of Conifers: <i>Abies pindrow</i> , <i>Picea smithiana</i> , <i>Cedrus deodara</i> , <i>Pinus</i> species and Broadleaf species: <i>Quercus</i> species, <i>Acacia catechu</i> , <i>Acacia nilotica</i> , <i>Dalbergia sissoo</i> , <i>Shorea robusta</i> , <i>Eucalyptus</i> species, <i>Populus</i> species, <i>Tectona grandis</i> , <i>Casuarina equisetifolia</i> and Bamboo species.		5
Unit VI	Introduction and definitions of forest and plantation, objectives, concept, scope and importance; Types of forest plantations: Commercial, industrial, production, protection, social forestry and agroforestry; Introduction, definition, importance of nursery; Types of nursery; Nursery bed preparation; Containers and its types;		5
Unit VII	Seedlings development; Planting stock (seedlings with naked roots, and seedling with ball of earth); Planting and pattern of planting; Stump planting; Beating up; Singling; Season of planting (monsoon, pre monsoon, winter and spring).		5
Unit VIII	Plantation organization and structure; Nursery and plantation site development; Nursery and plantation layout; Planting materials; Seeds and vegetative parts and their collections from different provenances/sites/agencies/forest research institutes/centres; Seed source and seed orchards; Storage techniques of seeds and other vegetative parts.		5

Suggested Readings:

1. *Principles and practices of Silviculture* by L.S.Khanna
2. *Propagation Practice of Tree Improvement Indian Trees* By Ram Prakash, D.C. Chaudhary
3. *Plantation Forestry In tropics* by J.Evans
4. *Forestry in India* by A.P.Dwivedi
5. *A text book of Silviculture* by A.P.Dwivedi
6. *Principle and practice of silviculture* by L.S.Khanna
7. *A text book of silviculture* by A.P.Dwivedi
8. *Manual of silviculture* by W.M.Sunlich
9. *Silviculture* by R.D.Nyland
10. *The practices of silviculture* by D.M.Smith
11. *Theory and practice of Indian silvicultural systems* by L.S.Khanna
12. *Siviculture of important Indian trees* by R.S. Troup

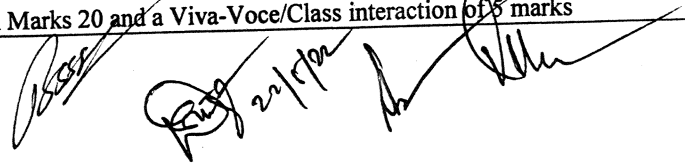
Suggested Continuous Evaluation Methods:**Total marks: 25**

One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks



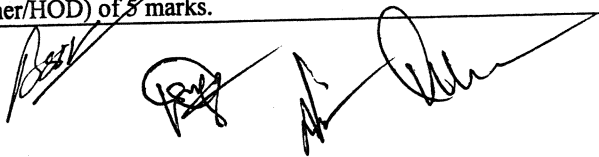
Programme: Diploma		Year: 2nd	Semester: III
Subject: Forestry			
Course Code: FORB 302P		Course Title: Principles of Silviculture, Plantation Forestry	
Course outcomes: After the completion of the course the students will be able to Forestry is one of the professional subjects which was introduced in the country and elsewhere due to various reasons depletion, deforestation and climate change as well as increased needs of plant product in nation and community development.			
Credits: 2		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2			
Practical	Suggested Lab /Virtual Experiment		Lectures
	1. Identification of Forest (Local/regional) Tree Species 2. Study of tree morphology for forms growth and root systems. 3. Phenology and silviculture characteristics of selected tree species. 4. Germination of plants from seeds/ vegetative parts. 5. Identification of mycorrhizal association of tree species. 6. Silviculture Systems. 7. Tending Operations. 8. Collection and storage techniques of tree seeds/vegetative parts. 9. Preparation techniques of seedlings for above tree species. 10. Spacing and number of plants in a unit area. 11. Pit digging techniques and mulching methods. 12. Tree species used for energy/fuel wood. 13. Tree species in paper, ply wood and match industries. 14. Selection of tree species planted in different problematic sites.		60
Suggested Readings: 1. <i>Principles and practices of Silviculture by L.S.Khanna</i> 2. <i>Propagation Practice of Tree Improvement Indian Trees By Ram Prakash, D.C. Chaudhary</i> 3. <i>Plantation Forestry In tropics by J.Evans</i> 4. <i>Forestry in India by A.P.Dwivedi</i> 5. <i>A text book of Silviculture by A.P.Dwivedi</i> 6. <i>Principle and practice of silviculture by L.S.Khanna</i> 7. <i>A text book of silviculture by A.P.Dwivedi</i> 8. <i>Manual of silviculture by W.M.Sunlich</i> 9. <i>Silviculture by R.D.Nyland</i> 10. <i>The practices of silviculture by D.M.Smith</i> 11. <i>Theory and practice of Indian silvicultural systems by L.S.Khanna</i> 12. <i>Silviculture of important Indian trees by R.S.Troup</i>			
Suggested Continuous Internal Evaluation (CIE) methods			
Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.			

Programme: Diploma		Year: 2 nd	Semester: IV
Subject: Forestry			
Course Code: FORB 401T		Course Title: Forest Botany and Taxonomy, Ethno medicine & Photochemistry of Medicinal and Aromatic Plants	
Course outcomes: After the completion of the course the students will be able The student will be able to use forestry knowledge in the management of forest resources and development of forest stands through their knowledge and practical .			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Tools & software in plant identification- delta internet directory for botany. Ecology and biology of plant resources of medicinal value;		5
Unit II	Medicinal and aromatic plant diversity in the Indian gene center; Plant exploration, introduction and exchange.		5
Unit III	Conservation of medicinal and aromatic plants;		5
Unit IV	Its techniques: In situ, ex- situ and biotechnological; Evaluation and breeding techniques of important medicinal and		5
Unit V	aromatic plants: <i>Picrorhizakurrooa</i> , <i>Swertiachirayita</i> , <i>Valerianajatamasi</i> , <i>Viola</i> species, <i>Gloriosasuperba</i> , <i>Rauwolfiaserpentina</i> , <i>Plantagoovata</i> , <i>Cassia angustifolia</i> , <i>Ocimum sanctum</i> , <i>Withaniasomnifera</i> .		10
Unit VI	Distinctiveness, uniformity and stability testing; Drug descriptors for medicinal and aromatic plants .		10
Unit VII	Cultivation of commercially importance medicinal and aromatic plants: <i>Picrorhizakurrooa</i> , <i>Aconitum heterophyllum</i> , <i>Podophyllumhexandrum</i> , <i>Swertia</i>		10
Unit VIII	Cultivation of commercially importance medicinal and aromatic plants: <i>chirayita</i> , <i>Valerianajatamanshi</i> , <i>Asparagus recemosus</i> , <i>Phyllanthusemblica</i> , <i>Terminaliachebula</i> , <i>Terminaliabellirica</i> and <i>Rheum emodi</i>		10
Suggested Readings: <ol style="list-style-type: none"> 1. <i>Endangered Medicinal plants</i> by A.B. Chaudhari 2. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume I) 3. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume II) 4. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume III) 5. <i>Cultivation and utilization of medicinal plants</i> by C.K. Atul and B.K. Kapur 6. <i>Glossary of Indian medicinal plants</i> by R.N. Chopra, S.L. Nayar and I.C. Chopra 7. <i>Applied Ethnobotany: People, Wild Plant Use and Conservation</i> by A. Cunningham 8. <i>Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction</i> by EIRI Board 9. <i>Ethnobotany. Principles and applications</i> by C.M. Cotton 			
Suggested Continuous Evaluation Methods:			
Total marks: 25 One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc. (as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks			



 22/1/20

Programme: Diploma		Year: 2nd	Semester: IV
Subject: Forestry			
Course Code: FORB 402P		Course Title: Commercial Botany & Phytochemical Analysis	
Course outcomes: After the completion of the course the students will be able to: <ul style="list-style-type: none"> • It will inculcate the forestry knowledge and practical skill among the students for diagnosis and analysis of existing problems in the field of forest and environmental development 			
Credits: 2		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2			
Practical	Suggested Lab /Virtual Experiment		Lectures
	<ol style="list-style-type: none"> 1. Identification of different medicinal and aromatic plants. 2. To visit the nearby medicinal and aromatic plant nurseries. 3. To study the different regeneration techniques. 4. Field visit to different regions to gain ethno botanical knowledge and the inter-relation between plant and people. 5. Survey and identification of plants used by the local people for medicine, food and other social purposes. 6. Collection and preparation of herbarium specimens of the above plants. 7. Harvesting and oil extraction of aromatic plants. 		60
Suggested Readings: <ol style="list-style-type: none"> 1. Endangered Medicinal plants by A.B. Chaudhari 2. Medicinal plants of Uttarakhand by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume I) 3. Medicinal plants of Uttarakhand by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume II) 4. Medicinal plants of Uttarakhand by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume III) 5. Cultivation and utilization of medicinal plants by C.K. Atul and B.K. Kapur 6. Glossary of Indian medicinal plants by R.N. Chopra, S.L. Nayar and I.C. Chopra 7. Applied Ethnobotany: People, Wild Plant Use and Conservation by A. Cunningham 8. Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction by EIRI Board 			
Suggested Continuous Internal Evaluation (CIE) methods			
Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.			



Programme: Bachelor of Science		Year: 3 rd	Semester: V
Subject: Forestry			
Course Code: FORB 501T		Course Title: Forest Mensuration & Remote Sensing and GIS	
Course outcomes: <ul style="list-style-type: none"> • After the completion of the course the students will be able to: • Students having knowledge, education, practical skill of forestry will be eligible for competitive examinations and can seek employment in different Sectors, i.e., Private, Public NGOs and Research Institute/Organization. 			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Forest mensuration; Definition and objectives; Scales of measurement; Units of measurements; Precision, bias and accuracy		5
Unit II	. Diameter and girth measurements; Breast height measurements; Instruments used; Measurement of height; Definitions; Methods of measurement of height ocular; Non instrumental and instrumental methods; Sources of error in height measurements leaning trees		5
Unit III	Tree stem form; Metzger's theory; Form factor; Types of form factor; Form height for quotient; Form class; Volume measurements of standing trees, logs and branch wood; Formulae involved		10
Unit IV	Definitions; Volume tables; Preparation of volume tables; Graphical method; Regression method. Determination of growth of trees; Increment; CAI and MAI; Increment percent; Increment borer; Stump analysis; Stem analysis; Measurement of tree crops; Crop diameter; Crop height; Crop age; Crop volume.		10
Unit V	Introduction, definition and importance of remote sensing; Basic of remote sensing; Platform and sensor remote sensing (active and passive system).		10
Unit VI	Remote sensing satellite, image and ground truth; Systems for data collection and analysis		
Unit VII	GIS: Basic concept, tools and components; GIS application in forestry; GPS and its uses; Advantages of RS and GIS in future prospect.		10
Unit VIII	Collection, storage, analysis, data and information of forest resources through remote sensing; Software used in remote sensing and GIS.		10
Suggested Readings: <ol style="list-style-type: none"> 1. <i>Forest Mensuration and Biometry</i> by A. N. Chaturvedi and L.S.Khanna 2. <i>Forest mensuration: A Handbook for Practitioners</i> by Forestry Commission Publications 3. <i>Forest Mensuration</i> by B. Husch, T.W. Beers and Kershaw 4. <i>2007. Forest Mensuration</i> by V.A. Laar and A.Akka 5. <i>Indian Forestry</i> by K. Manikandan and S.Prabhu 6. <i>Tree and Forest Measurement</i> by P.W.West 7. <i>Forest Mensuration</i> by C. Husch, C.I. Miller and T.W.Beers <i>GIS Fundamentals Applications and Implementations</i> by K. Elangovan 8. <i>Fundamentals of Remote Sensing</i> by George Joseph. 9. <i>Remote Sensing of the Environment: An Earth Resource Perspective</i> by J.R. Jensen 10. <i>Remote Sensing and Image Interpretation</i> by T. Lillesand, R.W. Kiefer and J. Chipman 11. <i>Remote Sensing: Principles and Interpretation</i> by F.F. Sabins 12. <i>Text Book of Remote Sensing and Geographic Information Systems</i> by K.C. Sahu 			
Suggested Continuous Evaluation Methods:			
Total marks: 25 One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks			

(34)

Programme: Bachelor of Science		Year: 3 rd	Semester: V
Subject: Forestry			
Course Code: FORB 502T	Course Title: Principles of Agroforestry & Forest statistics & Experimental Designs.		
Course outcomes: After the completion of the course the students will be able to: The course objective is to impart forestry education and knowledge and to develop skill in the students so that they could be able in the management of forest resources in the state and other parts of the country. The forestry course will provide the expertise of conservation and development of forests as well as develops skill in the graduate and post graduate students so that forest resources could not be depleted further from their natural growing habitats due the unscientific and illegal extraction of forest resources for different uses.			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction, definition, objectives, scope and importance of agroforestry and social forestry; History of agroforestry, traditional practices of agroforestry; Choice and characteristics of species for agroforestry; Multipurpose tree (MPTs) in Agroforestry; Potential and constrains of agroforestry systems.		10
Unit II	Agroforestry systems: Forest based agroforestry systems, agriculture-based agroforestry systems, and pasture-based agroforestry systems; Shifting cultivation; Taungya system; Alley cropping; Home gardens; Agri- silvicultural system; Agri-silvipastoral system ; Agri-horticultural system; Agri-horti-pastoral system; Tree-crop interaction.		10
Unit III	Diagnosis and design techniques; Socio-economic and ecological aspect of Agroforestry; Economic aspects of agroforestry; Cost, benefit, benefit-cost ratio; Land equivalent ratio (LER); Protein banks; Fodder species; Lopping cycle; Fodder values of trees; Alley cropping/hedge cropping; Ecological aspects of agroforestry; Species diversity of plant components; Soil fertility and Productivity aspect; Soil and water conservation aspects in Agroforestry.		10
Unit IV	Management of trees in agroforestry; Important tree species of agroforestry systems: Eucalyptus, poplar, Gmelina, Bamboo etc; Legume trees species: Subabul, Causaurina, Sesbenia, Grewia, Kachnar, Celtis, Ficusetc and Important fruit plants; Farm crops; Cereals: wheat, maize, rice, millets etc; Pulses: gram, pea, soyabean, urad, moong, arhar, lentil etc; Medicinal and aromatic plants; Spices; Vegetables and Grasses: Barseem (<i>Trifoliumalexandrinum</i>), Paragrass (<i>Bracheriamutica</i>), Napier (<i>Penecitumperpureaum</i>), Sorghum (<i>Sorghum vulgare</i>) and other farm crops used as grasses.		10
Unit V	Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data; Construction of frequency distribution, tables – graphic presentation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average and measures of location, mean, mode, median for raw and grouped data.		5
Unit VI	Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data; sampling, basic concepts, sampling vs. complete enumeration parameter and static, sampling methods,.		5
Unit VII	Regression, fitting of sample linear regression, tests of significance of correlation and regressions-efficient;		5
Unit VIII	Analysis of variance-assumptions-construction of ANOVA table– conclusions based on ANOVA; Comparisons based on means-critical difference, Completely and Randomized design-Layout, analysis, advantages and limitations; Randomized block design-layout, analysis, choice of no. of blocks, advantages and limitations; Latin square designs- layout, analysis, applications, advantages and limitations.		5

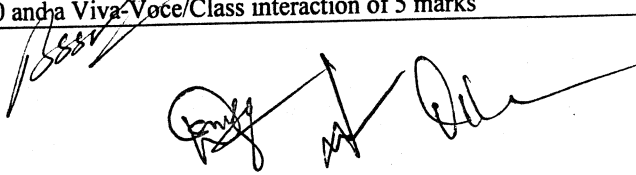
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Suggested Readings:

1. *Statistical Theory in Research* by R.L Anderson and Bancroft
2. *Experimental designs* by W.G Cochran and G.M.Cox
3. *Design and Analysis of Experiments* by M.N. Das and N.CGiri
4. *Experimental Design* by W.T. Federer and Macmillan
5. *Statistical Procedures for Agricultural Research* by K.A. Gomez and A.A Gomez
6. *The design and analysis of experiments* by O.Kemphorne
7. *Agroforestry* by A.P.Dwivedi
8. *An introduction of Agroforestry* by P.K.R.Nair
9. *Textbook of Agroforestry* by D.S. Chundawat and S.K.Gautam
10. *Agroforestry hand book* by S.S.Negi
11. *Agroforestry: theory and practices* by A.J. Raj and S.B.Lal
12. *Manual by Agroforestry and social forestry* by M.L. Sen, R.C. Dadheech and L.K. Deshora
13. *Perspective of social forestry* by B.L. Sharma and R.L. Vishnoi
14. *Principles and practices of socialcum community forests* by V.N.Prasad

Suggested Continuous Evaluation Methods:**Total marks: 25**

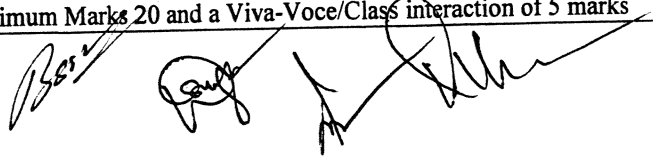
One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks



Programme: Bachelor of Science		Year: 3 rd	Semester: V
Subject: Forestry			
Course Code: FORB 503P	Course Title: : Forest Mensuration & Biometry, Agroforestry D&D, Remote Sensing and GIS, Experimental Designs.		
<p>Course outcomes: After the completion of the course the students will be able to: The forestry course will provide the expertise of conservation and development of forests as well as develops skill in the graduate and post graduate students so that forest resources could not be depleted further from their natural growing habitats due the unscientific and illegal extraction of forest resources for different uses.</p>			
Credits: 2		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2			
Practical	Suggested Lab /Virtual Experiment		Lectures
	<ol style="list-style-type: none"> 1. Determination of length, measurements of diameter, girth and basal area of trees using callipers, tape, ruler, penta prism, treecalliperetc. 2. Measurement of height using non instrumental method. 3. Preparation and use of simple height measuring instruments: Christens hypsometer, Smithies hypsometer. 4. Measurement of tree height using instrumental methods: Ravi Altimeter, Abney's level, Haga altimeter, relaskop, clinometer, blumeleiss, hypsometer, laser hypsometer. 5. Volume determination of standing and felled trees. 6. Exercise on stump analysis. 7. Exercise on stem analysis, annual ring counting using ringborer 8. Preparation of volume tables and local volume table. Uses of various photo-grammetry instruments. 9. Ground truthing and satellite images. 10. GPS data collection. 11. Hands on practice on remote sensing and GIS software. 12. Visual and digital interpretation of satellite image. 13. Recognition and identification of objects on photography, compilation of maps and their interpretation. 14. Introduction of various agroforestry systems prevailing in the region. 15. Identification of major tree species used in agroforestry practices. 16. Characteristics of multipurpose tree species used in agroforestry. 17. Various D&D techniques of agroforestry Formation of frequency distribution. Diagrammatic and graphic representation. Calculation of different measures of central tendency. 18. Computation of various measures of dispersion. 19. Analysis of variance-construction of ANOVA table of one-way classified data. Analysis of variance-construction of ANOVA table of two-way classified data. 		60
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 1. <i>Forest Mensuration and Biometry</i> by A. N. Chaturvedi and L.S.Khanna 2. <i>Forest mensuration: A Handbook for Practitioners</i> by Forestry CommissionPublications 3. <i>Forest Mensuration</i> by B. Husch, T.W. Beers andKershaw 4. 2007. <i>Forest Mensuration</i> by V.A. Laar and A.Akca 5. <i>Indian Forestry</i> by K. Manikandan and S.Prabhu 6. <i>Tree and Forest Measurement</i> by P.W.West 7. <i>Forest Mensuration</i> by C. Husch, C.I. Miller and T.W.Beers <i>Agroforestry</i> by A.P. Dwivedi 8. <i>An introduction of Agroforestry</i> by P.K.R. Nair 9. <i>Textbook of Agroforestry</i> by D.S. Chundawat and S.K. Gautam 10. <i>Agroforestry hand book</i> by S.S. Negi 11. <i>Agroforestry: theory and practices</i> by A.J. Raj and S.B. Lal 			
Suggested Continuous Internal Evaluation (CIE) methods			
<p>Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD of 5 marks.</p>			



Programme: Bachelor of Science		Year: 3 rd	Semester: VI
Subject: Forestry			
Course Code: FORB 601T	Course Title: Forest Protection , Tree improvement & Biotechnology, Application of biotechnology in Forestry		
Course outcomes: After the completion of the course the students will be able to: This course also provides the skills and professional knowledge to the students for combating the growing problems of climate change, environment degradation and loss of biodiversity of state and other areas of the country.			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25		Min. Passing Marks CIE : 09	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination : 26	
Total Max. Marks: 100		Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction of forest pathology and forest entomology; Introduction of various plants pathogens: Fungi, bacteria, viruses etc; Symptomatology and identification of plant diseases.		10
Unit II	Classification of forest tree diseases and their control; Common diseases in forest trees: Root rot, heart rot, wilt, stem canker, stem rust, die-back, galls, leaf spots, leaf blight, powdery mildew and leaf rust; Nursery diseases;		10
Unit III	Diseases caused by phanerogamic plant parasite like <i>Dendrophthoe</i> , <i>Acanthobium</i> , <i>Loranthus</i> etc; Principles of tree diseases control: Cultural, chemical and biological control methods.		10
Unit IV	Protection against injuries to plants by defoliating, sap sucking and mites; shoot, twig, root, seed, cone, wood boring insects and gall markers;		10
Unit V	Methods of control against insects and pests: Silvicultural, biological and chemical Forest fire; Encroachment; Shifting cultivation; Illicit felling; Grazing/ browsing		2
Unit VI	General concept of forest tree breeding, tree improvement and forest genetics; Reproduction in forest trees, dimorphism pollination mechanisms; Pollen dispersion distance, pollinators and their energetic; Attractants for pollinators; Pollen handling forced flowering for seed orchard manipulation; Pollination mechanisms; Variation in trees importance and its causes.		8
Unit VII	Natural variation as a basis for tree improvement; Geographic variations: Ecotypes, clines, races and land races; Selective breeding methods: Mass, family, within family, family plus within family; Plus tree selection for wood quality,		5
Unit VIII	Disease resistance and agroforestry objectives; Selection strategies and choice of breeding methods and progression selective breeding in forest trees; Indirect selection for biotic and abiotic stresses; Progeny and clone testing.		5
Suggested Readings:			
<ol style="list-style-type: none"> 1. Forest protection by L.S.Khanna 2. Hand book of forest protection by S.S.Negi 3. Forest Entomology by K.C.Joshi 4. Forest fire by S.S.Negi Forest Genetics by T.L. White, W.T. Adams and D.B. Neale 5. Text book of Forest Tree Breeding by C. Surendran, R.N. Sehgal and M. Parmathma 6. Introduction to Forest Genetics by Wright 7. Applied Forest Tree Improvement by B. Zobel and J. Talbert 8. Principles of Genetics by E.J. Garner, M.J. Simmons and P.D. Sunstad 9. Cytogenetics by P.K. Gupta 			
Suggested Continuous Evaluation Methods:			
Total marks: 25			
One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks			



Programme: Bachelor of Science		Year: 3rd	Semester: VI
Subject: Forestry			
Course Code: FORB 602T		Course Title: Forest Utilization(Timber and Non-Timber) and Forest Economics	
Course outcomes: After the completion of the course the students will be able to: <ul style="list-style-type: none"> • Student having knowledge and research in different environmental and social aspect of forestry which will be beneficial for human as well as other organism. • Create, select, and apply appropriate techniques, resources, and modern technology in assessment and process to enrich professional practice 			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction, Definition, scope and importance of forest utilization; Important forests products: Major timber, non timber products, fuel wood;		10
Unit II	Agriculture implements; Small timber and classification of minor forest produce: Grass oil, seed oil, tans and dyes, gum, resin, rubber,		5
Unit III	Fibre and flosses, grasses, katha and cutch, latex, nuts, bead seeds, leaves, honey, wax, animals products, minerals and other miscellaneous products.		5
Unit IV	Logging practices: Felling, extraction, season of felling, method of felling and conversion and tools used in forest logging;		10
Unit V	Transportation: Major and minor transportation; Storage and depots; Management and disposal of timber.		10
Unit VI	Introduction, definitions, objectives and scope of forest economics; Application of microeconomics in solving forest resource problems; Emphasis on forest products;		10
Unit VII	Demand and supply; Production theory; Forest products marketing; Forest capital theory; Concept of cost and benefits; Trade of timber and non-timber forest products(NTFP's).		5
Unit VIII	Valuation of NTFFPs and non-market goods and economics; Ecosystem services and market-based mechanism; Forest certification, sustainability Analysis and SWOT Analysis; Role of forest economics in public, private and community level.		5
	Suggested Readings: 1. <i>Forest Utilization FRI Publication</i> 2. <i>A handbook of forest utilization by T. Mehta</i> 3. <i>Forest product and their utilization by S.S. Negi</i> 4. <i>Forest: the non-wood resources by A.P. Dwivedi</i> 5. <i>Forestry for Economic development by M.M. Pant</i> 6. <i>Forest Economics: Principle and Application by J. C. Nautiyal</i>		
Suggested Continuous Evaluation Methods:			
Total marks: 25			
One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks			

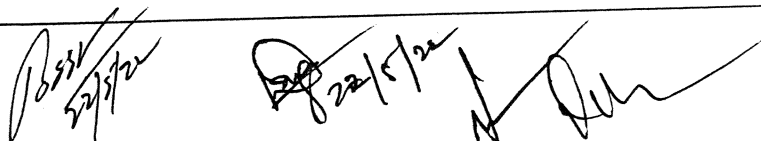
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Programme: Bachelor of Science		Year: 3rd	Semester: VI
Subject: Forestry			
Course Code: FORB 603P		Course Title : Collection of Timber and Non-Timber and Forest Economics & Project Evaluation, Micro-Propagation Techniques.	
Course outcomes: After the completion of the course the students will be able to: <ul style="list-style-type: none">• Use signal processing concepts and tools to provide solutions to real time problems.• Understand the impact of climate change and GHG on environmental sustainability, demonstrate the knowledge and need for sustainable development of the Earth.• Apply the fundamentals and practical knowledge to solve the complex forestry problems.			
Credits: 2		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2			
Practical	Suggested Lab /Virtual Experiment		Lectures
	<ol style="list-style-type: none">1. Identification and symptoms of different forest tree diseases.2. Various pathogenic and non-pathogenic disease of forest tree species.3. Forest fire and their types.4. Various disease of Sal, Shisham, Teak, Chir, Deodar, Eucalyptus and Khair.5. Various insects of Sal, Shisham, Teak, Chir, Deodar, Eucalyptus and Khair. Observation of modes pollination and reproduction in forest trees.6. Estimation pollen viability and controlled pollination experiment.7. Field practice in emasculation, crossing and selfing in local plants.8. Manipulation of flowering through hormonal application.9. Identification of ecotypes, races and land-races in natural forest.10. Marking of candidate trees, plus trees and elite trees.11. Induction of polyploidy through colchicines treatment.12. Successful case studies of tree breeding.13. Visit to seed orchard. Identification and uses of various (local) NTFP's.14. Extraction of grass oil, distillation unit.15. Extraction method of lac cultivation.16. Extraction method of resin and rosin.17. To visit the cutch and katha industries.18. To visit the pulp and paper industries.19. To visit the different timber depot.20. To determine the SWOT analysis.21. To determine the demand and supply curve.22. Law of equilibrium.		60
	Suggested Readings: <ol style="list-style-type: none">7. <i>Forest Utilization</i> FRIPublication8. <i>A handbook of forest utilization</i> by T.Mehta9. <i>Forest product and their utilization</i> by S.S.Negi10. <i>Forest: the non-wood resources</i> by A.P.Dwivedi11. <i>Forestry for Economic development</i> by M.M.Pant12. <i>Forest Economics: Principle and Application</i> by J. C.Nautiyal		
Suggested Continuous Internal Evaluation (CIE) methods			
Total marks: 25 One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.			

Minor / Elective Course Syllabus
SUBJECT : FORESTRY
DEPARTMENT OF FORESTRY
FACULTY OF LIFE SCIENCE
For OTHER FACULTY UNDER GRADUATE STUDENTS

Appendix-3
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Year : First (I)		Semester : Second (II)	
Minor/Elective		Forestry	
Course Code: FORB201T		Course Title: Forest Ecology, Wild Life Management & Ecotourism	
Course outcomes: After the completion of the course the students will be able to: <ol style="list-style-type: none"> In the country it is second major land resources but as per the National Forest Policy the forest should be 1/3rd (33%) forest area but the area is 10% less. To produce competent professional by imparting quality education to meet the industry requirements and for serving the societal needs. Conservation and Scientific Management of the natural resources of the state/country by training forestry students & Gain Knowledge about the economic values of this lower group of plant community 			
Credits: 4		Minor / Elective	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Theory	Topics		Lectures
Unit I	Introduction and definition of ecology; Types of ecology; Forest ecology: Definition and its importance in forest ecosystem management; Introduction, structure and components of ecosystem; Types of ecosystem: Forest, grassland, desert and aquatic ecosystem; Ecological concept of ecosystem: Tropic structure, ecological pyramids, food chain, food web, and energy flow.		10
Unit II	Introduction, definition, scope and importance of biodiversity; Threats and conservation methods of biodiversity; Species composition, species diversity, forest population and forest community; Niche; Methods of forest vegetation analysis, biomass, productivity, litter fall, forest floor, biomass (standing state biomass), major nutrients (c, n, p, k), litter decomposition, nutrient cycling and nutrient use efficiency.		10
Unit III	Climatic factors: Light, atmospheric temperature, moisture, wind and their effects; Topographic factors: Altitude, slope, aspects and exposure and their effects; Edaphic factors: Soil, its formation, soil profile, physico-chemical properties of soil and their effects; Soil organic matter; C:N ratio; Mycorrhiza and its types; Soil microorganism; Biotic factors: Relation between plant and plant, plant and animal, plant and man and their influences; Competition, symbiotic association, parasites, epiphytes, climbers and weeds.		10
Unit IV	Forest composition, distribution and major forest type in India and world: Classification of forests (Champion and Seth, 1968); Forest area, forest cover, growing stock and carbon stock of forests in India (as per forest survey of India); Succession: Introduction, definition, causes and mechanism of succession; Types of succession and concept of climax.		10
Unit V	Participation of local people in ecotourism; Limitations and problems; World tourism organization; Problems with definition of ecotourism and criticisms; International organizations and NGOs promoting ecotourism; Sociological implications of eco-tourism.		5
Unit VI	Wild-life management- Definition, importance and concepts. Wild life management in relation to allied subjects, study of rare and threatened species, steps taken for their preservation.		5
Unit VII	Wild-life values and conflicts positive values Aesthetic, cultural, social etc. Introduction to biological and ecological base of management. Distribution and behavior including various environmental factors		5
Unit VIII	Factor affecting animal population, concept of age and sex structure (Mortality and natality). Ecology of wild life. Field observations and investigations. Census, Management Techniques		5



 22/5/22

Suggested Readings:

1. *Ecology, Environmental Science and Conservation* by J.S. Singh, S.P. Singh and S. R. Gupta
2. *Ecology and Environment* by P. D.Sharma
3. *Fundamental of Ecology* by E.P. Odum
4. *Concept of Ecology* by E.J.Kormondy
5. *Ecology* by M.P.Arora
6. *Ecology* by S.N.Jha
7. *Concept of Modern Ecology* by P.C.Tewari
8. *Indian forestry* by K.Manikandan
9. *Eco-tourism and livelihood* by A.K Bhattacharya
10. *Tourism, Environment and Man: Sustainable Tourism* by Brigadier and B.P.SKhati
11. *Tourism in india Challenges and Opportunities* by Ruchi Ramesh and Sudhir KumarSingh
12. Gaston, K.J and Spicer, J.I. 2004. *Biodiversity: An Introduction*. Blackwell Publishing Company. USA.
13. Richard. B. Primack. 1998. *Essentials of conservation biology*. Sinauer Associates, Inc. USA.
14. Agarwal, S.K. 2002. *Biodiversity conservation*. Rohini Publishers, Jaipur.
15. Nautiyal, S and Kaul, A.K. 1999. *Forest Biodiversity and its conservation Practices in India*. Oriental Enterprises, Dehradun.
16. R. Umashaanker *et.al.* 2001. *Forest Genetic Resources*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
17. Ian. F. Spellberg. 1992. *Evaluation and Assessment for Conservation*. Chapman Hall, London. UK.
18. David, E.B. and Joel, T.C., 2003. *Monitoring Ecosystems*. Island Press. Washington, DC
19. Stanley, A.H., 2002. *Managing our wildlife resource*. Printice-Hall. USA.
20. Benson, E.E., 1999. *Plant conservation Biotechnology*. Taylor and Francis Ltd. London.
21. Agrawal, K.C., 2000. *Wildlife of India: Conservation and Management*.Nidhi Publishers. India
22. Dunbar, A.A., (Eds: Reprinted from BNHS). *The preservation of wildlife in India*. Daya Publishing House, New Delhi.
23. Sinha, P.C., 1998. *Wildlife and forest conservation*. Anmol Publication Pvt. Ltd, New Delhi.
24. Edward, O.G., 2004. *Ex situ plant conservation*. Isaland Press, Washington, DC

Suggested Continuous Evaluation Methods:

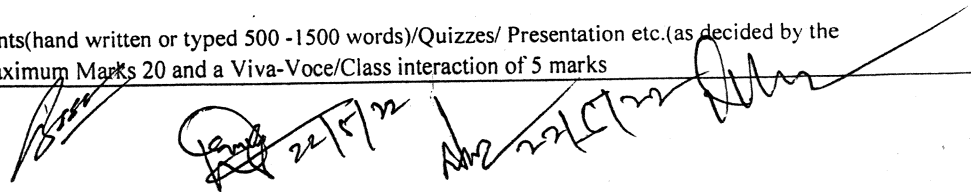
Total marks: 25

One Test/Assignments(hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks

Minor / Elective Course Syllabus
Subject : FORESTRY
DEPARTMENT OF FORESTRY
FACULTY OF LIFE SCIENCE
For OTHER FACULTY UNDER GRADUATE STUDENTS

42

Year: Second (2)		Semester : Fourth (IV)
MINOR/ELECTIVE	Forestry	
Course Code: FORB 401T	Course Title: Forest Botany and Taxonomy, Ethno medicine & Photochemistry of Medicinal and Aromatic Plants	
Course outcomes: After the completion of the course the students will be able The student will be able to use forestry knowledge in the management of forest resources and development of forest stands through their knowledge and practical.		
Credits: 4	MINOR/ELECTIVE	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE : 09 Min. Passing Marks End Semester Examination : 26 Total Min. Passing Marks : 35	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Theory	Topics	Lectures
Unit I	Tools & software in plant identification- delta internet directory for botany. Ecology and biology of plant resources of medicinal value;	5
Unit II	Medicinal and aromatic plant diversity in the Indian gene center; Plant exploration, introduction and exchange.	5
Unit III	Conservation of medicinal and aromatic plants;	5
Unit IV	Its techniques: In situ, ex- situ and biotechnological; Evaluation and breeding techniques of important medicinal and	5
Unit V	aromatic plants: <i>Picrorhiza kurrooa</i> , <i>Swertia chirayita</i> , <i>Valeriana jatamasi</i> , <i>Viola</i> species, <i>Glorio sasuperba</i> , <i>Rauwolfia serpentina</i> , <i>Plantago ovata</i> , <i>Cassia angustifolia</i> , <i>Ocimum sanctum</i> , <i>Withania somnifera</i> .	10
Unit VI	Distinctiveness, uniformity and stability testing; Drug descriptors for medicinal and aromatic plants.	10
Unit VII	Cultivation of commercially importance medicinal and aromatic plants: <i>Picrorhizakurrooa</i> , <i>Aconitum heterophyllum</i> , <i>Podophyllumhexandrum</i> , <i>Swertia</i>	10
Unit VIII	Cultivation of commercially importance medicinal and aromatic plants: <i>chirayita</i> , <i>Valeriana jatamanshi</i> , <i>Asparagus recemosus</i> , <i>Phyllanthus emblica</i> , <i>Terminalia chebula</i> , <i>Terminalia bellirica</i> and <i>Rheum emodi</i>	10
Suggested Readings: <ol style="list-style-type: none"> 1. <i>Endangered Medicinal plants</i> by A.B. Chaudhari 2. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume I) 3. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume II) 4. <i>Medicinal plants of Uttarakhand</i> by K.P. Singh, Anuj Kumar and Upendra Kumar (Volume III) 5. <i>Cultivation and utilization of medicinal plants</i> by C.K. Atul and B.K. Kapur 6. <i>Glossary of Indian medicinal plants</i> by R.N. Chopra, S.L. Nayar and I.C. Chopra 7. <i>Applied Ethnobotany: People, Wild Plant Use and Conservation</i> by A. Cunningham 8. <i>Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction</i> by EIRI Board 9. <i>Ethnobotany. Principles and applications</i> by C.M. Cotton 		
Suggested Continuous Evaluation Methods:		
Total marks: 25 One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc. (as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks		



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DEPARTMENT OF FORESTRY
B.Sc. (in Faculty of Life Science)
Syllabus of Compulsory Co-curricular Courses
Under NEP-2020

SEMESTER WISE PAPER TITLES WITH DETAILS

Semester	Course Code	Paper title	CIE	End Semester Examination	Total	Credits	Teaching hours
B. SC. 1ST YEAR OR CERTIFICATE							
I	CCB101	Food and Nutrition	25	75	100	2	30
II	CCB201	Health and Hygiene	25	75	100	2	30
B. SC. 2ND YEAR OR DIPLOMA							
III	CCB301	Human Values and Environment studies	25	75	100	2	30
IV	CCB401	Physical Education and Yoga	25	75	100	2	30
B. SC. 3RD YEAR OR Degree in Bachelor of Science (in Faculty of Life Science)							
V	CCB501	Analytic Ability and Digital Awareness	25	75	100	2	30
VI	CCB601	Communication Skills and Personality Development	25	75	100	2	30

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Syllabus of Compulsory Co-curricular Courses for
B.Sc. (in Faculty of Life Science)

Co-curricular course: Semester-I
Course Title: Food and Nutrition

Year: First	Semester: First	
Course Code: CCB101	Course Title: Food and Nutrition	
Course outcomes: <ul style="list-style-type: none"> • To learn the basic concept of the Food and Nutrition • To study the nutritive requirement during special conditions like pregnancy and lactation • To learn meal planning • To learn 100 days Nutrition Concept • To study common health issues in the society • To learn the special requirement of food during common illness 		
Credits: 2	Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0		
Unit	Topics	No. of Lectures Total=30
I	Concept of Food and Nutrition (a) Definition of Food, Nutrients, Nutrition, Health, balanced Diet (b) Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition (c) Meal planning- Concept and factors affecting Meal Planning (d) Food groups and functions of food	8
II	Nutrients: Macro and Micro RDA, Sources, Functions, Deficiency and excess of (a) Carbohydrate (b) Fats (c) Protein (d) Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc (e) Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K (f) Water (g) Dietary Fibre	7
III	1000 days Nutrition (a) Concept, Requirement, Factors affecting growth of child (b) Prenatal Nutrition (0 - 280 days): Additional Nutrients' Requirement and risk factors during pregnancy (c) Breast / Formula Feeding (Birth – 6 months of age) (d) Complementary and Early Diet (6 months – 2 years of age)	8
IV	Community Health Concept (a) Common diseases prevalent in the society and its causes (b) National and International Program and Policies for improving Dietary Nutrition	7

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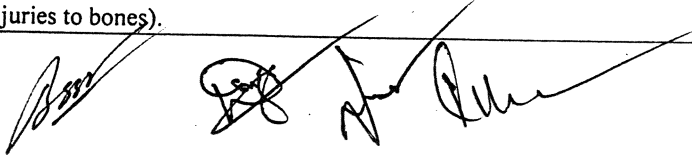
	<p>(c) Nutrition requirement in the following Diabetes Hypertension Obesity Constipation Diarrhea Typhoid</p> <p>(d) Immunity Boosting Food</p>	
<p>Suggested Readings:</p> <ol style="list-style-type: none">1. Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018.2. 1000Days-Nutrition_Brief_Brain-Think_Babies_FINAL.pdf3. https://pediatrics.aappublications.org/content/141/2/e201737164. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/		
<p>Suggested Continuous Internal Evaluation: Maximum Marks: 25 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks</p>		
<p>Suggested equivalent online courses: https://www.udemy.com/course/internationally-accredited-diploma-certificate-in-nutrition Diploma in Human Nutrition-Revised Offered by Alison</p>		

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Co-curricular Course: Semester-II
Course Title: Health and Hygiene

Year: First		Semester: II	
Course Code: CCB201		Course Title: Health and Hygiene	
Course outcomes:			
<ul style="list-style-type: none"> • Learn the skill needed to assess the ill or injured person. • Learn the skills to provide CPR to infants, children and adults. • Learn the skills to handle emergency child birth • Learn the Basic sex education help young people navigate thorny questions responsibly and with confidence. • Learn the Basic sex education help youth to understand Sex is normal. It's a deep, powerful instinct at the core of our survival as a species. Sexual desire is a healthy drive. • Help to understand natural changes of adolescence • Learn the skill to identify Mental Health status and Psychological First Aid 			
Credits: 2		Compulsory	
Max. Marks CIE: 25		Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100		Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0			
Unit	Topics		No. of Lectures Total=30
I	<p>A. Basic First Aid</p> <ul style="list-style-type: none"> • Aims of first aid & First aid and the law. • Dealing with an emergency, Resuscitation (basic CPR). • Recovery position, Initial top to toe assessment. • Hand washing and Hygiene • Types and Content of a First aid Kit <p>B. First AID Technique</p> <ul style="list-style-type: none"> • Dressings and Bandages. • Fast evacuation techniques (single rescuer). • Transport techniques. <p>C. First aid related with respiratory system</p> <ul style="list-style-type: none"> • Basics of Respiration. • No breathing or difficult breathing, Drowning, Choking, Strangulation and hanging, • Swelling within the throat, Suffocation by smoke or gases and Asthma. <p>D. First aid related with Heart, Blood and Circulation</p> <ul style="list-style-type: none"> • Basics of The heart and the blood circulation. • Chest discomfort, bleeding. <p>D. First aid related with Wounds and Injuries</p> <ul style="list-style-type: none"> • Type of wounds, Small cuts and abrasions • Head, Chest, Abdominal injuries • Amputation, Crush injuries, Shock <p>E. First aid related with Bones, Joints Muscle related injuries</p> <ul style="list-style-type: none"> • Basics of The skeleton, Joints and Muscles. • Fractures (injuries to bones). 		7



<p>II</p>	<p>F. First aid related with Nervous system and Unconsciousness</p> <ul style="list-style-type: none"> • Basics of the nervous system. • Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy. <p>G. First aid related with Gastrointestinal Tract</p> <ul style="list-style-type: none"> • Basics of The gastrointestinal system. • Diarrhea, Food poisoning. <p>H. First aid related with Skin, Burns</p> <ul style="list-style-type: none"> • Basics of The skin. • Burn wounds, Dry burns and scalds (burns from fire, heat and steam). • Electrical and Chemical burns, Sun burns, heat exhaustion and heatstroke. • Frost bites (cold burns), Prevention of burns, Fever and Hypothermia. <p>I. First aid related with Poisoning</p> <ul style="list-style-type: none"> • Poisoning by swallowing, Gases, Injection, Skin <p>J. First aid related with Bites and Stings</p> <ul style="list-style-type: none"> • Animal bites, Snake bites, Insect stings and bites <p>K. First aid related with Sense organs</p> <ul style="list-style-type: none"> • Basic of Sense organ. • Foreign objects in the eye, ear, nose or skin. • Swallowed foreign objects. <p>L. Specific emergency satiation and disaster management</p> <ul style="list-style-type: none"> • Emergencies at educational institutes and work • Road and traffic accidents. • Emergencies in rural areas. • Disasters and multiple casualty accidents. • Triage. <p>M. Emergency Child birth</p>	<p>6</p>
<p>III</p>	<p>Basic Sex Education</p> <ul style="list-style-type: none"> • Overview, ground rules, and a pre-test • Basics of Urinary system and Reproductive system. • Male puberty — physical and emotional changes • Female puberty — physical and emotional changes • Male-female similarities and differences • Sexual intercourse, pregnancy, and childbirth • Facts, attitudes, and myths about LGBTQ+ issues and identities • Birth control and abortion • Sex without love — harassment, sexual abuse, and rape • Prevention of sexually transmitted diseases. 	<p>9</p>
<p>IV</p>	<p>Mental Health and Psychological First Aid</p> <ul style="list-style-type: none"> • What is Mental Health First Aid? • Mental Health Problems in the India • The Mental Health First Aid Action Plan • Understanding Depression and Anxiety Disorders • Crisis First Aid for Suicidal Behavior & Depressive symptoms • What is Non-Suicidal Self-Injury? • Non-crisis First Aid for Depression and Anxiety • Crisis First Aid for Panic Attacks, Traumatic events • Understanding Disorders in Which Psychosis may Occur • Crisis First Aid for Acute Psychosis • Understanding Substance Use Disorder • Crisis First Aid for Overdose, Withdrawal • Using Mental Health First Aid 	<p>8</p>

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Suggested Readings:

- Indian First Aid Manual-<https://www.indianredcross.org/publications/FA-manual.pdf>
- Red Cross First Aid/CPR/AED Instructor Manual
- <https://mhfa.com.au/courses/public/types/youthedition4>
- Finkelhor, D. (2009). The prevention of childhood sexual abuse. Durham, NH: Crimes Against Children Research Center. www.unh.edu/ccrc/pdf/CV192.pdf
- Kantor L. & Levitz N. (2017). Parents' views on sex education in schools: How much do Democrats and Republicans agree? PLoS ONE, 12 (7): e0180250.
- Orenstein, P. (2016). Girls and sex: Navigating the complicated new landscape. New York, NY: Harper.
- Schwiengershausen, E. (2015, May 28). The Cut. www.thecut.com/2015/05/most-women-are-catcalled-before-they-turn-17.html
- Wiggins, G. & McTighe, J. (2008). Understanding by design. Alexandria, VA: ASCD.
- <https://marshallmemo.com/marshall-publications.php#8>

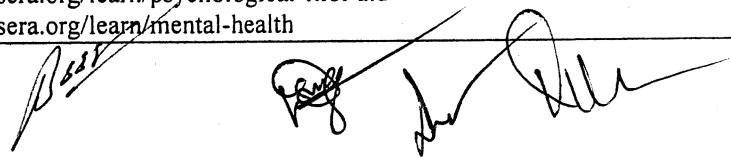
Suggested Continuous Internal Evaluation:

Maximum Marks: 25

One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

Suggested equivalent online courses:

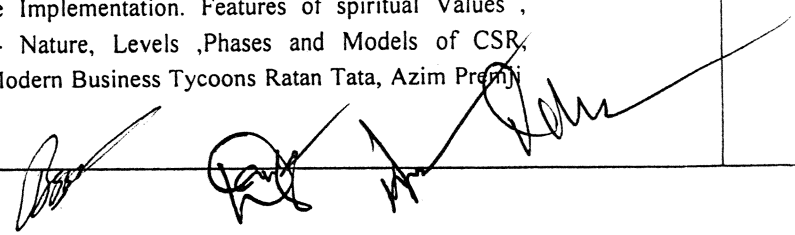
- <https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online>
- <https://www.firstaidforfree.com/>
- <https://www.coursera.org/learn/psychological-first-aid>
- <https://www.coursera.org/learn/mental-health>



Co-curricular Course: Semester-III

Course Title: Human Values and Environmental Studies

Year: Second	Semester: III	
Course Code: CCB301	Course Title: Human Values and Environmental studies	
<p>Course outcomes: The mission of the course on Human Values and Environmental Studies is to create morally articulate solutions to be truthful and just and to become responsible towards humanity. The course seeks to establish a continuous interest in the learners to improve their thought process with intent to develop a new generation of responsible citizens capable of addressing complex challenges faced by the society due to disruptions in human interactions effecting human values. This course works towards</p> <ul style="list-style-type: none"> • Building fundamental knowledge of the interplay of markets, ethics, and law, • Look at various challenges faced by individual to counter unethical issues • Look at core concepts for business ethics • Look at core concepts of anti-corruption • Look at core concepts for a morally articulate solution evolver to management issues in general, • Issues of sustainable development for a better environment. • To know how environmental degradation has taken place. • Be aware of negotiations and international efforts to save environment. • How to develop sustainably? • Efforts taken up by UN in Sustainable Development. • Efforts taken by India in Sustainable Development. • The course intends to create a sense of how to be more responsible towards the environment. Upon finishing of the course students will be able to come up with using ethical reasoning for decision making and frame ethical issues as well as operationalise ethical choices. The course integrates various facets of human values and environment. 		
Credits: 2	Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0 As the course requires two areas of Human Values and Environment Studies institutions can even optfor a parallel delivery		
Unit	Topics	No. of Lectures Total=30
I	<p>Human Values- Introduction- Values, Characteristics, Types ,Developing Value system in Indian Organisation , Values in Business Management , value based Organisation , Trans –cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam view on role of parents and Teachers.</p> <p>Human Values and Present Practices – Issues : Corruption and Bribe , Privacy Policy in Web and Social Media, Cyber threats ,Online Shopping etc. Remedies UK</p> <p>Bribery Act, Introduction to sustainable policies and practices in Indian Economy.</p> <p>Principles of Ethics</p> <p>Secular and Spiritual Values in Management- Introduction- Secular and Spiritual values, features , Levels of value Implementation. Features of spiritual Values ,</p> <p>Corporate Social Responsibility- Nature, Levels ,Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates.</p>	02 02 03



II	<p>Holistic Approach in Decision making- Decision making, the decision making process , The Bhagavad Gita: Techniques in Management , Dharma and Holistic Management.</p> <p>Discussion through Dilemmas –</p> <p>Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context , Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security , Dilemma on Organic food , Dilemma on standardization ,Dilemma on Quality standards.</p> <p>Case Studies</p>	03 03 02
III	<p>Ecosystem: Concept, structure & functions of ecosystem : producer, consumer, decomposer, foodweb, food chain, energy flow, Ecological pyramids Conservation of Biodiversity- In-situ & Ex- situ conservation of biodiversity Role of individual in Pollution control</p> <p>Human Population & Environment</p> <p>Sustainable Development</p> <p>India and UN Sustainable Development Goals Concept of circular economy and entrepreneurship</p>	7
IV	<p>Environmental Laws?</p> <p>International Advancements in Environmental Conservation Role of National Green Tribunal</p> <p>Air Quality Index</p> <p>Importance of Indian Traditional knowledge on environment</p> <p>Bio assessment of Environmental Quality</p> <p>Environmental Management System</p> <p>Environmental Impact Assessment and Environmental Audit</p>	8

Suggested Readings:

1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal et.al
2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel.
3. Human Values by A. N. Tripathi New Age International
4. Environmental Management by N.K. Uberoi
5. <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>
6. <https://www.india.gov.in/my-government/schemes>
7. <https://www.legislation.gov.uk/ukpga/2010/23/contents>
8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921

Suggested Continuous Internal Evaluation:

Maximum Marks: 25

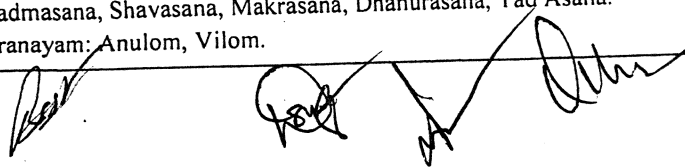
One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

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Co-curricular course: Semester-IV Course Title: Physical Education and Yoga

Year: Second	Semester: IV
Course Code: CCB401	Course Title: Physical Education and Yoga
Course outcomes: Students will learn the introduction of Physical Education, Concept of fitness and wellness, Weight management and lifestyle of an individual. The student will also learn about the relation of Yoga with mental health and value Education. In this course student will also learn about the aspects of the Traditional games of India.	
Credits: 2	Compulsory
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0	

Unit	Topics	No. of Lectures Total=30
I	Physical Education: <ul style="list-style-type: none"> • Meaning, Definition, Aim and Objective. • Misconception About Physical Education. • Need, Importance and Scope of Physical Education in the Modern Society. • Physical Education Relationship with General Education. • Physical Education in India before Independence. Physical Education in India after Independence. 	6
II	Concept of Fitness and Wellness: <ul style="list-style-type: none"> • Meaning, Definition and Importance of Fitness and Wellness. • Components of Fitness. • Factor Affecting Fitness and Wellness. Weight Management: <ul style="list-style-type: none"> • Meaning and Definition of Obesity. • Causes of Obesity. • Management of Obesity. • Health problems due to Obesity. Lifestyle: <ul style="list-style-type: none"> • Meaning, Definition, Importance of Lifestyle. • Factor affecting Lifestyle. • Role of Physical activity in the maintains of Healthy Lifestyle. 	8
III	Yoga and Meditation: <ul style="list-style-type: none"> • Historical aspect of yoga. • Definition, types scopes & importance of yoga. • Yoga relation with mental health and value education. • Yoga relation with Physical Education and sports. • Definition of Asana, differences between asana and physical exercise. • Definition and classification of pranayama. • Difference between pranayama and deep breathing. • Practical: Asana, Suraya-Namaskar, Bhujang Asana, Naukasana, Halasana, Vajrasan, Padmasana, Shavasana, Makrasana, Dhanurasana, Tad Asana. • Pranayam: Anulom, Vilom. 	8



IV

Traditional Games of India:

- Meaning.
- Types of Traditional Games-
 - Gilli- Danda
 - Kanche
 - Stapu
 - Gutte, etc.
- Importance/ Benefits of Traditional Games.
- How to Design Traditional Games.

8

Recreation in Physical Education:

- Meaning, Definition of Recreation.
- Scope and Importance of Recreation.
- General Principles of Recreation.
- Types of Recreational Activities.
- Aerobics and Zumba.(Fir India Movement)

Suggested Readings:

Singh, Ajmer, Physical Education and Olympic Abhiyan, "Kalayani Publishers", New Delhi, Revised Addition, 2006
 Patel, Shri Krishna, Physical Education, "Agrawal Publishers", Agra, 2014-15 Panday, Preeti, Sharirik
 Shiksha Sankalan, " Khel Sanskriti Prakashan, Kanpur
 Kamlesh M.L., "Physical Education, Facts and foundations", Faridabad P.B. Publications.
 B.K.S. Yengar, "Light and Yog. Yoga Deepika", George Allen of Unwin Ltd., London, 1981. Braj Bilari Nigam,
 Yoga Power "The Kpath of Personal achievement & quot; Domen and Publishers, New Delhi, 2001.
 Indira Devi, "Yoga for You", Gibbs, Smith Publishers, Salt Lake City, 2002 Domen and Publishers, New
 Delhi - 2001.
 Jack Peter, "Yoga Master the Yogic Powers", Abhishek Publications, Chandigarh, 2004. Janice Jerusalem,
 "A Guide To Yoga & quot; Parragon Bath, Baiihe-2004.

Suggested Continuous Internal Evaluation:

Maximum Marks: 25
 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

Suggested equivalent online courses:

- IGNOU.
- Rajarshi Tandan Open University.

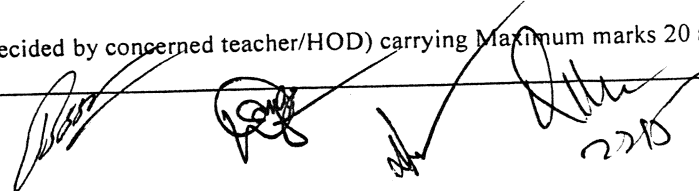
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Co-Curricular Course: Semester-V

Course Title: Analytic Ability and Digital Awareness

Year: Third		Semester: V	
Course Code: CCB501		Course Title: Analytic Ability and Digital Awareness	
Course outcomes (Analytic Ability): CO 1: Familiarize with analogy, number system, set theory and its applications, number system and puzzles. CO 2: To understand the basics of Syllogism, figure problems, critical and analytical reasoning. CO 3: Familiarize with word processing application and worksheet . CO 4: To understand the basics of web surfing and cyber security.			
Credits: 2		Co-Curricular	
Max. Marks CIE: 25		Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100		Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): 2-0-0			
Unit	Topic	No. of Lectures 30	
I	Alphabet test, Analogy, Arithmetic Reasoning, Blood relations, Coding and Decoding, Inequalities, Logical Venn diagram, Seating Arrangements, Puzzles and Missing numbers	8	
II	Syllogism, Pattern completion and figure series, Embedded Figure and counting of figures, Cube & Dice, Paper cutting and folding, Data sufficiency, Course of Action, Critical Reasoning, Analytical and decision making	7	
III	Computer Basics: Block diagram of Digital Computer, Classification of Computers, Memory System, Primary storage, Auxiliary memory, Cache memory, Computer Software (System/Application Software), MS Word Basics: The word screen, Getting to word documents, typing and Revising text, Finding and Replacing, Editing and Proofing tools, Formatting text characters, Formatting Paragraph, Document templates., Page set up, tables, Mail Merge, Macros, protecting documents, printing a document. MS-Excel Introduction, Worksheet basics, Creating worksheet, Heading information, Data & Text, Date & Time, Alphanumeric values, Saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Excel shortcut and function keys, Working with single and multiple workbook, Working with formulae & cell referencing, Auto sum, coping formulae, Absolute & relative addressing, Worksheet with ranges, Formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and using macros, Multiple worksheets- concepts Introduction of Open Source Applications: Libre Office, Open Office and Google Docs etc.	8	
IV	Web Surfing: An Overview: working of Internet, Browsing the Internet, E-Mail, Components of E-Mail, Address Book, Troubleshooting in E-Mail, Browsers: Netscape Navigator, Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, Tor, Search Engines lik Google, Duck Duck Go etc, Visiting web sites: Downloading. Cyber Security: Introduction to Information System, Type of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, phishing, spamming, fake news, general issues related to cyber security, Business need, Ethical and Professional issues of security.	7	
Suggested Readings: <ol style="list-style-type: none"> Sharma, A., "How to prepare for Data Interpretation and Logical Reasoning for the CAT" McGraw Hill Education Pvt. Ltd., New Delhi, India, 2011, Ed. 5, ISBN 978 2007 070 481 Aggarwal, R.S., "A Modern Approach to Verbal and Non-verbal Reasoning" S. Chand Publishers New Delhi, India, 2010, ISBN 10: 8121905516 Madan, Sushila, Introduction to Essential tools, Jain Book Agency, New Delhi/India, 2009, 5th ed.. Goel, Anita, Computer Fundamentals, Pearson Education, India, 2012 Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017 			
Suggested Continuous Internal Evaluation: Maximum Marks: 25 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks			

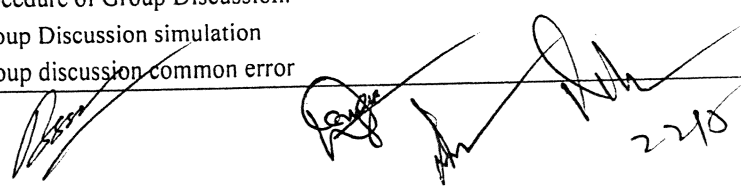

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Co-curricular course: Semester-VI

Course Title: Communication Skills and Personality Development

Year: Third		Semester: VI	
Course Code: CCB601		Course Title: Communication Skills and Personality Development	
Course outcomes: <ul style="list-style-type: none"> • To understand the concept of Personality. • To learn what personal grooming pertains. • To learn to make good resume and prepare effectively for interview. • To learn to perform effectively in group discussions. • To explore communication beyond language. • To learn to manage oneself while communicating. • To acquire good communication skills and develop confidence. 			
Credits: 2		Co-curricular	
Max. Marks CIE: 25		Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100		Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0			
Unit	Topics	No. of Lectures Total=30	
I	<p style="text-align: center;">PERSONALITY AND PERSONAL GROOMING</p> <p>Understanding Personality</p> <ul style="list-style-type: none"> • Definition and Meaning of Personality • Types of Personality • Components of Personality • Determinants of Personality • Assessment of Personality <p>Grooming Self</p> <ul style="list-style-type: none"> • Dress for success • Make up & skin care • Hair care & styles for formal look • Art of accessorizing • Oral Hygiene 	7	
II	<p style="text-align: center;">INTERVIEW PREPARATION AND GROUP DISCUSSION</p> <ul style="list-style-type: none"> • Meaning and Types of Interview [Face to Face, Telephonic, Video] • Interview procedure [Opening, Listening, Closure] • Preparation for Interview • Resume Writing • LinkedIn Etiquette • Meaning and methods of Group Discussion • Procedure of Group Discussion. • Group Discussion simulation • Group discussion common error 	8	



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III	<p style="text-align: center;">BODY LANGUAGE AND BEHAVIOUR</p> <ul style="list-style-type: none"> • Concept of human behavior • Individual and group behavior • Developing Self-Awareness • Behaviour and body language • Dimensions of body language: <ul style="list-style-type: none"> Proxemics Haptics Oculesics Paralanguage Kinesics Sign Language Chromatics Chronemics Olfactics • Cultural differences in Body Language • Business Etiquette & Body language • Body Language in the Post Corona Era • Virtual Meeting Etiquette • Social Media Etiquette 	7
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IV	<p style="text-align: center;">ART OF GOOD COMMUNICATION</p> <ul style="list-style-type: none"> • Communication Process • Verbal and Non-verbal communication • 7 C's of effective communication • Barriers to communication • Paralinguistics <ul style="list-style-type: none"> Pitch Tone Volume Vocabulary Word stress Pause • Types of communication <ul style="list-style-type: none"> Assertive Aggressive Passive Aggressive • Listening Skills • Questioning Skills • Art of Small Talk • Email Writing 	8
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Suggested Readings:

1. Cloninger, S.C., "Theories of Personality : Understanding Person", Pearson, New York, 2008, 5th edition.
2. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition.
4. Adler R.B., Rodman G. & Hutchinson C.C. , "Understanding Human Communication", OxfordUniversity Press : New York, 2011.
5. Suggestive digital platforms web links-

Suggested Continuous Internal Evaluation:
 Maximum Marks: 25
 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

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DEPARTMENT OF FORESTRY
SYLLABUS OF VOCATIONAL COURSES
FOR B.SC. (IN FACULTY OF LIFE SCIENCE)

Under NEP-2020

VOCATIONAL COURSE PAPER TITLES

COURSE CODE	PAPER TITLE	TOTAL CREDIT SKILL/THEORY	SKILL MAX. MARKS	THEORY MAX. MARKS	TYPE OF COURSE INDEPENDENT OR POGRESSIVE
VOC 01	Plant Nursery Management	2 +1 =3	60	40	Both
VOC 02	Dairy Technology	2 +1 =3	60	40	Both
VOC 03	Green House Technology	2 +1 =33	60	40	Both
VOC 04	Organic Farming	2 +1 =3	60	40	Both
VOC 05	Nutrition and Health Care Sciences	2 +1 =3	60	40	Both
VOC 06	Mushroom . Spawn Production and Cultivation	2 +1 =3	60	40	Independent
VOC 07	Mushroom Cultivation	2 +1 =3	60	40	Independent
VOC 08	Creative Photography	2 +1 =3	60	40	Independent
VOC 09	Multimedia and Animation	2 +1 =3	60	40	Both
VOC 10	Wall Painting and Mural Art	2 +1 =3	60	40	Independent
VOC 11	Creative Painting	2 +1 =3	60	40	Independent
VOC 12	Modern Technique For Plant Propagation	2 +1 =3	60	40	Both
VOC 13	Cultivation And Utilization of Medicinal and Aromatic Plants	2 +1 =3	60	40	Independent
VOC 14	Pathology Techniques	2 +1 =3	60	40	Independent
VOC 15	Descriptive Statistics Using Excel & 'R'	2 +1 =3	60	40	Independent

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Title of course:		Plant Nursery Management			
Nodal Department of HEI to run course		Agriculture Skill Council of India			
Board Area/Sector-		Agriculture Skill Council of India			
Sub Sector-		Independent and Progressive			
Nature of Course-Independent and Progressive		Agriculture Skill Council of India			
Name of Suggestive Sector Skill Council		Agriculture Skill Council of India			
Aliened NSQF Level		4			
Expected fee of the Course-Free/Paid					
Stipend to Student expected from industry					
Number of Seats.....					
Course Code- VOPNM (VOPNM101, VOPNM102, VOPNM201, VOPNM202)		Credits-03(1 Theory,2 Practical)			
Max Mark		Minimum Marks. 35			
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.					
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.		Nursery grower, landscaper, Gardener, Gardening industries, Self- Nursery			
Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours =1 credit)	No. of skill Hours (Total 60 Hours=2 credits)
Credit-3					
Semester-1 VOPNM101					
I	Introduction to gardening	General	Theory/ Practical	15 Hours	
II	Types of Gardens	Skill	Theory/Practical		30 Hours
III	Nursery methods and tools	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-2 VOPNM102					
I	Propagation of indoor & Outdoorplants	General	Theory/ Practical	15 Hours	
II	Principal and Practices of Landscape design for Home-garden & Public Park	Skill	Theory/Practical		30 Hours
III	Practicals	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-3 VOPNM201					
I	Seed Propagation	General	Theory/ Practical	15 Hours	
II	Common Fertigation,	Skill	Theory/Practical		30 Hours
III	Practicals	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-4 VOPNM202					

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I.	Entrepreneurship	General	Theory/Practical	15 Hours	
II.	protection & Management of Nursery	Skill	Theory/Practical		30 Hours
III.	Project Management & Marketing	Skill	Practical/Internship /Training		30 Hours

Suggested Readings: NURSERY MANAGEMENT: Handbook for Beginners

- Resource Book on Horticulture Nursery Management
- Establishment and Management of Plant Nursery System
- Practical Manual of Nursery Management

Suggested Digital platforms/web link for reading-

- https://www.academia.edu/40648067/NURSERY_MANAGEMENT_Handbook_for_Beginners
- <http://www.fdcn.nic.in/PDF/horticulture%20plant%20nursery.pdf>
- https://www.researchgate.net/publication/326096694_Practical_Manual_of_Nursery_Management

Suggested OJT/internship/Training/Skill partner :

Course Pre-requisites:

- No pre-requisite required, open to all
- To study this Course, a student must have the Subject science and any other in class/12th/certificate/diploma.
- If progressive to study this course a student must have passed previous courses of this series.

Notes:

- Number of units in theory/practical may vary as per need.
- Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).
- Credit for theory=01(Teaching hours=15)
- Credit for internship/OJT/Training/Practical=02(Training hours =60)

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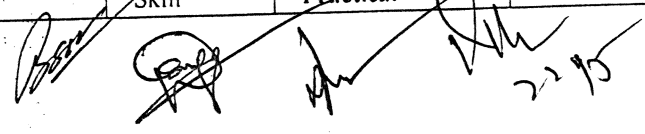
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02

Title of course:	Dairy Technology
Nodal Department of HEI to run course	
Board Area/Sector-	Agriculture & Dairy Products
Sub Sector-	
Nature of Course-Independent and Progressive	Independent and Progressive
Name of Suggestive Sector Skill Council	
Aliened NSQF Level	4
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code- VODT (VODT101, VODT102, VODT201, VODT202)	Credits-03(1 Theory,2 Practical)
Max Mark 60Marks Skill + 40Marks Theory = 100	Minimum Marks. 35
Name of proposed skill Partner (Please Specify, Name of industry, company etc. for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name-of industry, company etc.)	Dairy Technician, Dairy product maker, dairy industry supporter, Dairy Operator Open Own Dairy/Shop

Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours(Total =60 Hours=2 credits)
Semester-1 VODT101			3 Credits		
I.	Milk Procedure	General	Theory/Practical	15 Hours	
II.	Dairy equipment's	Skill	Practical		30 Hours
III.	Requirements of dairy industry	Skill	internship /Training		30 Hours
Semester-2 VODT101			3 Credits		
I.	Milk & Milk quality analysis	General	Theory/Practical	15 Hours	
II.	Dairy Equipment and their Maintenance	Skill	Practical		30 Hours
III.	Practicals	Skill	internship /Training		30 Hours
Semester-3 VODT101			3 Credits		
I.	Dairy Development And Cooperative System	General	Theory/Practical	15 Hours	
II.	Packaging and Distribution	Skill	Practical		30 Hours
III.	Fat & oil dairy products	Skill	internship /Training		30 Hours
Semester-4 VODT101			3 Credits		
I.	Dried Milk Products	General	Theory/Practical	15 Hours	
II.	Heat Desiccated	Skill	Practical		30 Hours

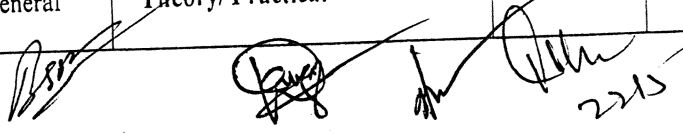


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	Milk Products				
III.	Concentrated Milk Products	Skill	internship /Training		30 Hours
Suggested Readings: By-Products Technology by Vijay Kumar Cheese Technology by S. K. Kanawjia & Yogesh Khetra Dairy Biotechnology by Sunita Grover V. K. Batish V. Padmanabha Reddy Dairy-Plant-Management-And-Pollution-Control by Vijaya Geetha Dairy Engineering by S. Ravi Kumar Fat Rich Dairy Products by Y. Kotilinga Reddy Yogesh Khetra M.H. Sathish Kumar Entrepreneurship Development and Industrial Consultancy A. K. Makwana A. K. Chauhan Ice Cream & Frozen Desserts A. Jana Suneeta Pinto P.R.S. Moorthy Market Milk by Latha Sabikhi PACKAGING OF DAIRY PRODUCTS Author H.G. Patel & Hiral Modha Department of Dairy Technology AAU, Anand M. Ranganadham TRADITIONAL DAIRY PRODUCTS M. Ranganadham					
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject science or any other .in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.					
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)					

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Title of course:		Green House Technology			
Nodal Department of HEI to run course					
Board Area/Sector-		Agriculture Skill Council of India			
Sub Sector-					
Nature of Course-Independent and Progressive		Independent and Progressive			
Name of Suggestive Sector Skill Council		Sector of Information Technology			
Allied NSQF Level		4			
Expected fee of the Course-Free/Paid					
Stipend to Student expected from industry					
Number of Seats.....					
Course Code- VOGH (VOGHT101, VOGHT102, VOGHT201, VOGHT202)		Credits-03(1 Theory, 2 Practical)			
Max Mark <i>60 Marks Skill + 40 Marks Theory = 100 Total</i>		Minimum Marks. 35			
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.					
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.		KVK , Green-house operator/helper/ grower Agriculture Industries Agri based Marketing industry			
Syllabus:-					
Unit	Topics	General/ Skill Component	Theory/Practical/OJT/ internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOGHT101		Credit-3			
I.	Basics of Green House Technology	General	Theory/ Practical	15 Hours	
II.	Different types of green house	Skill	Theory/Practical		30 Hours
III.	Growing Media	Skill	Practical/Internship /Training		30 Hours
Semester-2 VOGHT102		Credit-3			
I.	Micro irrigation system used in green house	General	Theory/ Practical	15 Hours	
II.	Automation in Protected Cultivation	Skill	Theory/Practical		30 Hours
III.	Automation and monitoring systems in green house	Skill	Practical/Internship /Training		30 Hours
Semester-3 VOGHT201		Credit-3			
I.	Seed propagation	General	Theory/ Practical	15 Hours	



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II.	GHT Management	Skill	Theory/Practical		30 Hours
III.	Fertilizers use and management	Skill	Practical/Internship /Training		30 Hours
Semester-4 VOGHT202 Credit-3					
I.	Soil fertility and productivity	General	Theory/ Practical	15 Hours	
II.	Commercial vegetable seedling production	Skill	Theory/Practical		30 Hours
III.	Training Visits	Skill	Practical/Internship /Training		30 Hours
Suggested Readings: Design and Maintenance of Green House by Dr. R.F. Sutar Greenhouse technology and management: Second Edition					
Suggested Digital platforms/web link for reading- https://agrimoon.com/design-and-maintenance-of-green-house-pdf-book-free/ https://www.researchgate.net/publication/287291076_Greenhouse_technology_and_management_Second_Edition					
Course Pre-requisites: <ul style="list-style-type: none">No pre-requisite required, open to allTo study this Course, a student must have the Subject Science .in class/12th/certificate/diploma.If progressive to study this course a student must have passed previous courses of this series.					
Notes: <ul style="list-style-type: none">Number of units in theory/practical may vary as per need.Total credit Semester-3(it can be more credits, but student will get only3 credits/semester or 5 credits/year).Credit for theory=01(Teaching hours=15).Credit for internship/OJT/Training/Practical=02(Training hours =60)					

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04

Title of course:		Organic Farming			
Nodal Department of HEI to run course					
Board Area/Sector-		Agriculture Skill Council of India			
Sub Sector-					
Nature of Course-Independent and Progressive		Independent and Progressive			
Name of Suggestive Sector Skill Council		Agriculture Skill Council of India			
Aliened NSQF Level		4			
Expected fee of the Course-Free/Paid					
Stipend to Student expected from industry					
Number of Seats.....					
Course Code- VOOF (VOOF101, VOOF102, VOOF201, VOOF202)		Credits-03(1 Theory,2 Practical)			
Max Mark <i>60 Marks Skill + 40 Marks Theory = 100</i>		Minimum Marks. <i>35</i>			
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.					
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.		Agri based Industry, Organic Product developer,			
Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total 15 Hours =1credit)	No. of skill Hours (Total=60 Hours=2 credits)
Semester-1 VOOF101					
I.	Basic Concept of Organic faming	General	Theory/ Practical	15 Hours	
II.	The Organic way of Farming	Skill	Theory/Practical		30 Hours
III.	Environmental Impacts of Conventional and Organic Farming	Skill	Practical/Internship /Training		30 Hours
Semester-2 VOOF102					
I.	Types of Farming	General	Theory/ Practical	15 Hours	
II.	Practicals	Skill	Theory/Practical		30 Hours
III.	Commercial production house	Skill	Practical/Internship /Training		30 Hours
Semester-3 VOOF201					
I.	Organic Manure	General	Theory/ Practical	15 Hours	
II.	Principles of Composting	Skill	Theory/Practical		30 Hours
III.	Green Manure	Skill	Practical/Internship /Training		30 Hours
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Semester-4 VOOF202					
I.	Recycling of Organic residues	General	Theory/ Practical	15 Hours	
II.	Impact and Introduction of Green technology	Skill	Theory/Practical		30 Hours
III.	Other Organic Farming Methods & Products	Skill	Practical/Internship /Training		30 Hours
Suggested Readings: Farmer's Handbook on Basic Agriculture Economics of Organic Farming					
Suggested Digital platforms/web link for reading https://ardhindie.com/book/read.php?file=Organic%20Farming https://www.manage.gov.in/publications/farmerbook.pdf https://orprints.org/id/eprint/30486/1/Economics%20of%20Organic%20Farming%20-%20Book.pdf https://www.academia.edu/40648067/NURSERY_MANAGEMENT_Handbook_for_Beginners http://www.fdcn.nic.in/PDF/horticulture%20plant%20nursery.pdf https://www.researchgate.net/publication/326096694_Practical_Manual_of_Nursery_Management					
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject Science in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.					
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)					

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05

Title of course:		NUTRITION AND HEALTH CARE SCIENCES
Nodal Department of HEI to run course		Health care
Board Area/Sector-		Nutrition
Sub Sector-		Independent and Progressive
Nature of Course-Independent and Progressive		Health care sector skill council
Name of Suggestive Sector Skill Council		4
Aliened NSQF Level		
Expected fee of the Course-Free/Paid		
Stipend to Student expected from industry		
Number of Seats.....		Credits-03(1 Theory,2 Practical)
Course Code- VOCNHCS (VOCNHCS101, VOCNHCS102, VOCNHCS201, VOCNHCS202)		
Max Mark	60 Marks Skill + 40 Marks Theory = 100	Minimum Marks. 35
Name of proposed skill Partner (Please Specify, Name of industry, company etc. for practical/training/internship/OJT.		
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.)		Nursing staff, Hospital management Staff, Dietetics, Nutritionist in healthclinics & Gyms

Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOCNHCS101					
I.	Basic concept of Nutrition	General	Theory/Practical	15 Hours	
II.	Human biology	Skill	Theory/Practical		30 Hours
III.	Laboratory Biochemistry	Skill	internship /Training		30 Hours
Semester-2 VOCNHCS102					
I.	Health indicators	General	Theory/Practical	15 Hours	
II.	Food & Nutrition	Skill	Practical		30 Hours
III.	Dietary Management of Disease	Skill	internship /Training		30 Hours
Semester-3 VOCNHCS201					
I.	Nutrition & Health status of Community	General	Theory/Practical	15 Hours	
II.	Approaches in Nutrition and Health education	Skill	Practical/ internship /Training		30 Hours
III.	Paramedic hospital techniques	Skill	Practical/ internship /Training		30 Hours
Semester-4 VOCNHCS202					
I.	Health Care: Yoga Techniques	General	Theory/Practical	15 Hours	
II.	Health Care: Preventive & Therapeutic techniques	Skill	Practical/ internship/Training		30 Hours
III.	Medical Pathology Laboratory	Skill	Practical/ internship /Training		30 Hours

<p>Suggested Readings: Food Technology Part –I by A. K. Singh P. N. Raju & A. Jana Food Technology Part-II by A. K. Singh P. N. Raju & A. Jana FOOD AND INDUSTRIAL MICROBIOLOGY Suja Senan R. K. Malik Shilpa Vij</p>
<p>Suggested Digital platforms/web link for reading- http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=15 http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=444</p>
<p>Course Pre-requisites:</p> <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject Science or any other in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.
<p>Notes:</p> <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)

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06

Title of Course: Mushroom spawn production and cultivation

Nodal Department of HEI to run course	
Broad Area/Sector	Agro-farming
Sub Sector	Mushroom cultivation
Nature of Course-Independent/Progressive	Independent
Name of suggestive Sector Skill Council	Agriculture Skill council of India, Gurugram122004
Alienated NSQF level	4
Expected fees of the course- Free/Paid	
Stipend to student expected from industry	
Number of Seats	
Course Code:	Credits: 03 (1 Theory, 2 Practical)
Max. Marks: 60 Marks Skill + 40 Marks Theory = 100	Min Marks: 35
Name of proposed Skill Partner (Please specify Name of Industry, Company etc. for Practical/Training/internship/OJT)	
Job prospects-Expected Fields of occupation where student will be able to get job after completing this course (Please specify name/type of industry)	Entrepreneur, Food IndustMry, Mycologist. Mushroom Farms.

Syllabus

Unit	Topics	General/Skill component	Theory/Practical/OJT/Internship/Training	No of Theory Hrs(Total-15 Hrs=1 Credit)	No of Skill Hrs(Total-60Hrs=2 Credits)
I	Introduction of Mushroom & Types	General/Skill	Theory - 02 Practical- 01	(02 Hours)	(02 hours)
II	Principle of Mushroom Cultivation & Production	General/Skill	Theory - 05 Practical- 08	(05 hours)	(16 hours)
III	Growing condition for mushroom	General/Skill	Theory - 02 Practical- 12	(02 Hours)	(24 Hours)
IV	Pest diseases and growing mushroom outside	General/Skill	Theory - 02 Practical- 04	(02 Hours)	(08 Hours)
V	Harvesting, storing and utilization of mushroom	General/Skill	Theory - 02 Practical- 02	(02 Hours)	(04 Hours)
VI	Marketing of mushroom and special assignments	General/Skill	Theory - 02 Practical- 03	(02 Hours)	(06 Hours)

Suggested Readings:

1. Tripathi D.P., Oxford & IBH publishers - Mushroom cultivation.
2. Pathak Yadav Gour, Published by Agrobios – Mushroom Production and Processing.
3. S. Kannaiyan & K. Ramasamy, Today & Tomorrow's Printers and Publishers - Handbook of edible mushrooms

Suggested equivalent online courses: www.nhb.gov.in

Title of course-	Mushroom Cultivation
Nodal Department of HEI to run course	
Broad Area/Sector-	Agriculture and Allied
Sub Sector-	Economic Agriculture Mycology
Nature of course - Independent / Progressive	Independent
Name of suggestive Sector Skill Council	Agriculture Skill Council of India
Aliened NSQF level	Level 3
Expected fees of the course-Free/Paid	
Stipend to student expected from industry	
Number of Seats-50	
Course Code-	Credits- 03 (1 Theory, 2 Practical)
Max Marks-100. Minimum Marks- 35	
Name of proposed skill Partner-	
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in	Self-employment: Owner of Mushroom farm, Wage employment: Worker in Mushroom farm.

Syllabus					
Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/Internship/ Training	No of theory hours (Total-15 Hours=1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction to Mushroom cultivation	<ul style="list-style-type: none"> Knowledge of General Safety, health and hygiene. Importance of Mushroom, scope, past, present status & futureprospects. Pros & cons in Mushroom cultivation: why the Mushroom cultivation? Problems in mushroom cultivation & its remedies 	<ul style="list-style-type: none"> Selection and Processing of straw for bed preparation Sterilization processpractice. 	3 hour	10 hour
II	Process of Mushroom Cultivation	<ul style="list-style-type: none"> Mushroom for health: ingredients in mushroom, i.e. Protein, Carbohydrate,Fiber, Fat, Vitamins, Minerals etc. Types of Mushroom. Poisonous Mushroom. Cultivation of Paddy StrawMushroom and ingredients used Oyster Mushroom Cultivation andingredients used. Milky Mushroom Cultivation andingredients used. Button Mushroom cultivation andingredients used 	<ul style="list-style-type: none"> Preparation of beds for cultivation of various mushrooms and its maintenance Growing and Identification of viable Spawn 	8 hour	35 hour
III	Maintain the health and hygiene standards of Mushroom.	<ul style="list-style-type: none"> Post Harvesting care and processing Visit to Mushroom farms. 	<ul style="list-style-type: none"> Preservation of Mushroom. Economics of Mushroom cultivation and Marketing 	4 hour	15 hour

Suggested Readings:

- Lynch, Tavis., "Mushroom Cultivation" An illustrated guide to growing your own mushroom at Home. Quarto Publishing Groups USA, 2018.
- Bonyard, Britt and Lynch, Tavis., "The beginner's Guide to Mushroom". Quarto Publishing Groups USA, 2020

Title of course- Creative Photography	
Nodal Department of HEI to run course-	
Broad Area/Sector-	Fine Arts and Allied
Sub Sector-	N S D
Nature of course -	Independent
Name of suggestive Sector Skill Council-	N S D
Aliened NSQF level:	1
Expected fees of the course -	
Stipend to student expected from industry	
Number of Seats-	
Course Code-	
Max Marks: 100 Minimum Marks - 35	Credits- 03 (1 Theory, 2 Practical)
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	Photo studios
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	Professional photography, Fashion photography,Product photography

Syllabus

Unit	Topics	General/ Skill component	Theory/ Practical/OJT/ Internship/ Training	No of theory hours (Total- 15 Hours= 1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction of photography	Teaching basic conceptsof photography	Theory	4	
II	Study of the basic functions of cameras	Practical exposure to professional camera	Practical		16
III	Camera, Lenses and Accessories	Theoretical aspects of camera lens and its accessories	Theory	5	
IV	Functional study of different lensesand other accessories	Practice exercises on lenses and its accessories	Practical		20
V	Principles of visual composition	Fundamentals of visual composition	Theory	6	
VI	Hands on Practice and creation of creative photography	Hands on experience on creative photography	Hands on practice and OJT		24

Readings:

Suggested

- Edward, "Photography: A Very Short Introduction", Oxford University Press, 2006.
 1. Beaumont Newhall, "The History of Photography: 1839 to the present day", Museum Of Modern Art, 1982
 2. Beaumont Newhall, "The Beginner's Photography Guide", D K, 15 July 2016.
 3. D K, "Digital Photography Complete Course", D K, 1st September 2015.

Course Pre-requisites:

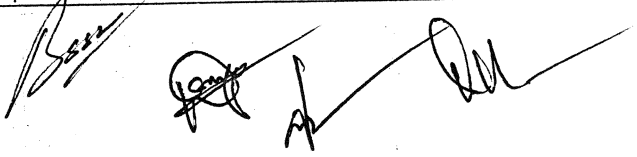
- To study this course, a student must have completed the class 12th examination
- If progressive, to study this course a student must have passed previous courses of this series.

Title of course:	Multimedia and Animation
Nodal Department of HEI to run course	
Board Area/Sector-	Sector of Information Technology
Sub Sector-	
Nature of Course-Independent and Progressive	Independent and Progressive
Name of Suggestive Sector Skill Council	Sector of Information Technology
Aliened NSQF Level	4
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code-VOMA (VOMA101, VOMA102, VOMA201, VOMA202)	Credits-03(1 Theory,2 Practical)
Max Mark <i>60Marks Skill + 40Marks Theory = 100</i>	Minimum Marks. <i>35</i>
Name of proposed skill Partner (Please Specify, Name of Industry, company etc for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc).	Animator, Graphic Designer, Journalist, Media Assistant, Print & Advertisement Media

Syllabus:-

Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOMA101 3 Credits					
I.	Basics of Animation	General	Theory/Practical	15 Hours	
II.	Skills for Animation Artist	Skill	Practical		30 Hours
III.	Introduction to equipment required for animation	Skill	internship /Training		30 Hours
Semester-2 VOMA102 3 Credits					
I.	Element of art	General	Theory/Practical	15 Hours	30 Hours
II.	Graphic Designing	Skill	Practical		30 Hours
III.	Design	Skill	internship /Training		30 Hours
Semester-3 VOMA201 3 Credits					
I.	Photoshop, Coral Draw	General	Theory/Practical	15 Hours	
II.	Coral Draw	Skill	Practical		30 Hours
III.	Quark Xpress	Skill	internship /Training		30 Hours
Semester-4 VOMA202 3 Credits					
I.	Graphic algorithm	General	Practical		30 Hours
II.	Tools for editing	Skill	Practical		30 Hours

III.	Automatic motion Control	Skill	Internship /Training	30 Hours
Suggested Readings: Introduction to Multimedia and Hypermedia MULTIMEDIA AND ITS APPLICATIONS by Pavithra Graphic Design and Multimedia By				
Suggested Digital platforms/web link for reading- http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=24 https://www.ebookphp.com/computer-graphics-multimedia-and-animation-epub-pdf/ http://www.eee.bham.ac.uk/spannm/Teaching%20docs/EE1F2/New%20Material/007177064x_chap01.pdf https://freebookcentre.net/ComputerScience-Books-Download/Computer-Graphics-and-Multimedia.html				
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject Computer in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.				
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)				



Title of course- Wall Painting and Mural Art					
Nodal Department of HEI to run course-					
Broad Area/Sector-			Fine Arts and Allied		
Sub Sector-			NSD		
Nature of course -			Independent		
Name of suggestive Sector Skill Council-			NSD		
Aliened NSQF level:			1		
Expected fees of the course -					
Stipend to student expected from industry					
Number of Seats-					
Course Code-					
Max Marks- 100 Minimum Marks - 35			Credits- 03 (1 Theory, 2 Practical)		
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT			Architects and professional artists		
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)			Architects and professional artists		
Syllabus :					
Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total- 15 Hours= 1 credit)	No of skill Hours (Total- 60 Hours= 2 credits)
I	Wall Painting and Mural Art: An overview	Explaining basics of wall painting and mural art	Theory	4	
II	Study of drawing objects, human figure, nature, birds, animals etc.	Practical exposure on studying drawing objects, human figure, nature etc.	Practical		14
III	Elements of drawing and design	Teaching basic concepts of design and drawing	Theory	5	
IV	Hands on Practice of layout development	Practice exercises on developing layout	Practical		16
V	Wall Paintings: Tools and techniques	Teaching basic Tools and techniques used in wall painting	Theory	6	
VI	Practice sessions for color application	Hands on experience on color applications on wall	OJT/ Internship		30
Suggested Readings:					
<ol style="list-style-type: none"> 1. Franz Albrecht, Marar Krishna Kumar & Marar Ke. Ke. "Wall Paintings in North Kerala, India: 1000 Years of Temple Art, Arnoldsche, the University of Michigan, 2004 2. Beach, Milo Cleveland, "Bundi Wall Paintings in Rajasthan: Rediscovered Treasures", Mercatorfonds, 2013. 3. Tse, Theodore and Terence, "Painting Murals fast & easy", North Light Books, 19 May, 2005 publication. 4. Bricca, Morgan, "The Mural Artist's Handbook", Morgan Mural Studio, 2020. 5. Loşifidis, K., Mural Art: Large Scale Art from Walls Around the World, Publikat, First Edition, June 30, 2008. 6. Grund, Charles, Painting Murals Step by Step, North Light Books, 1st edition, 2 Jan, 2003 					
Course Pre-requisites: To study this course, a student must have completed the class 12th examination					
• If progressive, to study this course a student must have passed previous courses of this series.					

Title of course - Creative Painting	
Nodal Department of HEl to run course-	
Broad Area/Sector-	Fine Arts and Allied
Sub Sector-	N S D
Nature of course -	Independent
Name of suggestive Sector Skill Council-	N S D
Aliened NSQF level:	1
Expected fees of the course	
Stipend to student expected from industry	
Number of Seats-	
Course Code-	
Max Marks- 100 Minimum Marks - 35	Credits- 03 (1 Theory, 2 Practical)
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	Art Studios and freelance artist

Syllabus

Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total-15 Hours= 1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction to creative painting	Teaching basics of creative painting	Theory	4	
II	Basic study of 2D objects	Practice on sketching 2D objects	Practical		14
III	Elements of painting	Explaining fundamentals of painting	Theory	5	
IV	Study of human figure and nature elements	Practice on sketching human figure and nature	Practical		16
V	Techniques in creative painting	Teaching theoretical concepts of creative painting	Theory	6	
VI	Hands on Practice and creation of paintings	Practical exposure to creative paintings	OJT/ Internship		30

Suggested Readings:

1. Sidaway Ian, "Mastering The Art of Drawing", J G Press, 1st October 2009.
2. Norling Earnest R., "Perspective Made Easy", www.bnpublishing.com; 21 November 2007, Illustrated edition.
3. Reyna Rubey De, "How TO Draw What You See", Watson-Guptill, 1 September 1996, First edition.
4. Civardi Giovanni, "Figure Drawing: A Complete Guide", Search Press, 24 October 2016

Course Pre-requisites:

- To study this course, a student must have completed the class 12th examination

Title of Course: Modern Techniques For Plant Propagation	
Nodal Department of HEI to run course	
Broad Area/Sector	Plant Propagation
Sub Sector	
Nature of Course-Independent/Progressive	
Name of suggestive Sector Skill Council	
Aliened NSQF level	
Expected fees of the course- Free/Paid	
Stipend to student expected from industry	
Number of Seats	
Course Code:	Credits: 03 (1 Theory, 2 Practical)
Max. Marks: 60 Marks Skill + 40 Marks Theory = 100	Min Marks: ...35.....
Name of proposed Skill Partner (Please specify Name of Industry, Company etc. for Practical/Training/internship/OJT)	
Job prospects-Expected Fields of occupation where student will be able to get job after completing this course (Please specify name/type of industry)	Organic Farming, Plant Designer

Syllabus

Unit	Topics	General/Skill component	Theory/Practical/OJT/Internship/Training	No of Theory Hrs(Total-15 Hrs=1 Credit)	No of Skill Hrs(Total-60 Hrs=2 Credits)
I	Introduction, Concept of Organic Farming, Elements of Organic Farming			1	-----
II	Components of Composting, Vermicomposting, green manures, organic fertilisers and pesticides.			4	16
III	Methods of propagation of plants other than seeds eg:- grafting, layering etc.			2	8
IV	All about Microgreens			2	4
V	Other recent garden practices like bonsai, vertical gardens and kokedama etc.			5	9
VI	Learning how to reach the market with your products.			1	1

Suggested Readings: 1. Mamta Bansal, -Basics of Organic Farming, CBS publications
 1. R.R. Sharma, -Textbook of Plant Propagation, CBS publications
 2. Amilava Rakshit, Priyanka Raha, Nirmal-Manures, fertilisers and pesticides, CBS publications
 4. Dr. Sumita Dodia-Elf Gardenia

Course Pre-requisites:

- *No pre-requisite required, open to all:
- *To study this course, a student must have the subject ANY in class 12th/Certificate/Diploma.
- *If progressive, to study this course, a student must have passed previous courses of the series.

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Course Title: Cultivation and utilization of medicinal and aromatic plants

Credits: 03

Course Outcomes:

- Students will be able to learn and carry out the farming methods.
- Students will be able to explore the knowledge of traditional plants
- Students will be able to use them economically for the benefit of the society.

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 1-0-2

Unit	Theory Topics	No. of Lectures	Practical/Internship/ Training	No. of Lectures
I	Introduction – Indian System of Medicine, Medicinal Botany	2		
II	Cultivation and Utilization of Medicinal and Aromatic Plants-	4	8 (16 Hours)	
III	Processing and Medicinal Uses of Herbal Plants Cultivation and Utilization of Medicinal and Aromatic Plants.	3	8 (16 Hours)	
IV	Screening and Standardization of Herbal Drugs.	2	5 (10 Hours)	
V	Neutraceutical (Natural Plant Products & Ethnobotany)	3	5 (10 Hours)	
VI	Quality Control of Herbal Medicine	1	4 (8 Hours)	

Suggested Readings:

1. Aromatic & Medicinal plants – Dr. M.P. Shiva, Alok Lehri, and Ms. Alka.
2. Indian Medicinal Plants – R.P. Rastogi and B.N. Malhotra.
3. Cultivation of Medicinal and Aromatic Crops – Farooqui Sreeram.
4. Handbook of medicinal plants – S.K. Bhattachariya.
5. Quality control and standardization of herbals – Dr. Dillip Kumar Jena, Dr. Pankaj Pradhan

This course can be opted as an vocational course by the students of following subjects: Open for all

Expected Fields of Occupation: Entrepreneur, Neutraceutical, Food Industry.

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Title of Course:- Pathology Techniques

Broad Area/Sector:- Lab Technology

Sub-sector:- Pathology testing basics

Nature of Course:- Independent

Name of Suggestive Skill Council: Technology skills in pathology

Maximum Marks:- 100 **Minimum Marks:-** 35 **Credits:-** 03(01 Theory, 02 Practical)

Name of Proposed Skill Partner (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):-

Job Prospects-Expected Fields of Occupation where student will be able to get job after completing this course (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):- All Pathology labs ,Scientific Pathology

Syllabus					
Unit	Topics	General/Skill Component	Theory/ Practical/ OJT/ Internship/ Training	No. of Theory Hours (Total 15 Hours = 01 Credit)	No. of Skill Hours (Total 60 Hours = 02 Credit)
I	Sterilisation	Blood Test	6 months	15	30 X 2
II	Colorimeters	Urine Test			
III	Haematology	Blood Culture			
IV	Coagulation techniques	Cell Counting			
V	Examples of body fluids	Culture media preparation			
VI	Buffer preparations	Handling different instruments-microscope			

Suggested Readings:-
 1. Author's Name, Initials, "Book Title", Publisher name, City/country of publication, Year of publication. Edition No. if any .Short text book for med.laboratory techniques author Satish Gupte

- Course Pre-requisites:-**
- No pre-requisite required, Open to All.
 - To study this course, a student must have the subject Chemistry and Biology in class 12th /certificate.
 - If progressive, to study this course a student must have passed previous courses of this series.

Note:

- Number of units in Theory/Practical may vary as per need.
- Total Credits per Semester = 03(It can be more, but students will get only 03 credits/ semester or 06 credits/year
- Credits for Internship/OJT/Training/Practical = 02 (Training Hours = 60)

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15

Title of Course: DESCRIPTIVE STATISTICS USING EXCEL & 'R'

Nodal Department of HEI to Run Course:-

Broad Area/Sector:- DATA ANALYSIS

Sub-sector:-

Nature of Course:- Independent

Name of Suggestive Skill Council:

Aliened NSQF Level:

Expected Fees of the Corse: -

Stipend to Student Expected from Industry:-

Number of Seats:-

Course Code:-

Maximum Marks: - 100 **Minimum Marks:- 35** **Credits:- 03 (01 Theory, 02 Practical)**

Name of Proposed Skill Partner (Please specify, Name of Industry, Company etc. for Practical / Training/Internship/OJT):-

Job Prospects-Expected Fields of Occupation where student will be able to get job after completing this course (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):-

Syllabus

Unit	Topics	General/Skill Component	Theory/ Practical/ OJT/ Internship/ Training	No. of Theory Hours (Total 15 Hours = 01 Credit)	No. of Skill Hours (Total 60 Hours = 02 Credit)
I	Introduction to 'R' & MS-Excel.	Familiarity with Software	Theory/Practical	02	05
II	Types of Data and Frequency Distribution	Data Handling	Theory/Practical	02	10
III	Graphical Representation of Data.	Data Representation	Theory/Practical	03	15
IV	Measures of Central Tendency and Dispersion	Computational /Analytical Ability	Theory/Practical	05	15
V	Simple Correlation and Rank Correlation	Computational /Analytical Ability	Theory/Practical	03	15

Suggested Readings:-

1. Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
2. Crawley, M.J. (2017). The R Book, John Wiley & Sons.
3. Eckhouse, R.H. and Morris, L.R. (1975). Minicomputer Systems Organization, Programming and Applications, Prentice-Hall.
4. Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc.

Suggested Digital Platforms/Web Links for Readings:-

- <http://heecontent.upsdc.gov.in/SearchContent.aspx>
- <https://swayam.gov.in/explorer?searchText=statistics>
- <https://nptel.ac.in/course.html> <https://www.edx.org/search?q=statistics>
- <https://www.coursera.org/search?query=statistics&>

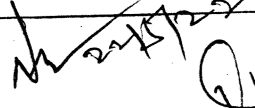
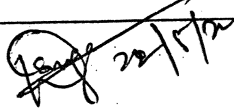
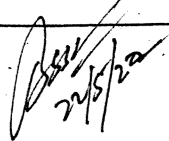
Note:

- -Number of units in Theory/Practical may vary as per need.
- Total Credits per Semester = 03 (It can be more, but students will get only 03 credits/ semester or 06 credits/year
- Credits for Internship/OJT/Practical = 02 (Training Hours = 60)

LIST OF VOCATIONAL COURSES

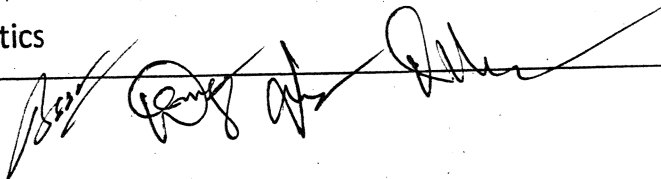
NAME OF VOCATIONAL COURSES

- 1- R.P English
- 2- Learning and Earning with R.P
- 3- Skill of Speaking
- 4- Speaking with Fun
- 5- A course in installation maintenance and repair of Electrical and Electronic Products.(For Second , third Semester or forth Semester)
- 6- Medical lab technology
- 7- Digital Marketing learning with earning
- 8- चुनाव विश्लेषक
- 9- दूर गाइड
- 10- Air Quality Management (Pollution)
- 11- Basic Computer in computer Application
- 12- Skill development in Sociology
- 13- Heritage Conservation (VOHC)
- 14- Circular Economy & Resource Management
- 15- Ecotourism & Hospitality (VOEH)
- 16- Library Science(VOLS)
- 17- Diary Technology (VODT)
- 18- Yoga Science (VOYS.)
- 19- Community Science(VOCS)
- 20- Multimedia and Animation (VOMA)



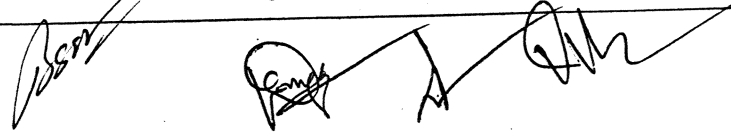
LIST OF VOCATIONAL COURSES

21. Agribusiness Management(VOA BM)
22. Computer Office Management(VOCOM)
- 23- Analytical Instrument (VOAI)
- 24- Agri Food Processing(VOAFP)
- 25- Public Health Engineering (VOPHE)
- 26- Green House Technology (VOGHT)
- 27- Plant Nursery Management(VOPNM)
- 28- Organic farming & Products (VOOFP)
- 29- Nutrition & Health Care Science(VONHCS).
- 30- Export & Import Management
- 31- Public Relation Officer
- 32- Technology Advancement Bootcmp
- 33- Integrated Food Processing Course
- 34- Food Processing
- 35- Vermicompost Technology
- 36- Proficiency in Spoken English Programme
- 37- Basic Computer Skill
- 38- Chemistry of Volatile distillates used as fragrances for increase and hawan samagri.
- 39- Certificate Course in Tally/ Accounting
- 40- Certificate Course in Computer Basic
- 41- Digital Marketing
- 42- HR Analytics



LIST OF VOCATIONAL COURSES

- 43- Goods & Service.Tax
- 44- E-Commerce
- 45- संगीत गायन प्रवेशिका
46. संगीत वादन (तबला)
- 47- संगीत नृत्य प्रवेशिका
- 48- संगीत वादन (कौशियो)
- 49- Certificate Course of Cutting and Scanning
- 50- Diploma in Data Entry & Office Automation
- 51- Diploma in Financial Accounting & Tally
- 52- Certificate in apiculture
- 53- Certificate in Pasciculture
- 54- Certificate in sericulture
- 55- Certificate courses on electrical appliances Maintenance and Designing of basic lab equipments.
- 56- Detection of Adulterants in common food.
- 57- Diploma in Industrial Pollution and waste water.
- 58- Electronics Technician
- 59- Animal Laboratory
- 60- Banking and Finance
- 61- Skilled Beekeeper
- 62- Pearl culture Technician
- 63- रेडियो के लिए लेखन एवं प्रस्तुतीकरण
- 64- कंप्यूटर. हिंदी भाषिक प्रयोजन एवं इंटरनेट के लिए सृजनात्मक लेखन
- 65- हिंदी साहित्य के समकालीन विमर्श एवं सृजनात्मक लेखन (महिलाओं के लिए सृजनात्मक लेखन)



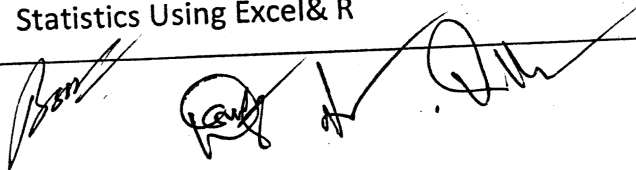
LIST OF VOCATIONAL COURSES

- 66- Tourism and heritage management
- 67- Music-Literature ,Arts ,Science
- 68- Sustainable Agriculture and Organic Farming
- 69- Laboratory water Quality attendant
- 70- Computational Physics
- 71- Radiation Physics:- Applications and Safety
- 72- Basic Instrumentation Physics
- 73- Health and Fitness Trainer
- 74- Creative Painting
- 75- Creative Photography
- 76- Designing Art and Craft
- 77- Fabric Painting
- 78- Flower Painting
- 79- Landscape Painting
- 80- Mural Art
- 81- Portrait Painting
- 82- Wall Painting
- 83- Wall Painting and Mural Art
- 84- Mushroom Cultivation
- 85- लेक-वार्ता और संस्कृति(डॉ शोफाली चतुर्वेदी एवं डॉ मधु श्रीवास्तव)
- 86- पटकथा लेखन
- 87- Comprehensive Programme on Stock Market
- 88- Fundamentals of Insurance

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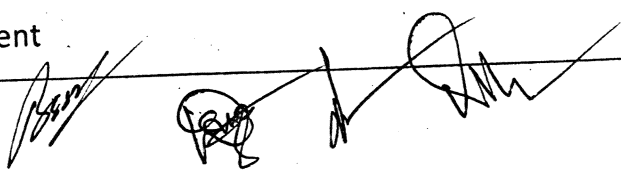
LIST OF VOCATIONAL COURSES

- 89- Fundamentals of Digital Marketing
- 90- Certificate Course on GST
- 91- Retail Management
- 92- Introduction of hospitality and Tourism Industry
- 93- Floriculture & Landscaping, Planning, Designing and Operation Management
- 94- Certificate Course in Mushroom Spawn Production and Cultivation
- 95- Modern Techniques For Plant propagation
- 96- Integrated Plant Protection
- 97- Certificate Course on Cultivation & Utilization of Medicinal & Aromatic Plants
- 98- Landscaping ,Planning, Designing and Operation Management
- 99- Plant Health Management
- 100- Pathology Techniques
- 101- Laboratory Skills& Standardization Methods
- 102- Basic of Laboratory Control
- 103- Fragrance & Flavor Development
- 104- Skills on Chemical Waste Management
- 105- Skills for Recovery and Reuse of Metals From Industrial Waste
- 106- Recovery and Reuse of Metals From Industrial Waste
- 107- Recovery and Reuse of Metals From Industrial Waste
- 108- Business English Communication
- 109- Descriptive Statistics Using Excel& R



LIST OF VOCATIONAL COURSES

- 110- Accounts & Tally
- 111- Good & Service Tax (GST)
- 112- MS Office & Internet
- 113- Export Import Documentation
- 114- Guidance & Counseling
- 115- General Sericulture
- 116- MS Office & Networking
- 117- Certification in Organic Farming
- 118- Study of the Autism Skills of Agra
- 119- Teaching Skills Development Vocational Certificate Course
- 120- Basics of Electrician Trade
- 121- Basics of Electronics Mechanic Trade
- 122- Office Automation With Internet
- 123- Basic of computer and Information Technology
- 124- Fashion Technology-General Knowledge
- 125- Electronics Components and Devices
- 126- Industrial Safety
- 127- Self Employed Tailor
- 128- Yoga Instructor
- 129- Data Entry Operator
- 130- Plant Nursery Management
- 131- Village and Cottage Industries Skill and Entrepreneurship Development



LIST OF VOCATIONAL COURSES

- 132- Yogic Science (PDS WFT 101)
 - 133- Wellness Fitness Training (PDS WFT 201)
 - 134- Medical Plants of local areas and their application
 - 135- Techniques in biofertilizers production
- [Handwritten signatures and dates are present below the list, including a date of 22/1/24.]*



डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा

विभाग शैक्षणिक विभाग

संचिका संख्या

सहायक कुलसचिव/कुलसचिव/कुलपति,

कृपया स्कूल ऑफ लाइफ साइंस संस्थान, खन्दारी आगरा में Department of Biotechnology की एकेडेमिक कमेटी की बैठक दिनांक 21.05.2022 की पाठ्यक्रम सम्बन्धी संस्तुतियों को विद्या परिषद् एवं कार्य परिषद् में अनुमोदन हेतु प्रस्तुत किया गया है।

यदि आप सहमत हो तो उक्त संलग्न पाठ्यक्रम सम्बन्धी संस्तुतियों को विद्या परिषद् के समक्ष प्रस्तुत करने की अनुमति प्रदान करना चाहें।

AR
31/05

M. Singh
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Registrar

For Academic Council
for approval & discussion

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(1)

DR. BHIMRAO AMBEDKAR UNIVERSITY
DEPARTMENT OF BIOTECHNOLOGY
School Of Life Sciences, Khandari Campus, Agra.

Dated: 25 May, 2022

To

The Assistant Registrar (Academic)
Dr. Bhimrao Ambedkar University,
Agra.

Sir,

Please find enclosed herewith the minutes of the meeting of Academic Committee of the Department of Biotechnology held on May 21, 2022. It is requested that it may please be placed before the Academic Council / Executive Council for approval at the earliest.

Thanking you

Yours faithfully,


B.S. Sharma
Dean

Encls. :

1. Minutes of the Academic Committee
2. Ordinances of the B.Sc. (in Faculty of Life Science) Appendix- 1
3. Syllabus for B.Sc. (In Faculty of Life Science) Subject Biotechnology, Appendix- 2
3. Syllabus for Minor Subject, Appendix -3
4. Syllabus for Co- curricular Courses of B.Sc. (In Faculty of Life Science) Appendix -4
5. Syllabus for Vocational Courses of B.Sc. (In Faculty of Life Science) Appendix -5
6. List of vocational courses Appendix -6

(2)

**DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA**

ATTENDANCE SHEET

Date: 21st May 2022

Time: 11:30 PM

Meeting: Academic Committee of Department of Biotechnology

Members of the Committee:

1. Prof. Rajendra Sharma (Retd)
Department of Botany, Dr. Bhimrao Ambedkar university, Agra
2. Dr. Ajayvir Singh, Scientist 'E'
NJIL&OMD, Agra
3. Dr. Amita Sarkar,
Agra College, Agra
4. Dr. Monika Asthana, Department of Biotechnology,
Dr. Bhimrao Ambedkar University, Agra
5. Prof. Bhupendra Swarup Sharma, Dean Life sciences,
Dr. Bhimrao Ambedkar University, Agra

R Sharma
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Ajayvir Singh
21/5/22

Amita Sarkar
21.5.22

Monika
21/5/22

Bhupendra Swarup Sharma
21/5/22

**DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA**

MINUTES

The minutes of the meeting of the Academic Committee of Department of Biotechnology held in the Department of Biotechnology of the Dr. Bhimrao Ambedkar University, Agra on 21st May 2022 at 11:30 AM. The following members were present:

1. Prof. Rajendra Sharma (Redt.) Department of Botany, Dr. Bhimrao Ambedkar University, Agra
2. Dr. Ajayvir Singh, Scientist 'E' NJIL&OMD, Agra
3. Dr. Amita Sarkar, Agra College, Agra
4. Dr. Monika Asthana, Department of Biotechnology, Dr. Bhimrao Ambedkar University, Agra
5. Prof. Bhupendra Swarup Sharma, Dean Life Sciences, Dr. Bhimrao Ambedkar University, Agra

1. The Academic Committee considered and approved of Ordinances of the B.Sc. (In Faculty of Life Science) course based on Choice Based Credit System (CBCS) as per NEP 2020. (Appendix – 1)
2. The Academic Committee considered and approved the Syllabus of Biotechnology Subject for B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 2)
3. The Academic Committee considered and approved the Subject Combinations (Three) for B.Sc. (In Faculty of Life Science) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 1)
4. The Academic Committee considered and approved the B.Sc. Syllabus of Minor/elective Subject for other Faculty based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023) (Appendix – 3)

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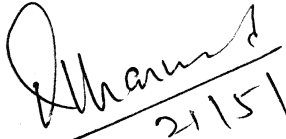
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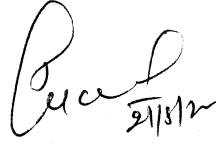
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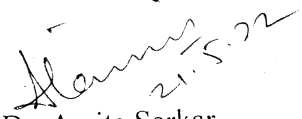
5. The Academic Committee considered and approved the Syllabus for Co- curricular courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 4)
6. The Academic Committee considered and approved the Syllabus for Vocational courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 5)
7. The Academic Committee authorized the Dean, Faculty of Life Science to prepare the syllabus of vocational courses other than approved in item no. 6 for B.Sc. (In Faculty of Life Science) from the available list of vocational courses approved by the University (Appendix-6)
8. The Academic Committee considered and approved the fee structure of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020 (To be implemented from the academic session 2022-2023. Tuition fees 10000/- per semester (20000/- per year) and other fees (examination, enrollment, sports and cultural activities etc.) as per University norms.


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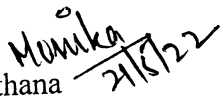
Prof. Rajendra Sharma (Retd)
Dr. Bhimrao Ambedkar University,
Agra


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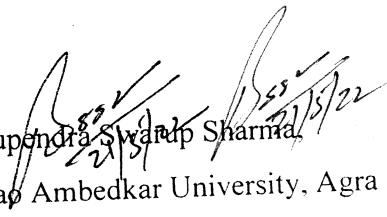
Dr. Ajayvir Singh,
NJIL&OMD


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Dr. Amita Sarkar
Agra College,


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Dr. Monika Asthana
Dr. Bhimrao Ambedkar University, Agra


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Prof. Bhupendra Swarup Sharma,
Dr. Bhimrao Ambedkar University, Agra



Appendix -1

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DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

FACULTY OF LIFE SCIENCE DEPARTMENT OF BIOTECHNOLOGY ORDINANCES OF BACHELOR OF SCIENCE (B.Sc.) (IN FACULTY OF LIFE SCIENCE) (Based on Choice Based Credit System) (UNDER NEP, 2020)

1. The title of the B.Sc. course shall be B.Sc. (in Faculty of Life Science). The Course shall be conducted by the Department of Biotechnology under the Faculty of Life Science, Dr. Bhimrao Ambedkar University, Agra.
2. The under graduate degree programme shall be initiated with six semesters (3 years) B. Sc. (in Faculty of Life Science) and can be extended up to eight semester (4 year) B. Sc. Research (in Faculty of Life Science). The B.Sc. (in Faculty of Life Science) programme will be based on Choice Based Credit System (CBCS). Each semester shall consist of minimum 90 working days.
3. The course shall be run in the self-finance mode. Fee structure for the course will be decided by the Academic Committee/Board of Studies of the Department or as per the University norms. The Examination fees and other fees per semester/annual will be paid by the student as per University Norms.
4. The Department of Biotechnology shall run B. Sc. course with Biotechnology (Major course) and six other Major courses/ subjects of the Faculty of Life Science in following combinations:
 - A. Biotechnology, Environmental Science, Microbiology
 - B. Biotechnology, Biochemistry, Zoology
 - C. Biotechnology, Botany, Forestry
5. Faculty of the Department shall be responsible/ committed to teach all the students of the other Departments (School of Life Sciences, University Campus) of Faculty of Life Science who has taken Biotechnology as a Major Course.
6. Bachelor of Science shall consist of following
 - A. For I, II, III and IV Semester (1st and 2nd year), there shall be:
 - a. Three Major courses of own faculty in each semester,
 - b. Three Practical (3 Major Courses of own faculty) in each semester,
 - c. One minor/elective course of other faculty (once in a year),
 - d. One vocational course in each semester,
 - e. One co-curricular course in each semester.

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B. For V and VI Semester (3rd year), there shall be

- Two Major courses of own faculty in each semester,
- Two Practical (2 Major Courses) in each semester,
- One co-curricular course in each semester.
- One Industrial/Summer Training/ Survey/ Minor Project in each semester.

C. For VII and VIII Semester (4th year), there shall be

- One Major Course of own faculty in each semester.
- One Practical (1 Major Courses) in each semester
- One minor/elective course of other faculty (once in a year)
- One Industrial/Summer Training/ Survey/ Research Project in each semester.

7. To start with, not more than 30 students shall be admitted in the First Semester of B. Sc. (in Faculty of Life Science) in the concern department, there will be only 10 seats in each combination.

8. Types of Courses –

A. **Core (Major) Course**:- Core (Major) course is a course which is compulsory for a student to study, if s/he has chosen that subject as Major. Each Major course will be of 4 credits (each paper of theory) and 2 credits (practical).

B. **Elective (Minor) Course**:- Elective (Minor) course is a course which can be chosen from a pool of elective courses offered in the programme. It can be a major course of other subject. Each Elective (minor) course will be of 4 credits (each paper of theory).

C. **Vocational / Skill development Course**: These courses will be offered by the Departments/Colleges in different Faculties as value added courses for enhancing employability. They will be of two types' Individual nature and progressive nature. There will be a capping on the maximum number of students in a particular course as specified by the department/colleges concerned. Each Vocational / skill development course will be of 3 credits.

Online courses / MOOCs: The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Course offered in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal. Online papers credit maximum of 20 % of the total credits required for that course could be earned in minor/elective papers from this mode and those credits have to be added by the University in their SGPA/ CGPA.

D. **Co-curricular Course**: These courses will be offered by the Departments/Institutes in different Faculties of the University as value added courses for overall personality development in first six semesters. They will be fixed for each semester as prescribed in regulations /guidelines of University New education Policy (NEP). They will be **qualifying** in nature and their **grades will not be added in CGPA**.

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- E. **Credited Value-Added Course:** These courses add value through enhanced employability skills and have credits assigned to them and may be offered through Vocational and Co-curricular courses. These courses will be counted for calculation of SGPA/CGPA. Credit Value-added course will be of 3 credits.
- F. **Non-credited Value-Added Course:** These courses may be offered to add value through enhanced employability skills but do not have credits assigned to them. The performance in these courses shall not be counted for computation of 'SGPA' and 'CGPA'.

G. Major and Minor Research Project:

- a. All students of the B.Sc. shall have to complete a minor research project in 3rd year (V and VI semester each) and a Major research project in 4th year (VII and VIII semester each)
- b. Topic for Minor project will have to be selected from any of the two major subjects of 3rd year.
- c. Topic of Major research project will have to be selected from major subject of 4th year.
- d. The Minor/Major research project may be interdisciplinary in nature. The research project may also be undertaken as industrial training/summer training/ internship/survey work/ etc.
- e. Each project shall be completed under the supervision of a teacher of the concern Department and/or co-supervision of a competent person of any industry/ company/ technical institute/ research institute etc.
- f. At the end of 3rd /4th year the student shall submit a combined project report of the research project undertaken in the two respective semesters (V and VI semester for 3rd year and VII and VIII semester for 4th year). This shall be evaluated by the supervisor and an external examiner appointed by the Vice Chancellor of the University on the recommendation of Dean of Faculty. The maximum marks for the same shall be 100.
- g. The grade for research project based on the marks out of 100 shall be mentioned in the marksheet of 3rd year students, but the same shall not be considered in calculation of CGPA.
- h. The Research project of 4th year shall be of 4 credits in each semester. The grade based on marks obtain in the project shall be mentioned in the marksheet and shall also be considered in calculation of CGPA.

9. Admission Criteria: The minimum qualification for admission to the Bachelor of Science (in Faculty of Life Science) shall be:

- a. A certificate of successfully completing class XII/Intermediate or 10+2 in science or equivalent from any Board recognized by the State or Central Government.
- b. The admission of Indian Nationals shall be based on entrance test or academic merit or a combination of the two and reservation /weightage in admission shall be as per University as well as UP Govt. rules. However, Foreign Nationals applying for admission through authorized channels shall be eligible for direct admission with a maximum capping as per University norms.
- c. Admission in the course will be finalized by the Dean/Admission Committee of the Faculty of Life Science.

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10. A. Program Duration and Credit Requirements:

- a. The under graduate degree programme shall be initiated with six semesters (3 years) B. Sc. (in Faculty of Life Science) and can be extended up to eight semester (4 year) B. Sc. Research (in Faculty of Life Science). The B.Sc. (in Faculty of Life Science) programme will be based on Choice Based Credit System (CBCS). Each semester shall consist of minimum 90 working days.
- b. The maximum duration for completing the **Certificate in Faculty** is 1 year (46 Credits), **Diploma in Faculty** is 2 years (92 Credits), Bachelor of faculty is 3 years(132 Credits) and B. Sc. Research in Faculty is 4 years(184 Credits). These will be consecutive academic years.

B. Distribution and Requirements of Credits for B. Sc. (in Faculty of Life Science) Programme is:

a. B. Sc. 1styear (I and II Semester) will be of 46 credits.

- I. Teaching of 03 Major Courses of Theory in each semester (I & II Semester) = 12 + 12 credits = 24 credits
II. Practical work of 03 Major Courses in each semester (I & II Semester) = 6 + 6 credits = 12 credits
III. Teaching of 01 Minor Course Theory (I or II semester) = 4 credits
IV. 01 Vocational Course in each semester (I & II Semester) = 3+ 3 credits = 6 credits
V. 01 Co-curricular in each semester (I & II Semester) = qualifying
- Certificate in Faculty will be awarded after completing two semesters (One Year) comprising total 46 Credits.

b. B. Sc. 2nd year (III and IV Semester) will be of 46 credits.

- I. Teaching of 03 Major Courses of Theory in each semester (III & IV Semester) = 12 + 12 credits = 24 credits
II. Practical work of 03 Major Courses in each semester (III & IV Semester) = 6 + 6 credits = 12 credits
III. Teaching of 01 Minor Course Theory (III & IV Semester) = 4 credits
IV. 01 Vocational Course in each semester (III & IV Semester) = 3+ 3 credits = 6 credits
V. 01 Co-curricular in each semester (III & IV Semester) = qualifying
- Diploma in Faculty will be awarded after completing four semesters (Two Years) comprising total 92 Credits.

c. B. Sc. 3rdyear (V and VI Semester) will be of 40 credits.

- I. Teaching of 02 Major Courses (2 Theory in each course) in each semester (V&VI Semester) = 16 + 16 credits = 32 credits
II. Practical work of 02 Major Courses(01 Practical in each course) in each semester (V&VI Semester) = 4+4credits = 8credits
III. 01 Co-curricular in each semester (V& VI Semester) = qualifying
IV. 01 Industrial/Summer Training/ Survey/ Minor Project in each semester (V& VI Semester) = qualifying
- Bachelor in Science (in Faculty of Life Science) will be awarded after completing all 6 semesters (3 years) comprising total 132 credits.

d. B. Sc. 4thyear (VII and VIII Semester) will be of 52 credits.

- I. Teaching of 01 Major Course (4 Theory in course) in each semester (VII&VIII Semester) = 16 + 16 credits = 32 credits
II. Teaching of 01 Minor Course Theory (VII or VIII semester) = 4 credits
III. Practical work of 01 Major Courses in each semester (VII & VIII Semester) = 4 + 4 credits = 08 credits
IV. 01 Industrial/Summer Training/ Survey/ Research Project in each semester(VII & VIII Semester) = 4 + 4credits = 8credits
- B. Sc. Research (in Faculty of Life Science) will be awarded after completing all 8 semesters (4 years) comprising total 184 credit.
- The B. Sc. (in Faculty of Life Science) Programme shall be spread over 6 semesters (3 years). Total marks assigned for this programme shall be 4200 and credits earned will be 132 and comprise of three different components viz: i) Teaching ii) Practical and (iii) Industrial/Summer Training/ Survey/ Research Project

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C. Distribution of Maximum Marks for B. Sc. (in Faculty of Life Science) Programme is:

a. B. Sc. 1st year (I & II Semester) will be of 1500 marks.

- I. Teaching of 03 Major Courses of Theory in each semester (I & II Semester) = 300 + 300 marks = 600 marks
 - II. Practical work of 03 Major Courses in each semester (I & II Semester) = 300 + 300 marks = 600 marks
 - III. Teaching of 01 Minor Course Theory (I or II semester) = 100 marks
 - IV. 01 Vocational Course in each semester (I & II Semester) = 100 + 100 marks = 200 marks
 - V. 01 Co-curricular in each semester (I & II Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 1st year (I & II Semester) = 1500 marks

b. B. Sc. 2nd year (III & IV Semester) will be of 1500 Marks.

- I. Teaching of 03 Major Courses of Theory in each semester (III & IV Semester) = 300 + 300marks = 600 marks
 - II. Practical work of 03 Major Courses in each semester (III & IV Semester) = 300 + 300marks = 600 marks
 - III. Teaching of 01 Minor Course Theory (III & IV Semester) = 100 Marks
 - IV. 01 Vocational Course in each semester (III & IV Semester) = 100 + 100Marks = 200 Marks
 - V. 01 Co-curricular in each semester (III & IV Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 2nd year (III & IV Semester) = 1500 marks

c. B. Sc. 3rd year (V & VI Semester) will be of 1200 Marks.

- i. Teaching of 02 Major Courses (2 Theory in each course) in each semester (V & VI Semester) = 400 + 400 = 800Marks
 - II. Practical work of 02 Major Courses (01 Practical in each course) in each semester (V & VI Semester) = 200+200 = 400Marks
 - III. 01 Co-curricular in each semester (V & VI Semester) = 100 marks (not included in CGPA; qualifying only)
 - IV. 01 Industrial/Summer Training/ Survey/ Minor Project in each semester (V & VI Semester) = 100 marks (not included in CGPA; qualifying only)
- Total Marks of B. Sc. 3rd year (V & VI Semester) = 1200 marks

d. B. Sc. 4th year (VII & VIII Semester) will be of 1300 Marks.

- I. Teaching of 01 Major Course (4 Theory in course) in each semester (VII & VIII Semester) = 400 + 400 = 800 Marks
 - II. Teaching of 01 Minor Course Theory (VII or VIII semester) = 100 Marks
 - III. Practical work of 01 Major Courses in each semester (VII & VIII Semester) = 100 + 100 = 200 Marks
 - IV. 01 Industrial/Summer Training/ Survey/ Research Project in each semester (VII & VIII Semester) = 100 + 100 = 200 Marks
- Total Marks of B. Sc. 4th year (VII & VIII Semester) = 1300 marks

- The B. Sc. (in Faculty of Life Science) Programme shall be spread over 6 semesters (3 years). Total marks assigned for this programme shall be 4200 and credits earned will be 132 and comprise of three different components viz: i) Teaching ii) Practical and (iii) Industrial/Summer Training/ Survey/ Research Project

11. Course Structure

The course structure and course outlines of B. Sc. (in Faculty of Life Science) programme shall be as per the respective regulations recommended by the respective Academic Committee/ Board of Studies of the Department and ratified by the competent authority.

12. Attendance Requirement

Students with less than 75% attendance shall not be eligible to appear in the End of Semester Examination (Every candidate will be required to have 75% attendance of the prescribed number of periods in each paper/ Practical). However, not more than 15 % Exemption in the prescribed number of attendance may be granted by the Vice-Chancellor on the recommendation of the Head of the Department/Dean on the basis of genuine reason or in case of following circumstances:

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- a. The student should be a sportsman or sports woman who has participated in games up to the level of National/ Inter-University/ Camps/ Tournaments and Youth Welfare Activities.
 - b. In spite of exemptions clarified above it will be compulsory for a candidate to have attended at least 60% prescribed number of periods.

13. Examinations and Assessment /Evaluation

A. Continuous Internal Evaluation (CIE)

- a. Continuous Internal Evaluation (CIE) of all the theory courses/ papers, major/ minor/ Co-curricular, will carry Maximum Marks 25.
- b. Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.
- c. Continuous Internal Evaluation (CIE) in Practical papers: shall be based on One Practical Tests/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.
- d. Continuous Internal Evaluation (CIE) will be conducted by the concerned teacher(s)/HOD.
- f. The evaluated answer books/quiz papers/ etc. and related material should be preserved in the Department for one year from the date of result declaration.
- g. The teacher will have to submit total marks out of M.M. 25 of Continuous Internal Evaluation (CIE) to the University online or as per University rules.

B. End Semester Examination

After 90 working days of teaching in a semester, the date sheet of End Semester Examination shall be approved by the Vice Chancellor on the recommendation of the Dean (Faculty of Life Science).

The question paper will be bilingual i.e. printed in Hindi and English. (Except Language papers) The End Semester examinations will be held at the end of each semester, in these examinations, all the theory papers / major/ minor courses/ will carry Maximum Marks 75 each. The examination duration will be of Three hours, or as per University Norms/ rules.

- a. First, Second, Third and Fourth Semester shall have three Theory Papers (3 Major Courses) of 75 marks each and three Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc. (as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE). One Practical examination of each major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.
- b. Fifth and Sixth semester shall have four Theory Papers (2 Major Courses) of 75 marks each and four Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher)carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE).

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One Practical examination of each major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.

- c. Seventh and Eighth semester shall have four Theory Papers (1 Major Courses) of 75 marks each and four Continuous Internal Evaluation (CIE) of 25 marks. Each Continuous Internal Evaluation (CIE) shall be based on One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/Presentation etc. (as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks. Total marks of each theory paper shall be 100 marks (4 Credits) including Continuous Internal Evaluation (CIE).

One Practical examination of a major course will be of 75 marks and 25 marks Continuous Internal Evaluation (CIE) (total 100 marks, 2 credits) in each semester.

One Research Project will be completed in each semester of IV year and have 100 marks each (4 Credits).

- d. Each theory paper of the Major /Minor Courses shall be divided into three sections; **Section-A** (10 very Short answer type question/MCQ/Fill in the Blank/One word answer of 2 marks each; all questions are compulsory), **Section-B** (attempt 5 questions out of 8 questions of 7 marks each ; each answer should not be less than 50 words) and **Section-C** (attempt 2 questions out of 4 long essay type questions of 10 marks each; each answer should not be less than 200 words).

All the questions should be spread uniformly over the entire syllabus. The students shall have to answer the questions in three hours, which shall be the duration of the question paper.

- e. The Panel of examiners for paper setting, evaluation of answer books, practical and project etc. of end semester examination external examiner as well as internal examiner shall be appointed by the Vice Chancellor on the recommendation of the Dean (Faculty of Life Science).

- f. The practical examination at the end of each Semester shall be conducted by a Board of two examiners (one external and one internal examiner) will be of 75 Marks and six hours duration, based on prescribed courses taught during the Semester.

The marks of practical examination shall be submitted in the University or uploaded on University website as per the prevailing arrangement.

- g. The Remuneration, TA/DA of University Examinations will be made as per the existing rules and regulations of the University.

- h. The total marks in a paper of major, minor courses and practical will be awarded to a student out of 100 marks, with Continuous Internal Evaluation and end semester exam put together. But a student will have to secure minimum 26 marks out of 75 in end semester exam and minimum 9 marks out of 25 in Continuous Internal Evaluation.

- i. A student must get at least 35% marks in each theory paper and Continuous Internal Evaluation separately in each Semester for being eligible for promotion to the next Semester. Further, he/she must get at least 35% marks in the practical examination. To pass the course the candidate should secure at least 35% marks in the aggregate.

- j. In special circumstances, the examination may also be conducted in objective type. In which out of 100 questions, the candidate will have to solve 75 questions. The duration of said examination will be 2:00 hours.

- k. All the answer sheets and other material related to the examination will be provided by the University to the department before the examination.

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- l. The evaluation work related to the End Semester Examination will be done by the University under centralized evaluation system or as per University rules.
 - m. Marks obtained in all subjects will be converted to comparative (credit point/grade) as per University norms for CBCS system.

C. End Semester Examination of Vocational Course

- a. The Vocational Course Examination will be of 100 marks. The Vocational subject (training based) will be of 60 marks and Vocational theoretical (learning based) paper will be of 40 marks, out of 100 marks. The examination pattern of the vocational subject will be as follows -
 - i. At the end of the respective semester, the Department will conduct exam of paper (training based) and paper (learning based) separately at their own level.
 - ii. For the evaluation of training based paper of vocational subject, the Department will appoint a joint team of trainers/training associate from skill partner (contracted by the MOU) and a teacher from the faculty at the internal level.
 - iii. For the examination of theory work, a question paper of 40 marks will have to be prepared by the Department through the concerned teacher/HOD in consultation with the training associate. This question paper will consist of 05 descriptive type questions, which the student will have to answer in a maximum of 75 words per question. The stipulated duration of the exam will be 1:00 hrs.

D. End semester examination of Compulsory Co-Curricular Course

End semester examination of Compulsory Co-Curricular Courses will be based on multiple choice questions Printed question booklet with OMR sheet provided by the University of 75 Marks having 100 questions. Candidate will have to attempt any 75 questions. For each question, 01 Mark will be awarded for the correct answer, there will be no provision of negative marking for wrong answers. The prescribed duration for the said examination will be 02:00 hours.

14. Minor Courses

- a. To ensure multidisciplinary, the student will have to study one minor course/ elective paper of other faculty with three major courses of own faculty.
- b. There shall be no prerequisite qualification to choose a minor subject.
- c. A student shall have to study one minor subject in B. Sc. 1st and 2nd year.
- d. Student may study and qualify the above mentioned minor subject in any one semester of 1st year (I or II semester) and 2nd year (III or IV semester).
- e. Minor/elective course shall be allotted by Department based on availability of seats at the beginning of the semester and fill in the Examination form.
- f. Student will have to opt for a minor / elective course offered by Department, from the subjects available at the Institutes/departments of the Khandari Campus, Dr. Bhimrao Ambedkar University Agra. Classes and examinations for minor / elective course shall be run simultaneously with their major courses/subjects.
- g. The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Minor/Elective Course offered in the semester as specified by the Department. The total credits required for that course could

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- be earned in Minor Course /Elective paper from this mode and those credits have to be added by the University in their SGPA/ CGPA on the submission of certificate.
- h. Student may complete minor course /elective paper from SWAYAM, MOOCS etc. by recognized Central or state government body, or UGC, or University during the period of B. Sc., it will be considered as one Minor paper of four credits. His marks/grades will be awarded according to the decision of Equivalence committee on the submission of the certificate.

15. Vocational Courses

- a. Students shall choose the course as per the choices offered by the Department. He/She will also have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Course in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal.
- b. A Memorandum of Understanding : Department are required to sign the MOUs at the local level. Department will contact nearby industries, I.T.I., Polytechnics, Engineering Colleges, Artisans, Registered Enterprises, Specialists for conducting vocational courses. In order to connect with Government run Vocational Courses/Training/Internships, Departments will coordinate with the concerned Institutions. The safety of a student in workplace should be considered while signing the MOU. All possible efforts should be made to pay student honorarium, as per rules, to students during their training/internship.
- c. **Time Table for vocational course:** Training/internship could be done during holidays or after Class hours. Alternatively, a day in a week may be fixed for this activity.
- d. **Seat Allocation for vocational course:** The number of seats in each course must be decided by the Department in consultation with the skill partner.
- e. **Examination :**
 - i. Theory examination (1 credit) will be conducted by the Department, while the training/internship examination (2 credit) will be conducted by the skill partner or by the Department wherever the facility exists.
 - ii. Skill partner/Department may evaluate the skills of the student either on the basis of the work done during the training/internship or on the basis of offline/online examination.
 - iii. Department will upload the marks on the portal in time after obtaining theory and skill marks.
 - iv. The details of the Vocational Course will be entered in the marksheet/degree issued by the University.
 - v. In addition to it, department and skill partner may issue a joint certificate to the student.
- f. **Syllabus**
 - i. The course structure of each vocational course for B. Sc. (in Faculty of Life Science) shall be as per the respective Regulations recommended by the respective Board of Studies/Academic Committee of the Department and ratified by the competent authority.

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- ii. In different vocational courses the ratio of the General Theory to Skill/ Training/Internship/Lab will be 40:60, and for such courses the arrangements to sign MOU with the skill partners will be made by the Department.
- iii. The theory component shall be of one credit (15 hours) and the skill component shall be of two credits (30 hours per credit). Thus the vocational course will be a 3 credit course comprised of 15 hours of theory (1 credit) and 60 hours of training/internship/lab (2credits).

g. Nature of the Syllabus

Syllabus shall be of two types:

- Individual Nature- A syllabus that would be completed in one semester.
- Progressive Nature—The complexity/specialization of syllabus would increase with each semester but will be complete in itself in each semester.

h. Credit

A student will have to earn a minimum of three credits from vocational courses in each semester, which means six credits every year. Students may choose a vocational course with more than required credits and deposit them, but in a year six credits/in two years 12 credits will be used to obtain certificate/diploma/degree.

16. Compulsory Co-curricular Courses

- a. One co-curricular course has to be qualified in each semester up to third year (total six courses in six semesters). These courses are only qualifying in nature and the marks of these courses will be assigned corresponding grades and mentioned on marks-sheet, they will not be counted in the calculation of SGPA/CGPA. Thus they are also known as non-credit courses.
- b. Number of lectures (Hours) in each course: 30
- c. Continuous Internal Evaluation (CIE) shall be based on One MCQ Test/Quizzes (as decided by the concerned teacher/HOD) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.
- d. End Semester Examination of co-curricular course (100 MCQ, 2 hours): 75 marks (no negative marking). Each question will carry 1 marks.
- e. Minimum passing marks of these courses will be 40 (Continuous Internal Evaluation and final semester exam put together).
- f. **The sequence of teaching co-curricular courses semester-wise is as follows:**
 - i. First Semester : Food Nutrition and Hygiene
 - ii. Second Semester : First Aid and Health
 - iii. Third Semester : Human Values and Environmental Studies
 - iv. Fourth Semester : Physical Education and Yoga
 - v. Fifth Semester : Analytic Ability and Digital Awareness
 - vi. Sixth Semester : Communication Skill and Personality Development.

Or as per University norms/rules.

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17. Examination, Promotion and Reappearing Rules:

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- a. A student obtaining grades 'P' to 'O' (grade point 4 or higher) in any course shall be considered PASS in that course.
- b. For non-credit courses 'Satisfactory' (grades 'P' to 'O') or 'Unsatisfactory' (Grade 'F' or 'AB') shall be indicated instead of the letter grade and these will not be counted for the computation of SGPA/CGPA.
- c. All students shall be promoted automatically from odd to even semesters but for promotion from even to odd semester i.e. from current year to next year She/He should have earned at least 75% credits of all the credits of current year. She/He may be promoted in this manner till VI Semester (III year). Further promotion (to VII semester) may not be allowed till she/he clears all the previous semester credits.
- d. Student who fails or want to improve in theory paper/(s) (End Semester examination) or test/(s) (Continuous Internal Evaluation) shall be given permission to reappear in that paper along with the next following batch. The chance to reappear shall be given only in not more than two courses in one Semester. The candidate shall, however be promoted to the next Semester. No separate examination will be conducted for such candidate.
- e. A Student may be allowed to re-register for a semester, within the maximum stipulated time period allowed to complete the program, provided he/she satisfies one of the following conditions. In such a case there shall be fresh assessment of Continuous Internal Evaluation and End Semester examination:
 - i. The student declares fail.
 - ii. The student did not appear in the semester examination or he/she was not granted permission to appear in the examination.
 - iii. The student has been detained by the University and subsequently has been permitted to take re-admission.
- f. If a candidate fails to appear in practical examination, a special practical examination can be conducted for the candidate on the deposition of fees as prescribed by the University as a special practical examination fees.
- g. A student may appear as an Ex-student in the End semester examination provided that he /she has completed all the Continuous Internal Evaluation (CIE) and Practical Examinations but failed in more than two courses or totally absent in all the End semester examination.
- h. Those Students who reappear in any course/s in any semester or re-register for a semester shall have to pay the prescribed fee (Tution, Examination and Other fees).
- i. Cases of use of unfairmeans in the examination shall be dealt with as per the rules and regulations of the University.
- k. Challenge evaluation shall be permitted as per rules/orders of the University.

l. Grade Card:

A grade card shall be issued by the University to each student at the end of every semester.

m. Transcript:

A Transcript shall be issued by the University to a student on successful completion of the program on request as per rules.

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n. Withholding of Grade Card/Transcript

The Grade Card/Transcript of a student shall be withheld if he/she has not paid his/her dues, or if there is a case of indiscipline pending against him/her.

- o.** The formula of conversion of CGPA to equivalent percentage of marks will be as per the University rules.

18. Exit option and award of B.Sc. (in Faculty of Life Science)

a. In case the student wishes to leave after completion of one year of B. Sc. (in Faculty of Life Science) programme, He/she shall be eligible for award of Certificate in Faculty, provided the student fulfils the following conditions:

- i.** Has pursued the prescribed courses of study and has earned 46 credits as prescribed under the relevant regulations within four academic years.
- ii.** Obtained a minimum CGPA of 4.0
- iii.** Paid all the dues of the University.
- iv.** No disciplinary proceedings are pending against him/her.
- v.** Any other condition, as notified by the competent authority of the University.

b. In case the student wishes to leave after completion of two years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a Diploma in Faculty, provided the Student fulfils the following conditions:

- i.** Has pursued the prescribed courses of study and has earned 92 credits as prescribed under the relevant regulations within three academic years after earning certificate.
- ii.** Obtained a minimum CGPA of 4.0
- iii.** Paid all the dues of the University.
- iv.** No disciplinary proceedings are pending against him/her.
- v.** Any other condition, as notified by the competent authority of the University.

c. In case the student wishes to leave after completion of three years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a Bachelor's Degree in Faculty, provided the student fulfils the following conditions:

- i.** Has pursued the prescribed courses of study and has earned 132 credits as prescribed under the relevant regulations within three academic years after diploma infaculty.
- ii.** Obtained a minimum CGPA of 4.0
- iii.** Paid all the dues of the University.
- iv.** No disciplinary proceedings are pending against him/her.
- v.** Any other condition, as notified by the competent authority of the University.

d. On completion of four years of B. Sc. (in Faculty of Life Science) Programme, he/she shall be eligible for award of a B. Sc. Research in faculty, provided the student fulfils the following conditions:

- i.** Has pursued the prescribed courses of study and has earned 184 credits as prescribed under the relevant regulations after Bachelor's degree.
- ii.** Obtained a minimum CGPA of 4.0
- iii.** Paid all the dues of the University.

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- iv. No disciplinary proceedings are pending against him/her.
 - v. Any other condition, as notified by the competent authority of the University.
- e. Students holding a Certificate or Diploma can apply for lateral entry (with same subjects and combination provided by Department) into the second /third year respectively of B. Sc. (in Faculty of Life Science) Programme through the laid down admission process for the purpose as notified by the University.

19. Interpretation clause

In case of any issue of interpretation arising during the course of implementation of these Ordinances or in case of any unforeseen circumstance, decision of the Vice Chancellor shall be final.

20. In case of misbehavior, indiscipline, the student may be expelled from the Department or given some other punishment recommended by the Dean, of Faculty of Life Science/HOD of Department/Proctor of the University. The decision of the Unfair means Committee of the University is final in the case of cheating and using unfair means by the student in any examination. All cases of expulsion shall be referred to the Vice-Chancellor for final approval.
21. Each student shall pay tuition, examination and other fees per semester/annual and as per University Orders.
22. Anything, not covered under the Ordinance (*vide supra*) shall be decided by the Academic Committee of the Department without prejudice to the powers of The Academic Council, Executive Council, The Admission Committee, and The Examination Committee of The University. The Academic Committee shall be responsible for courses, syllabus of B. Sc. (in Faculty of Life Science) or any other degree.

23. Conversion of CGPA to equivalent percentage of Marks as per University norms are given below-

Percentage of Marks = (CGPA*10) equivalent

A. The following percentage to Letter Grade/ Grade Points conversion scheme will be followed

Percentage	Equivalent Letter Grade	Equivalent Grade Point
>=95%	O	10
>=85% and <95%	A+	9
>=75% and <85%	A	8
>=65% and <75%	B+	7
>=55% and <65%	B	6
>=45% and <55%	C	5
>=35% and <45%	P	4
<35%	F	0
NA	AB	0

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B. Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

- a. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.

- b. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

where S_i is the SGPA of the i th semester and C_i is the total number of credits in that semester. The SGPA and CGPA shall be given upto 2 decimal points without rounding off. For example, if the SGPA / CGPA is 5.2434, the final CGPA will be 5.24. Similarly, if the SGPA / CGPA is 52.498 then also the final CGPA to be reflected in the transcript will be 5.24.

C. Grade Point Requirement / Minimum Standard

- a. A student, in order to be eligible for the award (i) passed all the prescribed courses as laid down and completed the minimum credit requirement of the programme already defined in the ordinance; (ii) she/he has obtained a CGPA of 4.0 at the end of the programme.

- b. The grade points - division mapping for UG programs will be as follows —

Grade Point Range	Division
≥ 6.0 and above	First
≥ 4.5 and < 6.0	Second
≥ 4.0 and < 4.5	Third
< 4.0	Fail

- c. A student shall be deemed to have cleared a course only if (i) he/she has in the internal assessment and has secured an overall grade at least 'P' or higher and (ii) if she/he has secured a grade at least 'P' or higher in the end- semester examination (for courses having end-semester examination). A student obtaining Grade 'F' shall be considered fail and will be required to reappear in the examination.
- d. If a student fails to clear a selected course then he/she shall be allowed to clear another similar credit course in lieu thereof or the same course.
- e. In case a student earns extra credits by clearing courses in addition to the minimum prescribed for the programme, all the courses and their grades will reflect in the grade sheet. However, for the purposes of calculating the Cumulative Grade Point Average (CGPA) in the final semester, only his/her best grades will be taken into account such that the minimum credit requirements for the programme are fulfilled.
- f. For awarding medals or for declaring the toppers in the course if the student gets the same CGPA, it should be resolved by considering the number of times at student has obtained higher SGPA

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- but if it is not resolved even at this stage, the number of times a student has obtained higher grades in a paper like O, A+ etc should be taken into account in rank ordering of the students in a programme. However in case of further discrepancies the final decision lies at the discretion of the Head of the Department/ Controller of Examination/Examination Committee.
- g. Transcript (Format) based on the above recommendations on letter grade, grade points and SGPA and CGPA may be used for each semester and a consolidated transcript indicating the performance of all semesters in the final semester transcript of the course.

D. Illustration of Calculation of SGPA

Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
Course 1	4	A	8	4*8=32
Course 2	4	A+	9	4*9=36
Course 3	3	B	6	3*6=18
Course 4	2	C	5	2*5=10
Course 5	4	F	0	4*0=0
Total ($\sum Ci$) = 17				Total ($\sum(Ci \times Gi)$) = 96

Thus SGPA = 96/17 = 5.64

E. Illustration of calculation of CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 17 SCPA: 5.64	Credit: 20 SGPA: 6.08	Credit: 22 SGPA: 4.9	Credit: 22 SGPA: 7.22

Thus, CGPA = (5.64*17 + 6.08* 20 + 4.9*22 + 7.22 *22)/81=5.97

Hence, equivalent percentage = (5.97*10)=59.7

And the division will be Second.

- F. In co curricular courses a student has to score 40 (Forty) % marks for clearing it. Grades will be indicated in the grade sheet but they will not be counted for evaluating CGPA.

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DEPARTMENT OF BIOTECHNOLOGY
B.Sc. (in Faculty of Life Science)
(Based on Choice Based Credit
System)
SUBJECT:BIOTECHNOLOGY
SYLLABUS
Under NEP-2020

SEMESTER WISE PAPER TITLES WITH DETAILS

Sem.	Course Code	Paper title	CIE	End Semester Examination	Total	Credits	Teaching hours
B. SC. 1ST YEAR OR CERTIFICATE COURSE IN TOOLS AND TECHNIQUES OF CELL AND MOLECULAR BIOLOGY							
I	BTB101T	Cell Biology and Genetics	25	75	100	4	60
	BTB102P	Cell Biology and Genetics Lab	25	75	100	2	60
II	BTB201T	Molecular Biology and Genetic Engineering	25	75	100	4	60
	BTB202P	Genetic Engineering Lab	25	75	100	2	60
B. SC. 2ND YEAR OR DIPLOMA IN TOOLS AND TECHNIQUES OF BIOTECHNOLOGY							
III	BTB301T	Biochemistry and Biochemical tools	25	75	100	4	60
	BTB302 P	Biochemistry Lab	25	75	100	2	60
IV	BTB401T	Microbiology and Immunology	25	75	100	4	60
	BTB402 P	Microbiology and Immunology Lab	25 25	75 75	100 100	2	60
B. SC. 3RD YEAR OR Degree in Bachelor of Science (in Faculty of Life Science)							
V	BTB501 T	Biostatistics and Bioinformatics	25	75	100	4	60
	BTB502T	Animal and Plant Biotechnology	25	75	100	4	60
	BTB503P	Bioinformatics, Biostatistics and Tissue culture Lab	25	75	100	2	60
VI	BTB601T	Industrial and Environmental Biotechnology	25	75	100	4	60
	BTB602T	Food Biotechnology	25	75	100	4	60
	BTB603P	Industrial and Environmental Biotechnology Lab	25	75	100	2	60

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Subject Prerequisite	
The candidate should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Maths) or any other science subject.	
Programme Outcomes (POs)	
After completion of the B. Sc (in Faculty of Life Science) the candidate should be able to:	
PO1	Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology research, Biotechnology Industry, Pharma industry, Medical or hospital related organizations, and Academia.
PO2	Demonstrate skills to use modern analytical tools/ software/ equipment and analyse and solve problems in various courses of biotechnology.
PO3	Execute their professional roles in society as biotechnology professionals, employers and employees in various industries, researchers and educators.
PO4	Design, perform experiments, analyse and interpret data for investigating complex problems in biotechnology and related fields.
PO5	Demonstrate learning skills to work as a team in a multidisciplinary environment.
PO6	Design and develop sustainable solutions to major biological problems by applying appropriate biotechnology tools.
PO7	Develop skills, attitude and values required for self-directed, lifelong learning and professional development.
PO8	Acquire knowledge and understanding of norms and ethics in the field of biotechnology.

PROGRAMME SPECIFIC OUTCOMES (PSOS)	
CERTIFICATE IN TOOLS AND TECHNIQUES OF CELL AND MOLECULAR BIOLOGY	
First Year	<p>This course introduces the knowledge of cell biology, genetics, molecular biology and genetic engineering. After completion of this certificate course, students will be able to –</p> <p>PSO1: demonstrate and apply their knowledge of cell biology, genetics, molecular biology and genetic engineering to solve the problems related to the field of biotechnology</p> <p>PSO2: gain knowledge about the application of various types of microscope. karyotyping, banding techniques, chromosome painting and FACS.</p> <p>PSO3: understand the basic concepts of genetics and molecular biology such as inheritance pattern, DNA replication, transcription and translation</p> <p>PSO4: understand and perform various recent molecular and recombinant DNA technology techniques in early diagnosis and prognosis of human diseases.</p> <p>PSO5: perform experiments of DNA isolation, agarose gel electrophoresis, gene cloning, transformations, protein expression and purification. This</p>

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experience would enable them to begin a career in industry that engages in genetic engineering as well as in research laboratories conducting fundamental research.
PSO6: apply at technical positions in different research laboratories, diagnostic centres and industries.

DIPLOMA IN TOOL AND TECHNIQUES IN BIOTECHNOLOGY

Second Year
 After completion of diploma course, students will be able to-
PSO1: familiarize with basic laboratory instruments and understand the principle of measurements using those instruments with experiments in biochemistry.
PSO2: understand the significance of Biochemistry and basics of enzymes.
PSO3: learn the chemistry, structure and functions of major bio-molecules and metabolism of carbohydrate, protein etc.
PSO4: understand different biochemical tools and techniques such as chromatography, electrophoresis, X-ray diffraction, NMR and mass spectrometry
PSO5: perform different experiments based on the techniques such as chromatography, electrophoresis, centrifugation etc.
PSO6: understand the different methods of sterilization
PSO7: understand and also able to perform different immunological techniques like agglutination reaction, ABO typing and ELISA.

DEGREE IN BACHELOR OF SCIENCE

Third Year
 After completing the three years degree course in Biotechnology, the students will be able to -
PSO1: demonstrate the concepts in computational Biology. Understand the interrelationship between Biology and Computer
PSO2: acquire knowledge in different domains of biotechnology enabling their application in industry, research and academia.
PSO3: perform and analyse the results of experiments using basic laboratory techniques of cell biology, molecular biology, genetic engineering, biochemistry, immunology, microbiology, bioinformatics, biostatistics, animal and plant biotechnology and Food biotechnology.
PSO4: recognize the foundations of modern biotechnology and explain the principles that form the basis for recombinant technology.
PSO5: develop an ability to properly understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind.
PSO6: exhibit ability to do research independently as well as in collaboration.
PSO7: recognize the importance of Bioethics, IPR, and entrepreneurship.

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Programme/Class: Certificate		Year: First (I)	Semester: First (I)
Subject: Biotechnology			
Course Code: BTB101T		Course Title: Cell Biology and Genetics	
Course Outcomes (COs)			
<p>This course introduces the principles of cell biology and genetics. After completion of this course, students will be able to-</p> <ul style="list-style-type: none"> • Learn different areas of cell biology including the structure and functions of cell, its organelles such as mitochondria, nucleus etc. • Understand how genetic information is transmitted in organism. • Understand the role of cytoskeleton and its remodelling including the diseases associated with improper remodelling. • Learn how the synthesized proteins are transported to different organelles. • Understand the regulation of cell cycle, programmed cell death and Cancer. • Learn different cell biology techniques like karyotyping, chromosome banding, FISH, FACS, centrifugation and microscopy. 			
Credits: 4		Core Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE: 09 Min. Passing Marks End Semester Examination: 26 Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week) L-T-P: 4-0-0			
Unit	Topics	NO. of Lectures	
I	<ul style="list-style-type: none"> • Introduction and history of Biotechnological science with special reference to contribution of Indian scholars in biological sciences 	2	
II	<ul style="list-style-type: none"> • Structure of animal, plant and bacterial cells, Diversity of cell size and shape • Cell theory • Cell Membrane: Chemical components of biological membranes, organization and Fluid Mosaic Model • Cytoskeleton and Extra cellular matrix 	8	
III	Structure and Function of Cell organelles: <ul style="list-style-type: none"> • Lysosomes: Vacuoles and micro bodies: Structure and functions • Ribosomes: Structures and function including role in protein synthesis. • Mitochondria: Structure and function, Genomes. • Chloroplasts: Structure and function, genomes. • Nucleus: Structure and function, nuclear envelope 	9	
IV	Chromosome structure: <ul style="list-style-type: none"> • Chromosomes: chromatin and chromosomes organization, euchromatin and heterochromatin, nucleosome, metaphase chromosome, genes and 	9	

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	<p>chromosomes.</p> <ul style="list-style-type: none"> • Structural and numerical changes in human chromosomes and ploidy in plants. • Mutations: Types of mutations, spontaneous and induced mutations, Physical and chemical mutagens 	
V	<p>Cell cycle, Cancer and Cell Signaling:</p> <ul style="list-style-type: none"> • Introduction to cell signalling and cell-cell interaction • Cell Cycle: Mitosis and Meiosis • Cell senescence and programmed cell death • Cancer 	7
VI	<p>Mendelian and non-Mendelian genetics:</p> <ul style="list-style-type: none"> • Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance • Mendelian genetics : Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment • Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy • Sex determination and sex linkage 	8
VII	<p>Linkage, crossing over and population genetics:</p> <ul style="list-style-type: none"> • Concept of Linkage & crossing-over, its use in genetic mapping • Extra chromosomal inheritance • Genetic Code • Fundamentals of Evolution and population genetics 	8
VIII	<p>Cytological techniques:</p> <ul style="list-style-type: none"> • Microscopy and staining techniques • Microtomy • Karyotyping • Chromosome banding, • <i>in situ</i> hybridization and FISH • chromosome painting • Fluorescence Activated Cell Sorting 	9

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Suggested Reading

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6th Ed.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: a Molecular Approach** (6th Ed.). Washington: ASM ; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments.** John Harris, D., Wiley & sons, New York
4. Iwasa J., Marshal W. **Karp's Cell Biology**(2018) (8th edition) Wiley & Sons, NY
5. Iwasa J., Marshal W. **Karp's Cell and Molecular Biology . Concepts and experiments.** (2015) (8th edition) Wiley & sons, New York
6. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). **Molecular Biology of the Gene** (5th ed.). Pearson
7. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). **Molecular Cell Biology** (8th Ed.). New York: W.H. Freeman
8. Gupta P.K. **Cell and Molecular Biology** 2018. 5th edition Rastogi Publication India.
9. Hartl, D. L., & Jones, E. W. (1998). **Genetics: Principles and Analysis.** Sudbury, MA: Jones and Bartlett.
10. Pierce, B. A. (2005). **Genetics: a Conceptual Approach.** New York: W.H. Freeman.
11. Tamarin, R. H., & Leavitt, R. W. (1991). **Principles of Genetics.** Dubuque, IA: Wm. C. Brown.
12. Smith, J. M. (1998). **Evolutionary Genetics.** Oxford: Oxford University Press
Genetics: Principles and Analysis – Hartl and Jones.
13. Gardner EJ, Simmons MJ, Sunstad DP. **Principles of Genetics.** 8th Edition. John Wiley and Sons.
14. Snustand DP, Simmons MJ. **Principles of Genetics.** (2016) 7th Edition. John Wiley and Sons.
15. Verma PS, Agarwal VK. **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.** (2004). S Chand and Company Ltd.
16. Satyanarayana U (2020). **Biotechnology.** Books and Allied (P) Ltd
17. Singh BD. (2015). **Biotechnology: Expanding Horizons** (4th edition). Kalyani Publishers
18. Dubey RC. (2014) **A Textbook of Biotechnology**(5th edition) S Chand and Company Ltd.

Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=cellbiology>
- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=genetics>
- <https://nptel.ac.in/courses/102/103/102103012/>
- <https://nptel.ac.in/courses/102/106/102106025/>
- <https://nptel.ac.in/courses/102/103/102103015/>

Suggested Continuous Internal Evaluation (CIE) methods Total marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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Programme/Class: Certificate		Year: First (1)	Semester: First (I)
Subject: Biotechnology			
Course Code: BTB102P		Course Title: Cell Biology and Genetics Lab	
Course Outcomes (COs)			
After completion of this course, students will be able to- <ul style="list-style-type: none"> • Learn, understand and develop skill and hands on training in basics of cell biology and genetics. • Be able to differentiate between plant and animal cells • Be analysed different stages of mitosis and meiosis 			
Credits: 2		Core Compulsory	
Max.Marks CIE: 25 Max.Marks End Semester Examination: 75 Total Max. Marks: 100		Min.PassingMarks CIE:09 Min.Passing Marks End Semester Examination: 26 Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4			
	Suggested Lab /Virtual Experiment		No. of Lectures
	1. Introduction to safety measures in Laboratories 2. Preparation of solutions and buffers 3. Equipment handling and pipetting 4. Study of structure of any Prokaryotic and Eukaryotic cell. 5. Microtomy: Fixation, block making, section cutting, double staining of animal tissues like liver, oesophagus, stomach, pancreas, intestine, kidney etc. 6. Cell division in onion root tip/ insect (grasshopper) gonads. 7. Vital Staining of Mitochondria with Janus green B. 8. Demonstration of diversity of cell types (Muscle, Neuron) 9. Demonstration of Sex chromatin in buccal smear.		60

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	10. Karyotype preparation. 11. Preparation of polytene chromosomes from salivary gland of Chironomous larvae. 12. Genetics problems based on : (i) Mendel's law (ii) Gene mapping and (iii) Transposable elements. 13. Ames test for mutagenesis. 14. Genetic experiment – Drosophila model	
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Suggested Reading

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6th Ed.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: a Molecular Approach** (6th Ed.). Washington: ASM ; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments**. John Harris, D., Wiley & sons, New York
4. Iwasa J., Marshal W. **Karp's Cell Biology**(2018) (8th edition) Wiley & Sons, NY
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7. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman. A. Martin, K. (2016). **Molecular Cell Biology** (8th Ed.). New York: W.H. Freeman
8. Gupta P.K. **Cell and Molecular Biology** 2018. 5th edition Rastogi Publication India.
9. Hartl, D. L., & Jones, E. W. (1998). **Genetics: Principles and Analysis**. Sudbury, MA: Jones and Bartlett.
10. Roskam's J. Rodgers L.(2002). **Lab Ref: A Handbook of Recipes, Reagents, and other reference tools for use at the Bench**. Cold Spring Harbor Laboratory Press. USA.
11. Barker K (2004). **At the Bench: A laboratory Navigator**. Cold Spring Harbor Laboratory Press. USA

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.

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Programme/Class: Certificate	Year: First (I)	Semester: Second (II)
Subject: Biotechnology		
Course Code: BTB201T	Course Title: Molecular Biology and Genetic Engineering	
Course Outcomes (COs)		

Student will be able to-

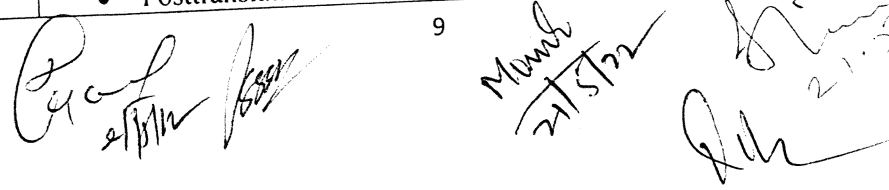
- Learn and understand the important discoveries that are made in the field of molecularbiology.
- Learn key molecular events that occur during the DNA replication, transcription, translation and regulation of gene concept.
- Gain knowledge on the foundation of genetic engineering and their applications inbiological research as well as in biotechnology industries.
- Understand gene concept, plasmids, and wide range of techniques, especially modernmolecular tools in diagnosis.
- Acquainted with various techniques of genetic engineering and their applications inbiological research, diagnostics as well as in biotechnology industries.

Credits:	Core Compulsory
Max.Marks CIE: 25	Min.PassingMarks CIE:09
Max.Marks End Semester Examination: 75	Min.Passing Marks End Semester Examination: 26
Total Max. Marks: 100	Total Min. Passing Marks: 35

Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0

Unit	Topic	No. of Lectures
I	Gene organization and regulation of gene expression: <ul style="list-style-type: none"> • Structure of DNA, Types of DNA • Gene organization in prokaryotes and eukaryotes. • Regulation of gene expression: Prokaryotes: lac and trp operons in <i>E. coli</i>. 	7
II	DNA Replication and DNA polymerases: <ul style="list-style-type: none"> • Replication of genetic material in prokaryotes and eukaryotes • A brief description of initiation at replication origins and its cell cycle regulation. • Structure and function of prokaryotic and eukaryotic DNA polymerases 	7
III	Transcription and mRNA processing: <ul style="list-style-type: none"> • RNA structure and types of RNA • Mechanism of transcription in prokaryotes and eukaryotes: transcription factors, structure of prokaryotic and eukaryotic RNA polymerases, initiation, elongation and termination. • RNA processing: processing of mRNA (Splicing, capping and polyadenylation) 	8
IV	Prokaryotic and eukaryotic translation: <ul style="list-style-type: none"> • Ribosome structure and assembly, tRNA, aminoacyl tRNA synthetases, • Mechanism of initiation, elongation and termination of polypeptides, Inhibitors of translation. • Posttranslational modification of proteins 	7

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V	Vectors: <ul style="list-style-type: none"> • Cloning vectors (plasmids, cosmids, bacterial artificial chromosomes and yeast artificial chromosomes), • shuttle vectors, • expression vectors 	7
VI	Enzymes used in DNA manipulating: <ul style="list-style-type: none"> • Restriction Endonuclease • Ligases • Polymerases • Kinases • Alkaline Phosphatases • Reverse Transcriptase 	8
VII	Genomic Library, PCR, Sequencing etc: <ul style="list-style-type: none"> • Preparation and comparison of Genomic and cDNA library. • PCR and its applications. • DNA Sequencing. • Site directed mutagenesis • Protein engineering concepts and examples (any two). 	8
VIII	Molecular Biology techniques: <ul style="list-style-type: none"> • DNA isolation (Plasmid/ Genomic DNA isolation) • Blotting (Southern, Northern, Western) • Electrophoresis of nucleic acids and proteins • Gene cloning, Screening and characterization of cloned DNA • DNA Fingerprinting • RFLP, RAPD 	8

Suggested Reading

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6th Ed.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: a Molecular Approach** (6th Ed.). Washington: ASM ; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments.** John Harris, D., Wiley & sons, New York
4. Iwasa J., Marshal W. **Karp's Cell Biology**(2018) (8th edition) Wiley & Sons, NY
5. Iwasa J., Marshal W. **Karp's Cell and Molecular Biology . Concepts and experiments.** (2015) (8th edition) Wiley & sons, New York
6. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). **Molecular Biology of the Gene** (5th ed.). Pearson
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8. Gupta P.K. **Cell and Molecular Biology 2018.** 5th edition Rastogi Publication India.
9. Brown TA. **Gene cloning and DNA analysis: An introduction.** (2016) 7th Edition. Wiley-Blackwell
10. Old, R. W., Primrose, S. B., & Twyman, R. M. (2006). **Principles of Gene Manipulation and Genomics**, 7th Edition: Blackwell Publishing.
11. Krebs JE, Goldstein ES and Kilpatrick ST (2014) **Lewin's Gene XII**, Jones and Barlett

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Publisher

- 12. Brown, T. A. (2018). **Genomes 4**.(4th edition) New York: Garland Science Pub.
- 13. Green, M. R., & Sambrook, J. (2014) Fourth Edition. **Molecular Cloning: a Laboratory Manual**. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
- 14. Micklos, DA & Freyer, CA. **DNA Science: A first course in Recombinant DNA Technology**(2nd Edition) –Cold Spring harbor laboratory press, NY
- 15. Satyanarayana U (2020). **Biotechnology**. Books and Allied (P) Ltd
- 16. Singh BD. (2015). **Biotechnology: Expanding Horizons** (4th edition). Kalyani Publishers
- 17. Dubey RC. (2014) **A Textbook of Biotechnology**(5th edition) S Chand and Company Ltd.

Suggested link

- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/transcription-translation/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/gene-regulation-and-the-lac-operon/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/agarose-gel-electrophoresis-dna-sequencing-pcr/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/basic-mechanics-of-cloning/>
- https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/labs/mod1_3/
- <https://nptel.ac.in/courses/102/103/102103045/#>

Suggested Continuous Internal Evaluation (CIE) methods Total marks:25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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Programme/Class: Certificate		Year: First (1)	Semester: Second (II)
Subject: Biotechnology			
Couse Code: BTB202P		Course Title: Genetic Engineering Lab	
Course Outcomes (COs)			
<p>After completion of the course, the student shall be able to -</p> <ul style="list-style-type: none"> • Prepare different bacterial growth media, • Understand principals and methods of competent cell preparation, restriction digestion, gene ligation, gene cloning, and transformation i. e gene manipulation. • Understand the method of agarose electrophoresis for plasmid and genomic DNA separation • Understand the method of blotting and PCR 			
Credits: 2		Core Compulsory	
Max.Marks CIE: 25 Max.Marks End Semester Examination: 75 Total Max. Marks: 100		Min.PassingMarks CIE:09 Min.Passing Marks End Semester Examination: 26 Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4			
Suggested Lab /Virtual Experiment			No. of Lectures
1. Preparation of solutions for Molecular Biology experiments. 2. Preparation of bacterial growth medium (L.B., 2XYT) 3. Competent cell preparation. 4. Transformation of <i>E.coli.</i> cells (color selection of transformants – with or without inserts) X –gal and IPTG. 5. Isolation of Plasmid DNA by alkaline lysis method 6. Isolation of genomic DNA from bacterial cells. 7. Agarose gel electrophoresis of genomic DNA & plasmid DNA 8. Concentration estimation by agarose gelectrophoresis 9. Preparation of restriction enzyme digests of DNAsamples 10. Ligation 11. Southern blotting 12. PCR			60
Suggested Reading			
1. Brown TA. Gene cloning and DNA analysis: An introduction. (2016) 7 th Edition. Wiley-Blackwell 2. Old, R. W., Primrose, S. B., & Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics , 7th Edition: Blackwell Publishing. 3. Krebs JE, Goldstein ES and Kilpatrick ST (2014) Lewin's Gene XII , Jones and Barlett Publisher 4. Brown, T. A. (2018). Genomes 4 .(4 th edition) New York: Garland Science Pub. 5. Green, M. R., & Sambrook, J. (2014) Fourth Edition. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press. 6. Micklos, DA & Freyer, CA. DNA Science: A first course in Recombinant DNA			

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Technology (2nd Edition) –Cold Spring Harbor laboratory press, NY

7. Roskam's J. Rodgers L.(2002). **Lab Ref: A Handbook of Recipes, Reagents, and other reference tools for use at the Bench.** Cold Spring Harbor Laboratory Press. USA.
8. Barker K(2004). **At the Bench: A laboratory Navigator.** Cold Spring Harbor Laboratory Press. USA

Suggested Continuous Internal Evaluation (CIE) methods

Total Marks: 25

One Practical Tests *(Record/Chart/Model)* carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.


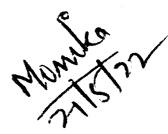

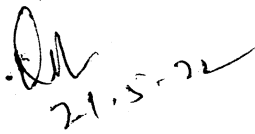
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Programme/Class: Diploma		Year: Second (2)	Semester: Third (III)
Subject: Biotechnology			
Course Code: BTB301T		Course Title: Biochemistry and Biochemical tools	
Course Outcomes			
After successful completion of the course, student will be able to:			
<ul style="list-style-type: none"> • Understand the significance of Biochemistry. • Learn the chemistry of carbohydrates, lipids, proteins and amino acids. • Understand the basics of enzymes. • Understand the metabolism of carbohydrate and proteins • Know the chemical structure of nucleotides including their components, describe primary, secondary structure of DNA and RNA. 			
Credits: 4		Core Compulsory	
Max.Marks CIE: 25		Min.PassingMarks CIE:09	
Max.Marks End Semester Examination: 75		Min.Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week) L-T-P: 4-0-0			
Unit	Topic	No. of Lectures	
I	Amino acids and Protein: <ul style="list-style-type: none"> • Structure and properties of Amino acids • Types of proteins and their classification • Forces stabilizing protein structure. • Different Level of structural organization of proteins. • Denaturation and renaturation of proteins. 	7	
II	Carbohydrates: <ul style="list-style-type: none"> • Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. • Homo and Hetero Polysaccharides, Mucopolysaccharides, • Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions. 	7	
III	Nucleic acids: <ul style="list-style-type: none"> • Structure and functions: • Physical & chemical properties of Nucleic acids, nucleosides & nucleotides, purines & pyrimidines, Biologically important nucleotides, 	7	
IV	Lipids: <ul style="list-style-type: none"> • Structure and functions of Lipids • Classification, nomenclature and properties of fatty acids, essential fatty acids. • Cholesterol. 	6	
V	Enzymes and Enzyme classification: <ul style="list-style-type: none"> • Nomenclature and classification of Enzymes. • Cofactors, coenzyme, prosthetic groups, holoenzyme and apoenzyme • Kinetics of enzyme action 	8	

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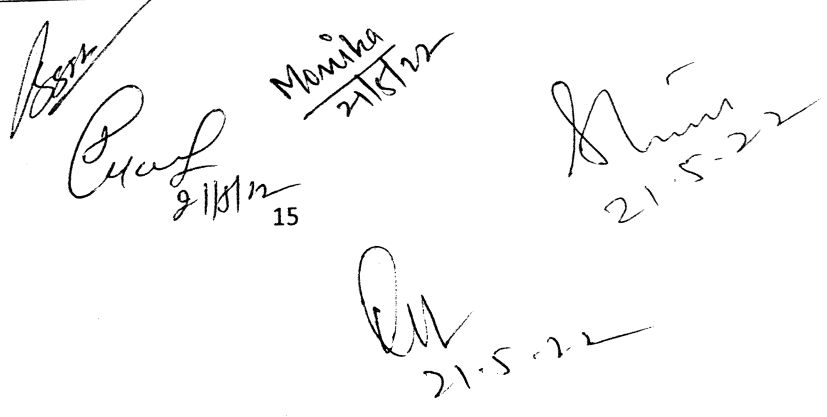
VI	Metabolism: <ul style="list-style-type: none"> • Metabolism of carbohydrates- Gluconeogenesis, Glycolysis, TCA, and Glyoxylate cycle • Metabolism of fatty acids-oxidation of saturated, unsaturated fatty acids • Oxidation of amino acids and urea cycle. 	9
VII	Vitamins and Hormone: <ul style="list-style-type: none"> • Introduction to Vitamins, hormones, Phytohormones and their role • Deficiency of vitamins and hormones and related human diseases. 	8
VIII	Techniques: <ul style="list-style-type: none"> • Chromatography and its types • Spectrometry and its types • NMR • X-ray diffraction • Centrifugation 	8

Suggested Reading

1. Berg, JM Tymoczko, JL. Gatto, GJ., Stryer, L. (2015). **Biochemistry**. (8th ed.) W H Freeman and Company New York.
2. Nelson DL. Cox MM. (2017) **Lehninger Principles of Biochemistry** (7th ed.). W H Freeman New York.
3. Voet, D., & Voet, J. G. (2016). **Biochemistry** (5th ed.). Hoboken, NJ: J. Wiley & Sons.
4. Rodwell VW. Bender D. Botham KM. Kennelly PJ Weil PA.(2018). **Harper's Illustrated Biochemistry**.(31st edition) McGraw-Hill Education
5. Hofmann A. Clokie S. **Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology**. (2018) (8th edition)Cambridge University Press
6. Boyer RF. (2012) **Biochemistry laboratory : modern theory and techniques**(2nd Edition). Pearson Education, Inc
7. Jain JL. Jain S. Jain N. (2005). **Fundamentals of Biochemistry**. (6th edition). S Chand and Company Ltd.
8. Satyanarayana U. Chakrapani U. (2013). **Biochemistry**. (4th edition). Elsevier and Booksand Allied (P) Lt

Suggested link

- <https://ocw.mit.edu/courses/findbytopic/#cat=science&subcat=biology&spec=biochemistry>
- <https://ocw.mit.edu/courses/find-by-topic/#cat=healthandmedicine&subcat=spectroscopy>
- <https://ocw.mit.edu/courses/chemistry/5-07sc-biological-chemistry-i-fall-2013/module-i/session-4/>
- <https://ocw.mit.edu/courses/biology/7-016-introductory-biology-fall-2018/lecture->



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- videos/lecture-4-enzymes-and-metabolism/
- <https://ocw.mit.edu/courses/chemistry/5-07sc-biological-chemistry-i-fall-2013/module-i/session-3/>
- <https://nptel.ac.in/courses/104/105/104105076/>
- <https://nptel.ac.in/courses/102/106/102106087/>

Suggested Continuous Internal Evaluation (CIE) methods

Total Marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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Programme/Class: Diploma	Year: Second (2)	Semester: Third(III)
Subject: Biotechnology		
Course Code: BTB302P	Course Title: Biochemistry Lab	

Course Outcomes

Students will get practical exposure to commonly used biochemical techniques and also they become familiar to use instruments like calorimeter, pHmeter etc.
 Introduce the primary steps in biomolecules (focus on proteins) purification which includes various methods in isolation and quantitation of proteins.
 2. Learn how to separate proteins from a heterogenous mixture.
 3. Learn to apply important chromatographic techniques to purify biomolecules
 4. Familiarize the working principles of electrophoresis and UV/Vis and fluorescence spectroscopic techniques and application of the knowledge to get basic structural information of proteins

Credits: 2	Core Compulsory	
Max.Marks CIE: 25	Min.PassingMarks CIE:09	
Max.Marks End Semester Examination: 75	Min.Passing Marks End Semester Examination: 26	
Total Max. Marks: 100	Total Min. Passing Marks: 35	

Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4

Suggested Lab /Virtual Experiment	No. of Lectures
1. Preparation of normal and molar solutions 2. Preparation of buffers. 3. To study activity of any enzyme under optimum conditions. 4. To study the effect of pH, temperature on the activity of salivary amylase enzyme. 5. Estimation of blood glucose by glucose oxidase method. 6. Spectrophotometer/colorimeter(Beer-Lambert's law) Estimation of Protein by UV-vis Spectrometer <ul style="list-style-type: none"> • (i)Lowry et al. method for estimation of protein (ii)Biuret method for estimation of protein 7. Spectroscopic estimation of DNA (UV) 8. Electrophoresis (a)Electrophoresis of red blood cell proteins (b) Electrophoresis of DNA 9. Separation of Amino acids by paper chromatography. 10. Qualitative tests for Carbohydrates, lipids and proteins 11. Estimation of DNA by Diphenylamine and RNA by Orcinol methods. 12. Estimation of reducing and total sugar by DNS and H ₂ SO ₄ -phenol methods. 13. Effect of pH and temperature on enzyme activity. 14. Determination of pK _a value of a weak acid by titrating with strong base.	60

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Suggested Reading

1. Berg, JM Tymoczko, JL. Gatto, GJ Jr. Stryer, L. (2015). **Biochemistry**. (8th ed.) W H Freeman and Company New York.
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7. Jain JL. Jain S. Jain N. (2005). **Fundamentals of Biochemistry**. (6th edition). S Chand and Company Ltd.
8. Satyanarayana U. Chakrapani U. (2013). **Biochemistry**.(4th edition). Elsevier and Books and Allied (P) Ltd
9. R.K. **Practical Biochemistry** – David Plummer. Pub: Tata McGraw Hill
10. Roskam's J. Rodgers L.(2002). **Lab Ref: A Handbook of Recipes, Reagents, and other reference tools for use at the Bench**. Cold Spring Harbor Laboratory Press. USA.
11. Barker K(2004). **At the Bench: A laboratory Navigator**. Cold Spring Harbor Laboratory Press. USA

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25
One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.

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Programme/Class: Diploma	Year: Second (2)	Semester: Fourth (IV)
Subject: Biotechnology		
Course Code: BTB401T	Course Title: Microbiology and Immunology	

Course Outcomes

- On the successful completion of the course, student will be able to:
- The pioneers in microbiology and their contributions
 - Understand the physical and chemical method of sterilization
 - Analyze the media composition and grow the desired microbe.
 - Understand the methods of cultivation of microorganisms
 - Understand different staining methods
 - Understand and differentiate the different types of microbes.
 - Understand the principles of immunology
 - Learn about structural features of components of immune system as well as their function and development of immune system and mechanisms by which our body elicits immune response.
 - Predict about nature of immune response that develops against bacterial, viral or parasitic infection, and prove it by designing new experiments.
 - Understand different tools and techniques of immunology
 - Understand the biology of different vaccines against infectious agents

Credits: 4	Core Compulsory	Min. Passing Marks CIE: 09
Max. Marks CIE: 25	Min. Passing Marks End Semester Examination: 26	Total Min. Passing Marks: 35
Max. Marks End Semester Examination: 75	Total Max. Marks: 100	

Total Number of Lectures-Tutorials-Practical (in hours per week) L-T-P: 4-0-0

Unit	Topic	No. of Lectures
I	Diversity and classification of microbes: <ul style="list-style-type: none"> • History and Evolution of Microbiology. • Classification of microorganisms: Microbial taxonomy, Microbial phylogeny and current classification of bacteria. • Microbial Diversity: Characterization of Prokaryotic and Eukaryotic cells, • Morphology and cell structure of major groups of microorganisms - Viruses, Bacteria, Algae, Fungi, and Protozoa. 	7
II	Microbial growth: <ul style="list-style-type: none"> • Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. 	8

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	<ul style="list-style-type: none"> Bacterial Reproduction: binary fission, endospore and sporulation in bacteria Transformation, Transduction And Conjugation 	
III	Pathogen contamination and infectious diseases: <ul style="list-style-type: none"> Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria. Major food born infections and intoxications. Preservation of various types of foods. Fermented Foods. Bacterial diseases of human- Tuberculosis, Tetanus, Typhoid, Cholera Viral diseases of human-Hepatitis B and C, AIDS 	8
IV	Sterilization, cultivation and staining: <ul style="list-style-type: none"> Principles and applications of different methods of sterilization Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms Methods of isolation, Purification and preservation. Principles of staining and types of staining 	7
V	Introduction to immune system: <ul style="list-style-type: none"> Introduction to Immunology, Components of mammalian immune system (cell and organs), Innate and Adaptive immunity Humoral and cell mediated immune response, Clonal selection theory An overview of primary and secondary immune responses 	8
VI	Antigen and Antibody structure and diversity: <ul style="list-style-type: none"> Antigen, epitopes and Adjuvents Structure and isotypes of Immunoglobulins allotypes and idiotypes B- and T-cell receptors B and T cell maturation Antibody diversity generation, somatic gene rearrangements during B-lymphocyte differentiation. 	8
VII	MHC, antigen processing and presentation: <ul style="list-style-type: none"> Major Histocompatibility complexes – class I & class II MHC antigens Antigen processing and presentation Autoimmune diseases, Immunodeficiency-AIDS and SCID. 	7
VIII	Immunological Techniques and Vaccines: <ul style="list-style-type: none"> Introduction to immunodiagnostics – Precipitation. Agglutination, RIA, ELISA and Immunofluorescence. 	7

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- Passive & active immunization.
- Types of vaccines-DNA vaccines, recombinant vaccines, inactivated vaccine
- Common indigenous vaccines

Suggested Reading

1. Pelczar M J, Reid R D, and Chan EC. (2001). **Microbiology** (5th ed.). New York: McGraw-Hill.
2. Willey J M, Sherwood L, Woolverton C J, Prescott L M, and Willey J M. (2011). **Prescott's Microbiology**. New York: McGraw-Hill.
3. Mattha, W, Berg C Y, and Black JG. (2005). **Microbiology, Principles and Explorations**. Boston, MA: John Wiley & Sons.
4. Cappuccino J G, and Welsh, C. (2016). **Microbiology: a Laboratory Manual**. Benjamin-Cummings Publishing Company.
5. Collins C H, Lyne PM, Grange J M, and Falkinham III J. (2004). **Collins and Lyne's Microbiological Methods** (8th ed.). Arnolds.
6. Levinson WE. (2020). **Review of Medical Microbiology and Immunology** (16th edition). McGraw Hill Education.
7. Ananthanarayana R, Panicker CKJ(2020). **Ananthanarayana and Panicker's Textbook of Microbiology**(11th edition) Universities Press (India) Pvt. Ltd
8. Punt J, Stranford S, Jones P., Owen JA, (2018). **Kuby Immunology**.(8th edition) New York: W.H. Freeman.
9. Delves P J, Martin SJ, Burton DR, and Roitt IM. (2017). **Roitt's Essential Immunology**.(13th edition). Wiley- Blackwell.
10. Murphy K, and Weaver C, (2016). **Janeway's Immunobiology**. (9th edition) New York: Garland Science.
11. Abbas AK, Lichtman AHH, Pillai S.(2017) **Cellular and Molecular Immunology** (9th edition)
12. Paul W E. (2012). **Fundamental Immunology**. New York: Raven Press.
13. Parham, P. (2005). **The Immune System**. New York: Garland Science.
14. Mohanty SK, Leela KS.(2014) **Textbook of Immunology**. (2nd Edition). Jaypee Brothers Medical Publishers Pvt Ltd.
15. Hay FC, Westwood OMR.(2008). **Practical Immunology**.(4th Edition). Wiley Blackwell.

Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=microbiology>
- <https://ocw.mit.edu/courses/find-by-topic/#cat=healthandmedicine&subcat=immunology>
- <https://nptel.ac.in/courses/102/103/102103038/>
- <https://nptel.ac.in/courses/102/105/102105083/>
- <https://nptel.ac.in/courses/102/103/102103015/>
- <https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod7.pdf>
- <https://nptel.ac.in/content/storage2/courses/102103015/module1/lec1/1.html>

Suggested Continuous Internal Evaluation (CIE) methods

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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Programme/Class: Diploma	Year: Second (2)	Semester: Fourth (IV)
Subject: Biotechnology		
Course Code: BTR402 P	Course Title: Microbiology and Immunology Lab	
Course Outcomes		
<p>After completion of this course , students will be able to:</p> <ul style="list-style-type: none"> • Understand methods of cleaning and sterilization of plasticwares and glasswares. • Understand and perform pure culture techniques which includes, pour plate and Spread plate . • Understand the preparation and use of differential, selective and special media. • Understand and identify the morphology of cells of the immune system. • Understand the basic concepts of blood grouping. • Understand antigen antibody interactions and thus quantitate the presence of antigen and or antibodies in biological samples. 		
Credits: 2	Core Compulsory	
Max.Marks CIE: 25	Min.PassingMarks CIE: 09	
Max.Marks End Semester Examination: 75	Min.Passing Marks End Semester Examination: 26	
Total Max. Marks: 100	Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4		
	Suggested Lab /Virtual Experiment	No. of Lectures
	<ol style="list-style-type: none"> 1. Safety measures in microbiology laboratory 2. Study of instruments: Compound microscope, Autoclave, Hot air oven, PH meter, and Laminar airflow 3. Introduction to different sterilization techniques 4. Isolation of bacteria & their biochemical characterization. 5. Staining methods: simple staining, Gram staining, spore staining, negative staining, hanging drop. 6. Preparation of media and sterilization, 7. Methods of isolation of bacteria from different sources. 8. Determination of bacterial cell size by micrometry. 9. Enumeration of microorganism - total & viable count. 10. Differential leucocytes count 11. Total leucocytes count 12. Total RBC count 13. Haemagglutination assay 14. Separation of serum from blood 15. Double immunodiffusion test using specific antibody and antigen. 16. ELISA demonstration 	60

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Suggested Readings:

1. Pelczar M J, Reid R D, and Chan EC. (2001). **Microbiology** (5th ed.). New York: McGraw-Hill.
2. Willey J M, Sherwood L, Woolverton C J, Prescott L M, and Willey J M. (2011). **Prescott's Microbiology**. New York: McGraw-Hill.
3. Mattha, W, Berg C Y, and Black JG. (2005). **Microbiology, Principles and Explorations**. Boston, MA: John Wiley & Sons.
4. Cappuccino J G, and Welsh, C. (2016). **Microbiology: a Laboratory Manual**. Benjamin-Cummings Publishing Company.
5. Collins C H, Lyne PM, Grange J M, and Falkinham III J. (2004). **Collins and Lyne's Microbiological Methods** (8th ed.). Arnolds.
6. Levinson WE. (2020). **Review of Medical Microbiology and Immunology** (16th edition). McGraw Hill Education.
7. Ananthanarayana R, Panicker CKJ(2020). **Ananthanarayana and Panicker's Textbook of Microbiology**(11th edition) Universities Press (India) Pvt. Ltd
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9. Delves P J, Martin SJ, Burton DR, and Roitt IM. (2017). **Roitt's Essential Immunology**.(13th edition). Wiley- Blackwell.
10. Murphy K, and Weaver C, (2016). **Janeway's Immunobiology**. (9th edition) New York: Garland Science

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.

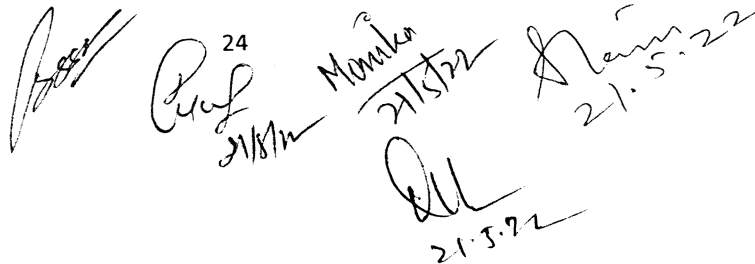
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Programme/Class: Degree		Year: Third (3)	Semester: Fifth (V)
Subject: Biotechnology			
Course Code: BTB501T		Course Title: Biostatistics and Bioinformatics	
Course Outcomes			
<p>After completion of the course, students will be able to -</p> <ul style="list-style-type: none"> • learn the need of statistical approach, identify the different axiomatic approach. • learn to study the variability of observation. • know effective use of Office package –word, excel, ppt and publisher etc • understand simple calculation usinf excel • understand the basic theories and practicals of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts. • critically analyse and interpret results of their studies with the help of bioinfomatical and biostatistical tools. 			
Credits: 4		Core Compulsory	
Max.Marks End Semester Examination: 75		Min.PassingMarks CIE:09	
Total Max. Marks: 100		Min.Passing Marks End Semester Examination: 26	
		Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0			
Unit	Topic		No. of Lectures
I	History and introduction to Bioinformatics: <ul style="list-style-type: none"> • Introduction and applications of bioinformatics • Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-RayDiffraction, and microarray). Applications of Bioinformatics. 		7
II	Databases, Data generation, Data storage and retrieval: <ul style="list-style-type: none"> • General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL), Protein databases (Primary, Composite, and Secondary). • Structure databases (CATH, SCOP, and PDBsum) • File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). • Introduction to Metadata. 		8
III	Sequence and Phylogeny analysis: <ul style="list-style-type: none"> • Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm). • Introduction to BLAST, using it on the web. • PCR primer designing etc. 		8
IV	Searching Databases: <ul style="list-style-type: none"> • SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. • Genome Annotation: Pattern and repeat finding, Gene identification tools. 		7



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V	Types and Collection of data: <ul style="list-style-type: none"> • Primary and Secondary data, Classification and Graphical representation of Statistical data. • Measures of central tendency and Dispersion. 	7
VI	Probability: <ul style="list-style-type: none"> • Definition of probability, Theorems on total and compound probability • Elementary ideas of Binomial, Poisson and Normal distributions. 	8
VII	Sampling: <ul style="list-style-type: none"> • Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. • Problems on test of significance, t-test, chi-square test • for goodness of fit and analysis of variance (ANOVA) 	8
VIII	Correlation and Regression: <ul style="list-style-type: none"> • Types, Karl-Pearson's correlation, Spearman's Rank correlation, Regression equation and fitting • Main features of regression analysis-simple and multiple regression analysis • Differences between correlation and regression analysis 	7

Suggested Reading

1. Lesk, A. M. (2002). **Introduction to Bioinformatics**. Oxford: Oxford University Press.
2. Mount, D. W. (2001). **Bioinformatics: Sequence and Genome Analysis**. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
3. Baxevanis, A. D., & Ouellette, B. F. (2001). **Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins**. New York: Wiley-Interscience.
4. Pevsner, J. (2015). **Bioinformatics and Functional Genomics**. Hoboken, NJ.: Wiley-Blackwell.
5. Bourne, P. E., & Gu, J. (2009). **Structural Bioinformatics**. Hoboken, NJ: Wiley-Liss.
6. Sharma V. Munjal A. Shanker A.(2018). **A Textbook of Bioinformatics**.(2nd Edition). Rastogi Publication.
7. Choudhuri S. (2014) **Bioinformatics for beginners**. (1st edition) Elsevier.
8. Harisha S. (2019) **Fundamentals of Bioinformatics**. Dreamtech Press
9. Rastogi SC. Mendiratta N. Rastogi P. (2013). **Bioinformatics Methods and Applications Genomics Proteomics and Drug Discovery**. (4th edition). Prentice Hall India Learning Private Limited
10. Ghosh Z. Mallick B. (2008). **Bioinformatics: Principles and Applications**. OUP India
11. Rosner, B. (2000). **Fundamentals of Biostatistics**. Boston, MA: Duxbury Press.
12. Daniel, W. W. (1987). **Biostatistics, a Foundation for Analysis in the Health Sciences**. New York: Wiley
13. Mariappan P. (2013) **Biostatistics**. Pearson
14. Rastogi VB.(2015). **Biostatistics** (3rd Edition). MedTec

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Suggested link

- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-bioinformatics-and-proteomics-january-iap-2005/lecture-notes/>
- <https://ocw.mit.edu/courses/biology/7-91j-foundations-of-computational-and-systems-biology-spring-2014/>
- <https://ocw.mit.edu/courses/biology/7-91j-foundations-of-computational-and-systems-biology-spring-2014/lecture-slides/>
- <https://ocw.mit.edu/courses/mathematics/18-650-statistics-for-applications-fall-2016/>
- <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
- <https://ocw.mit.edu/courses/mathematics/18-443-statistics-for-applications-fall-2003/lecture-notes/>

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25 One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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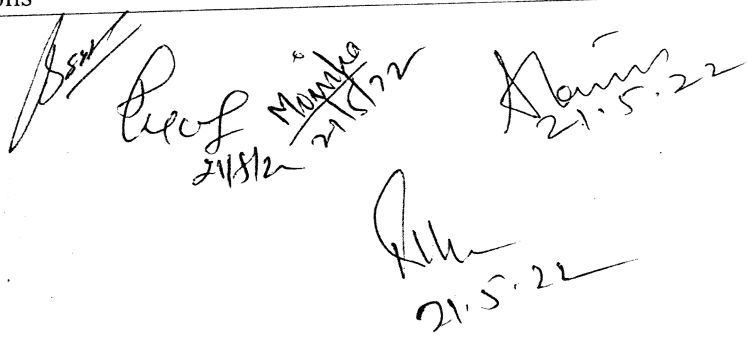
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Programme/Class: Degree		Year: Third (3)	Semester: Fifth (V)
Subject: Biotechnology			
Course Code: BTB502T		Course Title: Animal and Plant Biotechnology	
Course Outcomes (COs)			
After completion of this course, students will be able to-			
<ul style="list-style-type: none"> • Understand the principles, practices and application of animal biotechnology in Transgenesis, Tissue Engineering, and biopharmaceuticals. • Understand the principles, practices and applications of plant biotechnology, transgenic plant generation, plant tissue culture, plant genomics, and genetic transformation. • Understand applications of stem cells and tissues engineering. • Learn different gene delivery methods to deliver foreign gene in plants and animals • Know about different products of transgenic animals, plants and microbes. 			
Credits: 4		Core Compulsory	
Max.Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0			
Unit	Topic	No. of Lectures	
I	Transgenesis: <ul style="list-style-type: none"> • Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. • Animal diseases need help of Biotechnology – Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis. 	7	
II	Gene delivery methods for animals : <ul style="list-style-type: none"> • Viral vectors • Vector less or direct DNA transfer, particle bombardment, electroporation, microinjection & chemical methods, creation of animal models of human diseases. 	8	
III	Animal propagation: <ul style="list-style-type: none"> • Artificial insemination, animal Clones. • Conservation Biology – embryo transfer techniques. 	6	
IV	Genetic modification in Medicine: <ul style="list-style-type: none"> • Gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, • Human genetic engineering, problems & ethics • Introduction to Stem Cell Technology and its applications 	8	



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V	Introduction, Cryo and organogenic differentiation: <ul style="list-style-type: none">• Types of culture: Seed , Embryo, Callus, Organs, Cell and Protoplast culture.• Micropopagation Axillary bud proliferation, Meristem and shoot tip culture, cud culture, organogenesis, embryogenesis, advantages and disadvantages of micropopagation.• Protoplast isolation and fusion, methods of protoplast isolation, Protoplast development, Somatic hybridization, identification and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations.• Somaclonal variation nomenclature, methods, applications basis and disadvantages	7
VI	In vitro haploid production Androgenic methods: <ul style="list-style-type: none">• Anther culture, Microspore culture androgenesis• Significance and use of haploids, Ploidy level and chromosome doubling, diplodization, Gynogenic haploids, factors effecting gynogenesis• Chromosome elimination techniques for production of haploids in cereals.	8
VII	Plant Growth Promoting bacteria: <ul style="list-style-type: none">• Nitrogen fixation,• Nitrogenase, Hydrogenase, Nodulation• Biocontrol of pathogens• Growth promotion by free-living bacteria.	8
VIII	Transgenesis: <ul style="list-style-type: none">• Plant transformation technologies• <i>Agrobacterium tumifaciens</i> infection, basis of tumor formation, features of Ti & Ri plasmids, mechanisms of DNA transfer, role of virulence genes, use of Ti plasmid as vector, binary vectors• Application of plant transformation for productivity and performance: Herbicides resistance, insect resistance, Bt genes, non-Bt like protease inhibitors, virus resistance, long shelf life of fruits and flowers	8

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Suggested Reading

1. Razdan, M. K. (2003). **Introduction to Plant Tissue Culture**. Enfield, NH: Science
2. Chawla, H. S. (2000). **Introduction to Plant Biotechnology**. Enfield, NH: Science.
3. Smith R(2012). **Plant Tissue Culture** (3rd Edition) Academic Press.
4. Slater, A., Scott, N. W., & Fowler, M. R. (2008). **Plant Biotechnology: an Introduction to Genetic Engineering**. Oxford: Oxford University Press.
5. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). **Biochemistry & Molecular Biology of Plants**. Chichester, West Sussex: John Wiley & Sons.
6. Umesha, S. (2013). **Plant Biotechnology**. The Energy and Resources.
7. Glick, B. R., & Pasternak, J. J. (2010). **Molecular Biotechnology: Principles and Applications of Recombinant DNA**. Washington, D.C.: ASM Press.
8. Brown, T. A. (2006). **Gene Cloning and DNA Analysis: an Introduction**. Oxford: Blackwell Pub.
9. Primrose, S. B., & Twyman, R. M. (2006). **Principles of Gene Manipulation and Genomics**. Malden, MA: Blackwell Pub.
10. Slater, A., Scott, N. W., & Fowler, M. R. (2003). **Plant Biotechnology: The Genetic Manipulation of Plants**. Oxford: Oxford University Press.
11. Levine, M. M. (2004). **New Generation Vaccines**. New York: M. Dekker.
12. Pörner, R. (2007). **Animal Cell Biotechnology: Methods and Protocols**. Totowa, NJ: Humana Press
13. Singh B. Gautam SK (2013). **Textbook of animal biotechnology**. The Energy and Resources Institute, TERI
14. Gupta PK.(2018) **Animal Biotechnology**. Rastogi Publications
15. Singh BD. (2015). **Plant Biotechnology** (3rd edition). Kalyani Publishers
16. Chawla HS. (2020) **Introduction to Plant Biotechnology**(3rd edition) OXFORD & IBH Publishing
17. Satyanarayana U (2020). **Biotechnology**. Books and Allied (P) Ltd
18. Singh BD. (2015). **Biotechnology: Expanding Horizons** (4th edition). Kalyani Publishers
19. Dubey RC. (2014) **A Textbook of Biotechnology** (5th edition) S Chand and Company Ltd.

Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&parent=1>
- <https://ocw.mit.edu/courses/materials-science-and-engineering/3-051j-materials-for-biomedical-applications-spring-2006/lecture-notes/lecture13.pdf>
- <https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/lecture-notes/>
- <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-535-principles-and-practice-of-tissue-engineering-fall-2004/>
- https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/labs/mod1_3/

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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1. Razdan. M. K. (2003). **Introduction to Plant Tissue Culture**. Enfield. NH: Science
2. Chawla, H. S. (2000). **Introduction to Plant Biotechnology**. Enfield, NH: Science.
3. Smith R(2012). **Plant Tissue Culture** (3rd Edition) Academic Press.
4. Slater, A., Scott, N. W., & Fowler, M. R. (2008). **Plant Biotechnology: an Introduction to Genetic Engineering**. Oxford: Oxford University Press.
5. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). **Biochemistry & Molecular Biology of Plants**. Chichester, West Sussex: John Wiley & Sons.
6. Umeha, S. (2013). **Plant Biotechnology**. The Energy and Resources.
7. Glick, B. R., & Pasternak, J. J. (2010). **Molecular Biotechnology: Principles and Applications of Recombinant DNA**. Washington, D.C.: ASM Press.
8. Brown, T. A. (2006). **Gene Cloning and DNA Analysis: an Introduction**. Oxford: Blackwell Pub.
9. Primrose, S. B., & Twyman, R. M. (2006). **Principles of Gene Manipulation and Genomics**. Malden, MA: Blackwell Pub.
10. Slater, A., Scott, N. W., & Fowler, M. R. (2003). **Plant Biotechnology: The Genetic Manipulation of Plants**. Oxford: Oxford University Press.
11. Levine, M. M. (2004). **New Generation Vaccines**. New York: M. Dekker.
12. Pörtner, R. (2007). **Animal Cell Biotechnology: Methods and Protocols**. Totowa, NJ: Humana Press
13. Singh B. Gautam SK (2013). **Textbook of animal biotechnology**. The Energy and Resources Institute, TERI
14. Gupta PK.(2018) **Animal Biotechnology**. Rastogi Publications
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Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=stem-cells>
- <https://ocw.mit.edu/courses/materials-science-and-engineering/3-051j-materials-for-biomedical-applications-spring-2006/lecture-notes/lecture13.pdf>
- <https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/lecture-notes/>
- <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-535-principles-and-practice-of-tissue-engineering-fall-2004/>
- https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/labs/mod1_3/

Suggested Continuous Internal Evaluation (CIE) methods

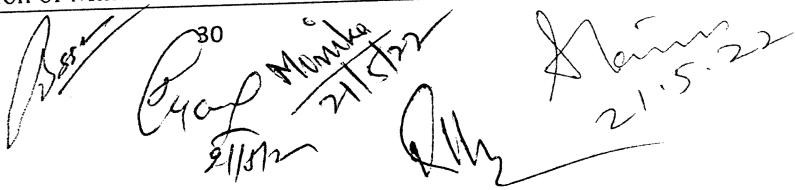
Total marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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Programme/Class: Degree		Year: Third (3)	Semester: Fifth (V)
Subject: Biotechnology			
Course Code: BTB503P		Course Title: Bioinformatics, Biostatistics Tissue culture Lab	
Course Outcomes (COs)			
Students should be able to - <ul style="list-style-type: none"> • apply basic bioinformatics tools for the studies and research in other areas of their biotechnology and microbiology programs, such as finding • gene/protein homologs, designing primers, identifying mutations, etc. • do cleaning, sterilization of laboratory, plastic and glasswares. • prepare different types of culture media for animal and plant cell culture • understand and solve the problems in the area of animal and plant Biotechnology. 			
Credits: 2		Core Compulsory	
Max.Marks CIE: 25 Max.Marks End Semester Examination: 75 Total Max. Marks: 100		Min.PassingMarks CIE:09 Min.Passing Marks End Semester Examination: 26 Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4			
	Suggested Lab /Virtual Experiment	No. of Lectures	
	<ol style="list-style-type: none"> 1. An introduction to Computers, MS-Word, MS Excel, MSPower Point. 2. Sequence information resource: Using NCBI, EMBL, Genbank, Entrez, Swissprot/ TrEMBL, UniProt. 3. Similarity searches using tools like BLAST and interpretation of results. 4. Multiple sequence alignment using ClustalW and interpretation of results. 5. Use of gene prediction methods (GRAIL, Genscan, Glimmer). 6. Use of various primer designing and restriction site prediction tools. 7. Use of different protein structure prediction databases (PDB, SCOP, CATH etc.). 8. Exercise to data entry, edit, copy, move etc. using MSEXCEL spreadsheet 9. Computations analysis of biological data by Mean, Median, Mode, S.D., Correlation, regression Analysis, Chi square test, Student test, ANOVA 10. Designing of bar diagram, pi chart, histogram, scatter plots, in EXCEL for presentation of data. 11. Measure of skewness and kurtosis 12. Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization 13. Sources of contamination and decontamination measures. 14. Preparation of Hanks Balanced salt solution 15. Preparation of Minimal Essential Growth medium 	60	



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16. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
17. Preparation of complex nutrient medium (Murashige & Skoog's medium)
18. To selection, Prune, sterilize and prepare an explant for culture.
19. Significance of growth hormones in culture medium.
20. To demonstrate various steps of Micropropagation.

Suggested Reading

1. Lesk, A. M. (2002). **Introduction to Bioinformatics**. Oxford: Oxford University Press.
2. Mount, D. W. (2001). **Bioinformatics: Sequence and Genome Analysis**. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
3. Baxevanis, A. D., & Ouellette, B. F. (2001). **Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins**. New York: Wiley-Interscience.
4. Pevsner, J. (2015). **Bioinformatics and Functional Genomics**. Hoboken, NJ.: Wiley-Blackwell.
5. Bourne, P. E., & Gu, J. (2009). **Structural Bioinformatics**. Hoboken, NJ: Wiley-Liss.
6. Sharma V. Munjal A. Shanker A. (2018). **A Textbook of Bioinformatics**. (2nd Edition). Rastogi Publication.
7. Choudhuri S. (2014) **Bioinformatics for beginners**. (1st edition) Elsevier.
8. Harisha S. (2019) **Fundamentals of Bioinformatics**. Dreamtech Press
9. Rastogi SC. Mendiratta N. Rastogi P. (2013). **Bioinformatics Methods and Applications Genomics Proteomics and Drug Discovery**. (4th edition). Prentice Hall India Learning Private Limited
10. Ghosh Z. Mallick B. (2008). **Bioinformatics: Principles and Applications**. OUP India
11. Rosner, B. (2000). **Fundamentals of Biostatistics**. Boston, MA: Duxbury Press.
12. Daniel, W. W. (1987). **Biostatistics, a Foundation for Analysis in the Health Sciences**. New York: Wiley
13. Mariappan P. (2013) **Biostatistics**. Pearson
14. Rastogi VB. (2015). **Biostatistics** (3rd Edition). MedTec

Suggested Continuous Internal Evaluation (CIE) methods

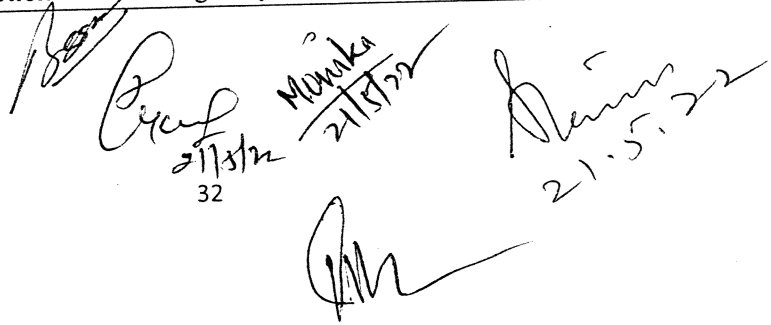
Total marks: 25

One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.

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Programme/Class: Degree	Year: Third (3)	Semester: Sixth (VI)
Subject: Biotechnology		
Course Code: BTB601T	Course Title: Industrial and Environmental Biotechnology	
Course Outcomes		
<p>After successful completion of the course, student will be able to:</p> <ul style="list-style-type: none"> • understand the problems in isolation, strain improvement and growth of microorganisms in industrial processes. • isolate and improve the industrially important microorganisms. • understand design and types of fermenters and operation of fermenters. • learn fundamentals of Environmental Biotechnology • understand the importance of clean (pollution free) environment • understand biotechnological solutions to address environmental issues including pollution, mineral resource winning, renewable energy and water recycling. • understand the regulation of bioethics and policies of IPR and entrepreneurship. 		
Credits: 4	Compulsary	
Max.Marks CIE: 25	Min.PassingMarks CIE:09	
Max.Marks End Semester Examination: 75	Min.Passing Marks End Semester Examination: 26	
Total Max. Marks: 100	Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0		
Unit	Topic	No. of Lectures
I	Introduction of Industrial microbiology and Bioprocess technology: <ul style="list-style-type: none"> • History-Introduction, scope and relation with other sciences. • Screening for new metabolites: primary and secondary products. • Strain development through selection, mutations and recombination, and other recent methods 	7
II	Bioprocess technology: <ul style="list-style-type: none"> • Introduction to bioprocess technology. • Design and working of a typical bioreactor • Range of bioprocess technology and its chronological development. • Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics- Batch, Fedbatch and Continuous culture. 	9
III	Production of alcohols, antibiotic and enzymes: <ul style="list-style-type: none"> • Production of alcohols (Ethanol) and organic acids (citric and acetic). • Production of biologically active compounds: 	9



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	<p>antibiotics (penicillin) and enzymes (amylase, protease).</p> <ul style="list-style-type: none"> • Production of microbial food and single cell proteins • Bioreactor for immobilized cells/enzyme system • Biosensors and their applications 	
IV	<p>Environment and pollution:</p> <ul style="list-style-type: none"> • Physico-chemical and biological characteristics of environment. • Water, soil and air as a component of environment. • Pollutants: Nature, origin, source, monitoring and their impacts. • Air, Water and Noise pollution • Conventional fuels and their environmental impact 	8
V	<p>Bioremediation:</p> <ul style="list-style-type: none"> • Bioremediation of soil & water contaminated with oil spills, heavy metals and detergents. • Degradation of lignin and cellulose using microbes. Phyto-remediation. • Degradation of pesticides and other toxic chemicals by micro-organisms- degradation aromatic and chlorinated hydrocarbons and petroleum products. 	8
VI	<p>Sewage treatment and biofertilizers:</p> <ul style="list-style-type: none"> • Treatment of municipal waste and Industrial effluents. • Bio-fertilizers: Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil. • Algal and fungal biofertilizers (VAM) 	7
VIII	<p>Bioleaching and genetically modified organisms:</p> <ul style="list-style-type: none"> • Enrichment of ores by microorganisms (Gold, Copper and Uranium). • Environmental significance of genetically modified microbes, plants and animals. 	6
VIII	<p>Bioethics, IPR, Entrepreneurship:</p> <ul style="list-style-type: none"> • Importance of Bioethics, IPR and entrepreneurship • Introduction to Intellectual Property Rights (IPR)- World Intellectual properties, Indian Intellectual properties • Entrepreneurship in India 	6
<p>Suggested Reading</p> <ol style="list-style-type: none"> 1. Glazier AN and Nikaido H (2007). Microbial Biotechnology – Fundamental & Applied Microbiology – Second Edition. Cambridge University Press. 2. Casida LE (2019) Industrial Microbiology. Second Edition, New Age International Publisher. 3. Stanbury P F and Whitaker, A. (2010). Principles of Fermentation Technology. Oxford: Pergamon Press 4. Shuler M L and Kargi F. (2002). Bioprocess Engineering: Basic Concepts. Upper Saddle River, NJ: Prentice Hall. 5. Crueger W and Crueger A (2002) Cruegers Biotechnology: A Textbook of Industrial Microbiology. Third Edition, Panima Publishing Corp., New Delhi. 6. Blanch H W and Clark D S. (1997). Biochemical Engineering. New York: M. 		

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7. Bailey J E and Ollis D F. (1986). **Biochemical Engineering Fundamentals**. New York: McGraw-Hill.
8. Richard HB, Julian ED, Arnold LD. (2010) **Manual of Industrial Microbiology and Biotechnology**, 3rd Edition
9. Thakur IS. (2011) **Environmental Biotechnology basic concepts and applications**. I. K. International Publishing House Pvt. Limited
10. Evans GM and J. C. Furlong (2003). **Environmental Biotechnology: Theory and Applications**. Wiley Publishers.
11. Ritmann R and McCarty P L (2000). **Environmental Biotechnology: Principle & Applications**. 2nd Ed., McGraw Hill Science.
12. Scragg A., (2005) **Environmental Biotechnology**. Pearson Education Limited.
13. Srinivas TR (2008). **Environmental Biotechnology**. New Age International Pvt. Ltd.
14. Chapman JL. **Ecology: Principal & Application**. Cambridge Univ. Press.
15. Odum E and Barret G. (2004) **Fundamentals of Ecology**. Nataraj Publication.

Suggested link

- <https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-34-waste-containment-and-remediation-technology-spring-2004/lecture-notes/>
- <https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-018j-ecology-i-the-earth-system-fall-2009/>
- https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-018j-ecology-i-the-earth-system-fall-2009/lecture-notes/MIT1_018JF09_Lec07.pdf
- <https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-89-environmental-microbiology-fall-2004/>
- <https://ocw.mit.edu/high-school/biology/exam-prep/cellular-energetics/fermentation-cellular-respiration/fermentation/>

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

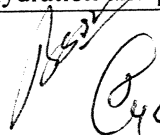
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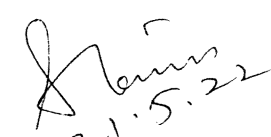
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Programme/Class: Degree		Year: Third (3)	Semester: Sixth (VI)
Subject: Biotechnology			
Course Code: BTB602T		Course Title: Food Biotechnology	
Course Outcomes			
After successful completion of the course, student will be able to:			
<ul style="list-style-type: none"> • understand the history and evolution of food technology and processing. • understand the importance microorganisms in food preservation • learn various food processing and preservation technologies. 			
Credits: 4		Core Compulsory	
Max.Marks CIE: 25		Min.PassingMarks CIE:09	
Max.Marks End Semester Examination: 75		Min.Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0			
Unit	Topic	No. of Lectures	
I	Introduction to Food Biotechnology <ul style="list-style-type: none"> • Historical Background of Food technology • Traditional fermented foods (meat, fish, bread, sauerkraut, soy bean, coffee, cocoa, tea) • Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines • Improvements through Biotechnology (e.g. Golden Rice, Potato, Flavr Savr Tomato etc.) 	7	
II	Enzymes in Food Industry: <ul style="list-style-type: none"> • Carbohydrases • Proteasase • Lipases • Modification of food using enzymes: • Role of endogenous enzymes in food quality, • Enzymes use as processing aid and ingredients 	8	
III	Food Fermentations: <ul style="list-style-type: none"> • Common fermented foods - Cheese, Butter, Yoghurt, fermented/condensed milk and kefir. • Alcoholic beverages (Beer, Wine, Whisky), • Sauerkraut, Pickles, Soy products, Tea, coffee etc. 	7	
IV	Food preservation: <ul style="list-style-type: none"> • Food adulteration and prevailing food standards in India. • Source of microorganisms in milk and their types. • Microbiological examination of milk (standard plate count, direct microscopic count, reductase and phosphatase test). • Dehydration and pasteurization of milk. 	7	


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V	Value addition products: <ul style="list-style-type: none">• Value addition products like High Fructose Syrup, Invert Sugars etc. SCPs (e.g. Spirulina, Yeast etc.) as food supplements,• Edible fungus: Mushrooms. Potential of Probiotics.• Flavour enhancers: Nucleosides, nucleotides and related compounds. Organic acids (Citric acid, Acetic acid) and their uses in foods/food products.	7
VI	Vitamins and Minerals: <ul style="list-style-type: none">• Importance of Vitamins and their supplementation in foods and feedstock.• Food preservation and storage. Food Processing• Important minerals and their function in body and deficiency conditions• Requirements, allowances, enrichment, restorations, fortifications, losses of minerals, optimization and retention of minerals;	7
VII	Growth of microorganisms in food: <ul style="list-style-type: none">• Intrinsic and extrinsic factors.• Food Spoilage (microbial and non-microbial) Control mechanisms of food spoilage: Physical and Chemical.• Microbial spoilage of food and factors affecting them: Spoilage of various kinds of foods: fish. meat, poultry, sea foods, bread and dairy products).• Food adulteration and prevailing food standards in India.• Indicator Microorganisms: As an indicator of good quality	8
VIII	Food and water borne diseases: <ul style="list-style-type: none">• Gastroenteritis, Diarrhoea, Shigellosis, Salmonellosis, Typhoid, Cholera, Polio, Hepatitis, Dental Infections, etc.• Food borne intoxications: Staphylococcal, Bacillus, Clostridium etc.• Detection of food-borne pathogens.	9

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Suggested Reading

1. Ray B and Bhunia A. 2008. **Fundamental Food Microbiology**, 4th Ed., CRC press, Taylor and Francis Group, USA.
2. Martin RA and Maurice OM. 2008. **Food Microbiology**, 3rd Ed., The Royal Society of Chemistry, Cambridge, UK.
3. James M J.. 2000. **Modern Food Microbiology**, 6th Ed. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.
4. Frazier WC, and Westhoff DC. **Food Microbiology**. Fourth edition, MacGraw Hills publication
5. Lopez GFG, Canaas G, Nathan EV. **Food Sciences and Food biotechnology**.
6. Adams AR, and Moss MO. *Food Microbiology*. Third edition, Royal Society of Chemistry publishing .
7. Hohn T and Leisinger KM. **Biotechnology of Food Crops in Developing Countries**.
8. Doyle MP, Beuchat LR and Montville TJ. **Food Microbiology Fundamentals and Frontiers**. ASM Press.
9. Schwartzberg HG, Rao MA. (Eds.) **Biotechnology and Food Process Engineering** .

Suggested link

- https://ocw.mit.edu/courses/linguistics-and-philosophy/24-03-good-food-ethics-and-politics-of-food-spring-2017/lecture-notes/MIT24_03S17_lec24.pdf
- https://ocw.mit.edu/courses/linguistics-and-philosophy/24-03-good-food-ethics-and-politics-of-food-spring-2017/lecture-notes/MIT24_03S17_lec20.pdf
- <https://www.rug.nl/research/irecs/research/edulink-fsba/fsba-course-modules/fsba-module-2-unit-3-notes-english.pdf>
- <https://foodinsight.org/wp-content/uploads/2003/03/Biotech-Guide.pdf>

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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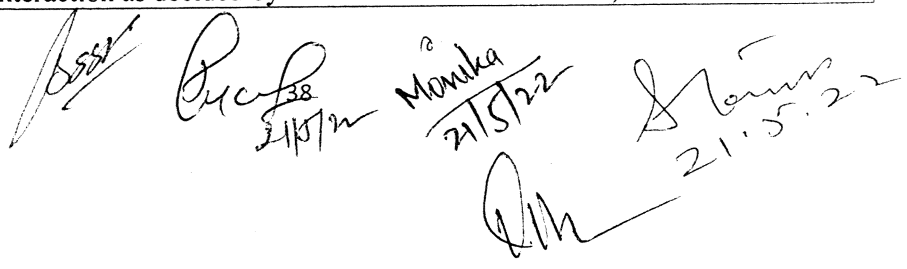
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Programme/Class: Degree		Year: Third (3)		Semester: Sixth (VI)	
Subject: Biotechnology					
Course Code: BTB603P		Course Title: Industrial and Environmental Biotechnology Lab			
Course Outcomes					
After completion of this course , students will be able to-					
<ul style="list-style-type: none"> • understand various methods of screening of industrially important microorganisms from different sources. • understand the working of small scale fermenter and also determine the aeration efficiency of the fermenter • understand the technique of immobilization of cells like yeast and E.coli. 					
Credits: 2		Core Compulsory			
Max.Marks End Semester Examination: 75		Max.Marks CIE: 25		Min.PassingMarks CIE: 09	
Total Max. Marks: 100				Min.Passing Marks End Semester Examination: 26	
				Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 0-0-4					
	Suggested Lab /Virtual Experiment				No. of Lectures
	<ol style="list-style-type: none"> 1. Calculation of bacterial growth curve. 2. Calculation thermal death point (TDP) of a microbial sample. 3. Production and analysis of ethanol. 4. Production and analysis of amylase.. 5. Production and analysis of lactic acid. 6. Isolation of industrially important microorganism from natural resource. 7. Calculation of Total Dissolved Solids (TDS) of water sample. 8. Calculation of BOD of water sample. 9. Calculation of COD of water sample. 10. Bacterial Examination of Water by MPN Method. 				60
Suggested Reading					
<ol style="list-style-type: none"> 1. Glazier AN and Nikaido H (2007).Microbial Biotechnology – Fundamental & Applied Microbiology – Second Edition. Cambridge University Press. 2. Casida LE (2019) Industrial Microbiology. Second Edition,New Age International Publisher. 3. Stanbury P F and Whitaker, A. (2010). Principles of Fermentation Technology. Oxford: Pergamon Press 4. Crueger W and Crueger A (2002) Crueger’s Biotechnology: A Textbook of Industrial Microbiology. Third Edition, Panima Publishing Corp., New Delhi. 5. Blanch H W and Clark D S. (1997). Biochemical Engineering. New York: M. Dekker. 6. Bailey J E and Ollis D F. (1986). Biochemical Engineering Fundamentals. New York: McGraw-Hill. 7. Richard HB, Julian ED, Arnold LD. (2010) Manual of Industrial Microbiology and Biotechnology, 3rd Edition 					
Suggested Continuous Internal Evaluation (CIE) methods					
Total marks: 25					
One Practical Tests/Record/Chart/Model carrying Maximum Marks 20 and a Viva-Voce/Practical Class Interaction as decided by the concerned teacher/HOD) of 5 marks.					



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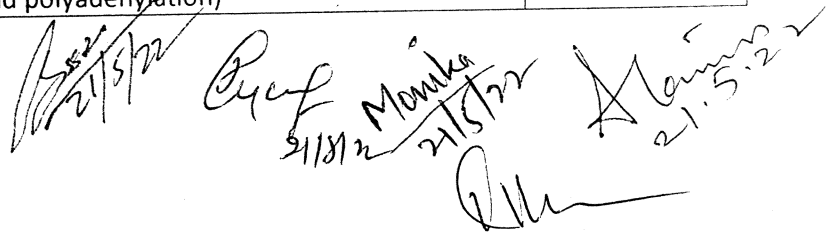
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Appendix-3

MINOR/ELECTIVE COURSE SYLLABUS
SUBJECT - BIOTECHNOLOGY,
DEPARTMENT OF BIOTECHNOLOGY,
FACULTY OF LIFE SCIENCE
FOR OTHER FACULTY UNDER GRADUATE STUDENTS

Year: First (1)		Semester: Second (II)
MINOR/ELECTIVE		Subject : Biotechnology
Course Code: BTB201T		Course Title: Molecular Biology and Genetic Engineering
Course Outcomes (COs)		
Student will be able to- <ul style="list-style-type: none"> • Learn and understand the important discoveries that are made in the field of molecularbiology. • Learn key molecular events that occur during the DNA replication, transcription, translation and regulation of gene concept. • Gain knowledge on the foundation of genetic engineering and their applications inbiological research as well as in biotechnology industries. • Understand gene concept, plasmids, and wide range of techniques, especially modernmolecular tools in diagnosis. • Acquainted with various techniques of genetic engineering and their applications inbiological research, diagnostics as well as in biotechnology industries. 		
Credits:		MINOR/ELECTIVE
Max.Marks CIE: 25 Max.Marks End Semester Examination: 75 Total Max. Marks: 100		Min.PassingMarks CIE:09 Min.Passing Marks End Semester Examination: 26 Total Min. Passing Marks: 35
Total Number of Lectures-Tutorials-Practical (in hours per week)L-T-P: 4-0-0		
Unit	Topic	No. of Lectures
I	Gene organization and regulation of gene expression: <ul style="list-style-type: none"> • Structure of DNA, Types of DNA • Gene organization in prokaryotes and eukaryotes. • Regulation of gene expression: Prokaryotes: lac and trp operons in <i>E. coli</i>. 	7
II	DNA Replication and DNA polymerases: <ul style="list-style-type: none"> • Replication of genetic material in prokaryotes and eukaryotes • A brief description of initiation at replication origins and its cell cycle regulation. • Structure and function of prokaryotic and eukaryotic DNA polymerases 	7
III	Transcription and mRNA processing: <ul style="list-style-type: none"> • RNA structure and types of RNA • Mechanism of transcription in prokaryotes and eukaryotes: transcription factors, structure of prokaryotic and eukaryotic RNA polymerases, initiation, elongation and termination. • RNA processing: processing of mRNA (Splicing, capping and polyadenylation) 	8



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IV	Prokaryotic and eukaryotic translation: <ul style="list-style-type: none">• Ribosome structure and assembly, tRNA, aminoacyl tRNA synthetases,• Mechanism of initiation, elongation and termination of polypeptides, Inhibitors of translation.• Posttranslational modification of proteins	7
V	Vectors: <ul style="list-style-type: none">• Cloning vectors (plasmids, cosmids, bacterial artificial chromosomes and yeast artificial chromosomes),• shuttle vectors,• expression vectors	7
VI	Enzymes used in DNA manipulating: <ul style="list-style-type: none">• Restriction Endonuclease• Ligases• Polymerases• Kinases• Alkaline Phosphatases• Reverse Transcriptase	8
VII	Genomic Library, PCR, Sequencing etc: <ul style="list-style-type: none">• Preparation and comparison of Genomic and cDNA library.• PCR and its applications.• DNA Sequencing.• Site directed mutagenesis• Protein engineering concepts and examples (any two).	8
VIII	Molecular Biology techniques: <ul style="list-style-type: none">• DNA isolation (Plasmid/ Genomic DNA isolation)• Blotting (Southern, Northern, Western)• Electrophoresis of nucleic acids and proteins• Gene cloning, Screening and characterization of cloned DNA• DNA Fingerprinting• RFLP, RAPD	8

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Suggested Reading

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6th Ed.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: a Molecular Approach** (6th Ed.). Washington: ASM ; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments**. John Harris, D., Wiley & sons, New York
4. Iwasa J., Marshal W. **Karp's Cell Biology**(2018) (8th edition) Wiley & Sons, NY
5. Iwasa J., Marshal W. **Karp's Cell and Molecular Biology . Concepts and experiments**. (2015) (8th edition) Wiley & sons, New York
6. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). **Molecular Biology of the Gene** (5th ed.). Pearson
7. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). **Molecular Cell Biology** (8th Ed.). New York: W.H. Freeman
8. Gupta P.K. **Cell and Molecular Biology** 2018. 5th edition Rastogi Publication India.
9. Brown TA. **Gene cloning and DNA analysis: An introduction**. (2016) 7th Edition. Wiley-Blackwell
10. Old, R. W., Primrose, S. B., & Twyman, R. M. (2006). **Principles of Gene Manipulation and Genomics**, 7th Edition: Blackwell Publishing.
11. Krebs JE, Goldstein ES and Kilpatrick ST (2014) **Lewin's Gene XII**, Jones and Barlett Publisher
12. Brown, T. A. (2018). **Genomes 4**.(4th edition) New York: Garland Science Pub.
13. Green, M. R., & Sambrook, J. (2014) Fourth Edition. **Molecular Cloning: a Laboratory Manual**. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

Suggested link

- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/transcription-translation/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/molecular-biology/gene-regulation-and-the-lac-operon/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/agarose-gel-electrophoresis-dna-sequencing-pcr/>
- <https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/basic-mechanics-of-cloning/>
- https://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/labs/mod1_3/
- <https://nptel.ac.in/courses/102/103/102103045/#>

Suggested Continuous Internal Evaluation (CIE) methods Total marks:25

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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MINOR/ELECTIVE COURSE SYLLABUS
SUBJECT - BIOTECHNOLOGY,
DEPARTMENT OF BIOTECHNOLOGY,
FACULTY OF LIFE SCIENCE
FOR OTHER FACULTY UNDER GRADUATE STUDENTS

Year: Second (2)		Semester: Fourth (IV)	
Minor/Elective		Subject: Biotechnology	
Course Code: BTB401T		Course Title: Microbiology and Immunology	
Course Outcomes			
<p>On the successful completion of the course, student will be able to:</p> <ul style="list-style-type: none"> • The pioneers in microbiology and their contributions • Understand the physical and chemical method of sterilization • Analyze the media composition and grow the desired microbe. • Understand the methods of cultivation of microorganisms • Understand different staining methods • Understand and differentiate the different types of microbes. • Understand the principles of immunology • Learn about structural features of components of immune system as well as their function and development of immune system and mechanisms by which our body elicits immune response. • Predict about nature of immune response that develops against bacterial, viral or parasitic infection, and prove it by designing new experiments. • Understand different tools and techniques of immunology • Understand the biology of different vaccines against infectious agents 			
Credits: 4		Minor/Elective	
Max. Marks CIE: 25		Min. Passing Marks CIE: 09	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 26	
Total Max. Marks: 100		Total Min. Passing Marks: 35	
Total Number of Lectures-Tutorials-Practical (in hours per week) L-T-P: 4-0-0			
Unit	Topic	No. of Lectures	
I	Diversity and classification of microbes: <ul style="list-style-type: none"> • History and Evolution of Microbiology. • Classification of microorganisms: Microbial taxonomy, Microbial phylogeny and current classification of bacteria. • Microbial Diversity: Characterization of Prokaryotic and Eukaryotic cells, • Morphology and cell structure of major groups of microorganisms - Viruses, Bacteria, Algae, Fungi, and Protozoa. 	7	
II	Microbial growth: <ul style="list-style-type: none"> • Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. • Bacterial Reproduction: binary fission, endospore and sporulation in bacteria • Transformation, Transduction And Conjugation 	8	

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III	Pathogen contamination and infectious diseases: <ul style="list-style-type: none">• Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal.• Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria.• Major food born infections and intoxications, Preservation of various types of foods. Fermented Foods.• Bacterial diseases of human- Tuberculosis, Tetanus, Typhoid, Cholera• Viral diseases of human-Hepatitis B and C, AIDS	8
IV	Sterilization, cultivation and staining: <ul style="list-style-type: none">• Principles and applications of different methods of sterilization• Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms• Methods of isolation, Purification and preservation.• Principles of staining and types of staining	7
V	Introduction to immune system: <ul style="list-style-type: none">• Introduction to Immunology, Components of mammalian immune system (cell and organs), Innate and Adaptive immunity• Humoral and cell mediated immune response, Clonal selection theory• An overview of primary and secondary immune responses	8
VI	Antigen and Antibody structure and diversity: <ul style="list-style-type: none">• Antigen, epitopes and Adjuvants• Structure and isotypes of Immunoglobulins allotypes and idiotypes• B- and T-cell receptors• B and T cell maturation• Antibody diversity generation, somatic gene rearrangements during B-lymphocyte differentiation.	8
VII	MHC, antigen processing and presentation: <ul style="list-style-type: none">• Major Histocompatibility complexes – class I & class II MHC antigens• Antigen processing and presentation• Autoimmune diseases, Immunodeficiency-AIDS and SCID.	7
VIII	Immunological Techniques and Vaccines: <ul style="list-style-type: none">• Introduction to immunodiagnostics – Precipitation, Agglutination, RIA, ELISA and Immunofluorescence.• Passive & active immunization.• Types of vaccines-DNA vaccines, recombinant vaccines, inactivated vaccine• Common indigenous vaccines	7

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Suggested Reading

1. Pelczar M J, Reid R D, and Chan EC. (2001). **Microbiology** (5th ed.). New York: McGraw-Hill.
2. Willey J M, Sherwood L, Woolverton C J, Prescott L M, and Willey J M. (2011). **Prescott's Microbiology**. New York: McGraw-Hill.
3. Mattha, W, Berg C Y, and Black JG. (2005). **Microbiology, Principles and Explorations**. Boston, MA: John Wiley & Sons.
4. Cappuccino J G, and Welsh, C. (2016). **Microbiology: a Laboratory Manual**. Benjamin-Cummings Publishing Company.
5. Collins C H, Lyne PM, Grange J M, and Falkinham III J. (2004). **Collins and Lyne's Microbiological Methods** (8th ed.). Arnolds.
6. Levinson WE. (2020). **Review of Medical Microbiology and Immunology** (16th edition). McGraw Hill Education.
7. Ananthanarayana R, Panicker CKJ(2020). **Ananthanarayana and Panicker's Textbook of Microbiology**(11th edition) Universities Press (India) Pvt. Ltd
8. Punt J, Stranford S, Jones P., Owen JA, (2018). **Kuby Immunology**.(8th edition) New York: W.H. Freeman.
9. Delves P J, Martin SJ, Burton DR, and Roitt IM. (2017). **Roitt's Essential Immunology**.(13th edition). Wiley- Blackwell.
10. Murphy K, and Weaver C, (2016). **Janeway's Immunobiology**. (9th edition) New York: Garland Science.
11. Abbas AK, Lichtman AHH, Pillai S.(2017) **Cellular and Molecular Immunology** (9th edition)
12. Paul W E. (2012). **Fundamental Immunology**. New York: Raven Press.
13. Parham, P. (2005). **The Immune System**. New York: Garland Science.
14. Mohanty SK, Leela KS.(2014) **Textbook of Immunology**. (2nd Edition). Jaypee Brothers Medical Publishers Pvt Ltd.
15. Hay FC, Westwood OMR.(2008). **Practical Immunology**.(4th Edition). Wiley Blackwell.

Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=microbiology>
- <https://ocw.mit.edu/courses/find-by-topic/#cat=healthandmedicine&subcat=immunology>
- <https://nptel.ac.in/courses/102/103/102103038/>
- <https://nptel.ac.in/courses/102/105/102105083/>
- <https://nptel.ac.in/courses/102/103/102103015/>
- <https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod7.pdf>
- <https://nptel.ac.in/content/storage2/courses/102103015/module1/lec1/1.html>

Suggested Continuous Internal Evaluation (CIE) methods

One Test/Assignments (hand written or typed 500 -1500 words)/Quizzes/ Presentation etc.(as decided by the teacher) carrying Maximum Marks 20 and a Viva-Voce/Class interaction of 5 marks.

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DEPARTMENT OF BIOTECHNOLOGY
B.Sc. (in Faculty of Life Science)
Syllabus of Compulsory Co-curricular Courses
Under NEP-2020

SEMESTER WISE PAPER TITLES WITH DETAILS

Semester	Course Code	Paper title	CIE	End Semester Examination	Total	Credits	Teaching hours
B. SC. 1ST YEAR OR CERTIFICATE							
I	CCB101	Food and Nutrition	25	75	100	2	30
II	CCB201	Health and Hygiene	25	75	100	2	30
B. SC. 2ND YEAR OR DIPLOMA							
III	CCB301	Human Values and Environment studies	25	75	100	2	30
IV	CCB401	Physical Education and Yoga	25	75	100	2	30
B. SC. 3RD YEAR OR Degree in Bachelor of Science (in Faculty of Life Science)							
V	CCB501	Analytic Ability and Digital Awareness	25	75	100	2	30
VI	CCB601	Communication Skills and Personality Development	25	75	100	2	30

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Syllabus of Compulsory Co-curricular Courses for
B.Sc. (in Faculty of Life Science)

Co-curricular course: Semester-I
Course Title: Food and Nutrition

Year: First	Semester: First	
Course Code: CCB101	Course Title: Food and Nutrition	
Course outcomes: <ul style="list-style-type: none">• To learn the basic concept of the Food and Nutrition• To study the nutritive requirement during special conditions like pregnancy and lactation• To learn meal planning• To learn 100 days Nutrition Concept• To study common health issues in the society• To learn the special requirement of food during common illness		
Credits: 2	Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0		
Unit	Topics	No. of Lectures Total=30
I	Concept of Food and Nutrition (a) Definition of Food, Nutrients, Nutrition, Health, balanced Diet (b) Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition (c) Meal planning- Concept and factors affecting Meal Planning (d) Food groups and functions of food	8
II	Nutrients: Macro and Micro RDA, Sources, Functions, Deficiency and excess of (a) Carbohydrate (b) Fats (c) Protein (d) Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc (e) Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K (f) Water (g) Dietary Fibre	7
III	1000 days Nutrition (a) Concept, Requirement, Factors affecting growth of child (b) Prenatal Nutrition (0 - 280 days): Additional Nutrients' Requirement and risk factors during pregnancy (c) Breast / Formula Feeding (Birth – 6 months of age) (d) Complementary and Early Diet (6 months – 2 years of age)	8
IV	Community Health-Concept (a) Common diseases prevalent in the society and its causes (b) National and International Program and Policies for improving Dietary Nutrition	7

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	(c) Nutrition requirement in the following Diabetes Hypertension Obesity Constipation Diarrhea Typhoid (d) Immunity Boosting Food	
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Suggested Readings:

- 1. Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018.
- 2. 1000Days-Nutrition_Brief_Brain-Think_Babies_FINAL.pdf
- 3. <https://pediatrics.aapublications.org/content/141/2/e20173716>
- 4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/>

Suggested Continuous Internal Evaluation:

Maximum Marks: 25

One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/Class interaction of 5 marks

Suggested equivalent online courses:

<https://www.udemy.com/course/internationally-accredited-diploma-certificate-in-nutrition>
Diploma in Human Nutrition-Revised Offered by Alison

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Co-curricular Course: Semester-II

Course Title: Health and Hygiene

Year: First		Semester: II	
Course Code: CCB201		Course Title: Health and Hygiene	
Course outcomes: <ul style="list-style-type: none"> Learn the skill needed to assess the ill or injured person. Learn the skills to provide CPR to infants, children and adults. Learn the skills to handle emergency child birth Learn the Basic sex education help young people navigate thorny questions responsibly and with confidence. Learn the Basic sex education help youth to understand Sex is normal. It's a deep, powerful instinct at the core of our survival as a species. Sexual desire is a healthy drive. Help to understand natural changes of adolescence Learn the skill to identify Mental Health status and Psychological First Aid 			
Credits: 2		Compulsory	
Max. Marks CIE: 25		Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75		Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100		Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0			
Unit	Topics	No. of Lectures Total=30	
I	A. Basic First Aid <ul style="list-style-type: none"> Aims of first aid & First aid and the law. Dealing with an emergency, Resuscitation (basic CPR). Recovery position, Initial top to toe assessment: Hand washing and Hygiene Types and Content of a First aid Kit B. First AID Technique <ul style="list-style-type: none"> Dressings and Bandages. Fast evacuation techniques (single rescuer). Transport techniques. C. First aid related with respiratory system <ul style="list-style-type: none"> Basics of Respiration. No breathing or difficult breathing, Drowning, Choking, Strangulation and hanging, Swelling within the throat, Suffocation by smoke or gases and Asthma. D. First aid related with Heart, Blood and Circulation <ul style="list-style-type: none"> Basics of The heart and the blood circulation. Chest discomfort, bleeding. D. First aid related with Wounds and Injuries <ul style="list-style-type: none"> Type of wounds, Small cuts and abrasions Head, Chest, Abdominal injuries Amputation, Crush injuries, Shock E. First aid related with Bones, Joints Muscle related injuries <ul style="list-style-type: none"> Basics of The skeleton, Joints and Muscles. Fractures (injuries to bones). 	7	

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II	<p>F. First aid related with Nervous system and Unconsciousness</p> <ul style="list-style-type: none"> Basics of the nervous system. Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy. <p>G. First aid related with Gastrointestinal Tract</p> <ul style="list-style-type: none"> Basics of The gastrointestinal system. Diarrhea, Food poisoning. <p>H. First aid related with Skin, Burns</p> <ul style="list-style-type: none"> Basics of The skin. Burn wounds, Dry burns and scalds (burns from fire, heat and steam). Electrical and Chemical burns, Sun burns, heat exhaustion and heatstroke. Frost bites (cold burns), Prevention of burns, Fever and Hypothermia. <p>I. First aid related with Poisoning</p> <ul style="list-style-type: none"> Poisoning by swallowing, Gases, Injection, Skin <p>J. First aid related with Bites and Stings</p> <ul style="list-style-type: none"> Animal bites, Snake bites, Insect stings and bites <p>K. First aid related with Sense organs</p> <ul style="list-style-type: none"> Basic of Sense organ. Foreign objects in the eye, ear, nose or skin. Swallowed foreign objects. <p>L. Specific emergency satiation and disaster management</p> <ul style="list-style-type: none"> Emergencies at educational institutes and work Road and traffic accidents. Emergencies in rural areas. Disasters and multiple casualty accidents. Triage. <p>M. Emergency Child birth</p>	6
III	<p>Basic Sex Education</p> <ul style="list-style-type: none"> Overview, ground rules, and a pre-test Basics of Urinary system and Reproductive system. Male puberty — physical and emotional changes Female puberty — physical and emotional changes Male-female similarities and differences Sexual intercourse, pregnancy, and childbirth Facts, attitudes, and myths about LGBTQ+ issues and identities Birth control and abortion Sex without love — harassment, sexual abuse, and rape Prevention of sexually transmitted diseases. 	9
IV	<p>Mental Health and Psychological First Aid</p> <ul style="list-style-type: none"> What is Mental Health First Aid? Mental Health Problems in the India The Mental Health First Aid Action Plan Understanding Depression and Anxiety Disorders Crisis First Aid for Suicidal Behavior & Depressive symptoms What is Non-Suicidal Self-Injury? Non-crisis First Aid for Depression and Anxiety Crisis First Aid for Panic Attacks, Traumatic events Understanding Disorders in Which Psychosis may Occur Crisis First Aid for Acute Psychosis Understanding Substance Use Disorder Crisis First Aid for Overdose, Withdrawal Using Mental Health First Aid 	8

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Suggested Readings:

- Indian First Aid Manual-<https://www.indianredcross.org/publications/FA-manual.pdf>
- Red Cross First Aid/CPR/AED Instructor Manual
- <https://mhfa.com.au/courses/public/types/youthedition4>
- Finkelhor, D. (2009). The prevention of childhood sexual abuse. Durham, NH: Crimes Against Children Research Center. www.unh.edu/ccrc/pdf/CV192.pdf
- Kantor L. & Levitz N. (2017). Parents' views on sex education in schools: How much do Democrats and Republicans agree? PLoS ONE, 12 (7): e0180250.
- Orenstein, P. (2016). Girls and sex: Navigating the complicated new landscape. New York, NY: Harper.
- Schwiagershausen, E. (2015, May 28). The Cut. www.thecut.com/2015/05/most-women-are-catcalled-before-they-turn-17.html
- Wiggins, G. & McTighe, J. (2008). Understanding by design. Alexandria, VA: ASCD.
- <https://marshallmemo.com/marshall-publications.php#8>

Suggested Continuous Internal Evaluation:

Maximum Marks: 25

One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

Suggested equivalent online courses:

- <https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online>
- <https://www.firstaidforfree.com/>
- <https://www.coursera.org/learn/psychological-first-aid>
- <https://www.coursera.org/learn/mental-health>

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Co-curricular Course: Semester-III

Course Title: Human Values and Environmental Studies

Year: Second	Semester: III
Course Code: CCB301	Course Title: Human Values and Environmental studies

Course outcomes:

The mission of the course on Human Values and Environmental Studies is to create morally articulate solutions to be truthful and just and to become responsible towards humanity. The course seeks to establish a continuous interest in the learners to improve their thought process with intent to develop a new generation of responsible citizens capable of addressing complex challenges faced by the society due to disruptions in human interactions effecting human values. This course works towards

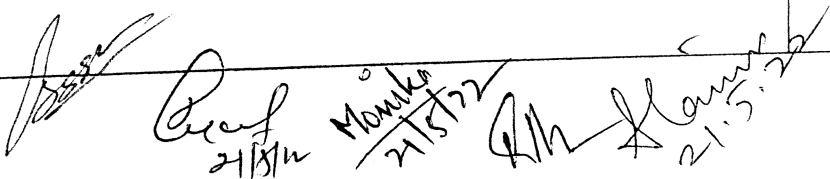
- Building fundamental knowledge of the interplay of markets, ethics, and law,
- Look at various challenges faced by individual to counter unethical issues
- Look at core concepts for business ethics
- Look at core concepts of anti-corruption
- Look at core concepts for a morally articulate solution evolver to management issues in general,
- Issues of sustainable development for a better environment.
- To know how environmental degradation has taken place.
- Be aware of negotiations and international efforts to save environment.
- How to develop sustainably?
- Efforts taken up by UN in Sustainable Development.
- Efforts taken by India in Sustainable Development.

The course intends to create a sense of how to be more responsible towards the environment. Upon finishing of the course students will be able to come up with using ethical reasoning for decision making and frame ethical issues as well as operationalise ethical choices. The course integrates various facets of human values and environment.

Credits: 2	Compulsory
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100	Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0
As the course requires two areas of Human Values and Environment Studies institutions can even opt for a parallel delivery

Unit	Topics	No. of Lectures Total=30
I	<p>Human Values- Introduction- Values, Characteristics, Types ,Developing Value system in Indian Organisation , Values in Business Management , value based Organisation , Trans –cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam view on role of parents and Teachers.</p> <p>Human Values and Present Practices – Issues : Corruption and Bribe , Privacy Policy in Web and Social Media, Cyber threats ,Online Shopping etc. Remedies UK Bribery Act, Introduction to sustainable policies and practices in Indian Economy.</p> <p>Principles of Ethics Secular and Spiritual Values in Management- Introduction- Secular and Spiritual values, features , Levels of value Implementation. Features of spiritual Values , Corporate Social Responsibility- Nature, Levels ,Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates.</p>	02 02 03



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<p>II</p>	<p>Holistic Approach in Decision making- Decision making, the decision making process , The Bhagavad Gita: Techniques in Management , Dharma and Holistic Management. Discussion through Dilemmas – Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context , Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security , Dilemma on Organic food , Dilemma on standardization ,Dilemma on Quality standards. Case Studies</p>	<p>03 03 02</p>
<p>III</p>	<p>Ecosystem: Concept, structure & functions of ecosystem : producer, consumer, decomposer, foodweb, food chain, energy flow, Ecological pyramids Conservation of Biodiversity- In-situ & Ex- situ conservation of biodiversity Role of individual in Pollution control Human Population & Environment Sustainable Development India and UN Sustainable Development Goals Concept of circular economy and entrepreneurship</p>	<p>7</p>
<p>IV</p>	<p>Environmental Laws? International Advancements in Environmental Conservation Role of National Green Tribunal Air Quality Index Importance of Indian Traditional knowledge on environment Bio assessment of Environmental Quality Environmental Management System Environmental Impact Assessment and Environmental Audit</p>	<p>8</p>

Suggested Readings:

1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal et.al
2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel.
3. Human Values by A. N. Tripathi New Age International
4. Environmental Management by N.K. Uberoi
5. <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>
6. <https://www.india.gov.in/my-government/schemes>
7. <https://www.legislation.gov.uk/ukpga/2010/23/contents>
8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921

Suggested Continuous Internal Evaluation:

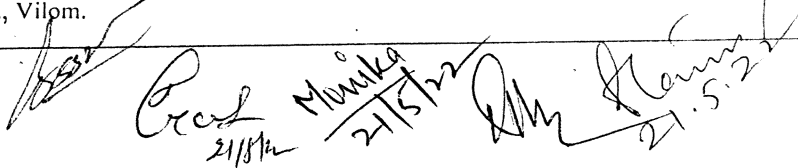
Maximum Marks: 25

One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

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Co-curricular course: Semester-IV Course Title: Physical Education and Yoga

Year: Second		Semester: IV	
Course Code: CCB401		Course Title: Physical Education and Yoga	
Course outcomes: Students will learn the introduction of Physical Education, Concept of fitness and wellness, Weight management and lifestyle of an individual. The student will also learn about the relation of Yoga with mental health and value Education. In this course student will also learn about the aspects of the Traditional games of India.			
Credits: 2		Compulsory	
Max. Marks CIE: 25 Max. Marks End Semester Examination: 75 Total Max. Marks: 100		Min. Passing Marks CIE: 10 Min. Passing Marks End Semester Examination: 30 Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0			
Unit	Topics	No. of Lectures Total=30	
I	Physical Education: <ul style="list-style-type: none"> • Meaning, Definition, Aim and Objective. • Misconception About Physical Education. • Need, Importance and Scope of Physical Education in the Modern Society. • Physical Education Relationship with General Education. • Physical Education in India before Independence. Physical Education in India after Independence. 	6	
ii	Concept of Fitness and Wellness: <ul style="list-style-type: none"> • Meaning, Definition and Importance of Fitness and Wellness. • Components of Fitness. • Factor Affecting Fitness and Wellness. Weight Management: <ul style="list-style-type: none"> • Meaning and Definition of Obesity. • Causes of Obesity. • Management of Obesity. • Health problems due to Obesity. Lifestyle: <ul style="list-style-type: none"> • Meaning, Definition, Importance of Lifestyle. • Factor affecting Lifestyle. • Role of Physical activity in the maintains of Healthy Lifestyle. 	8	
III	Yoga and Meditation: <ul style="list-style-type: none"> • Historical aspect of yoga. • Definition, types scopes & importance of yoga. • Yoga relation with mental health and value education. • Yoga relation with Physical Education and sports. • Definition of Asana, differences between asana and physical exercise. • Definition and classification of pranayama. • Difference between pranayama and deep breathing. • Practical: Asana, Suraya-Namaskar, Bhujang Asana, Naukasana, Halasana, Vajrasana, Padmasana, Shavasana, Makrasana, Dhanurasana, Tad Asana. • Pranayam: Anulom, Vilom. 	8	



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IV

Traditional Games of India:

- Meaning.
- Types of Traditional Games-
 - ✦ Gilli- Danda
 - ✦ Kanche
 - ✦ Stapu
 - ✦ Gutte, etc.
- Importance/ Benefits of Traditional Games.
- How to Design Traditional Games.

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Recreation in Physical Education:

- Meaning, Definition of Recreation.
- Scope and Importance of Recreation.
- General Principles of Recreation.
- Types of Recreational Activities.
- Aerobics and Zumba.(Fir India Movement)

Suggested Readings:

Singh, Ajmer, Physical Education and Olympic Abhiyan, "Kalayani Publishers", New Delhi, Revised Addition, 2006
 Patel, Shri Krishna, Physical Education, "Agrawal Publishers", Agra, 2014-15 Panday, Preeti, Sharirik
 Shiksha Sankalan, " Khel Sanskriti Prakashan, Kanpur
 Kamlesh M.L., "Physical Education, Facts and foundations", Faridabad P.B. Publications.
 B.K.S. Yengar, "Light and Yog. Yoga Deepika", George Allen of Unwin Ltd., London, 1981. Braj Bilari Nigam,
 Yoga Power "The Kpath of Personal achievement & quot; Domen and Publishers, New Delhi, 2001.
 Indira Devi, "Yoga for You", Gibbs, Smith Publishers, Salt Lake City, 2002 Domen and Publishers, New
 Delhi - 2001.
 Jack Peter, "Yoga Master the Yogic Powers", Abhishek Publications, Chandigarh, 2004. Janice Jerusalem,
 "A Guide To Yoga & quot; Parragon Bath, Baiihe-2004.

Suggested Continuous Internal Evaluation:

Maximum Marks: 25

One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks

Suggested equivalent online courses:

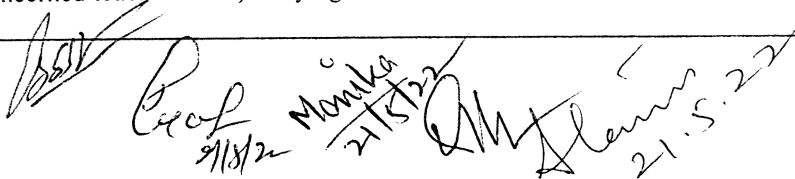
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- Rajarshi Tandan Open University.

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Co-Curricular Course: Semester-V
Course Title: Analytic Ability and Digital Awareness

Year: Third	Semester: V	
Course Code: CCB501	Course Title: Analytic Ability and Digital Awareness	
Course outcomes (Analytic Ability): CO 1: Familiarize with analogy, number system, set theory and its applications, number system and puzzles. CO 2: To understand the basics of Syllogism, figure problems, critical and analytical reasoning. CO 3: Familiarize with word processing application and worksheet . CO 4: To understand the basics of web surfing and cyber security.		
Credits: 2	Co-Curricular	
Max. Marks CIE: 25	Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75	Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100	Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): 2-0-0		
Unit	Topic	No. of Lectures 30
I	Alphabet test, Analogy, Arithmetic Reasoning, Blood relations, Coding and Decoding, Inequalities, Logical Venn diagram, Seating Arrangements, Puzzles and Missing numbers	8
II	Syllogism, Pattern completion and figure series, Embedded Figure and counting of figures, Cube & Dice, Paper cutting and folding, Data sufficiency, Course of Action, Critical Reasoning, Analytical and decision making	7
III	Computer Basics: Block diagram of Digital Computer, Classification of Computers, Memory System, Primary storage, Auxiliary memory, Cache memory, Computer Software (System/Application Software), MS Word Basics: The word screen, Getting to word documents, typing and Revising text, Finding and Replacing, Editing and Proofing tools, Formatting text characters, Formatting Paragraph, Document templates., Page set up, tables, Mail Merge, Macros, protecting documents, printing a document. MS-Excel Introduction, Worksheet basics, Creating worksheet, Heading information, Data & Text, Date & Time, Alphanumeric values, Saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Excel shortcut and function keys, Working with single and multiple workbook, Working with formulae & cell referencing, Auto sum, coping formulae, Absolute & relative addressing, Worksheet with ranges, Formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and using macros, Multiple worksheets- concepts Introduction of Open Source Applications: Libre Office, Open Office and Google Docs etc.	8
IV	Web Surfing: An Overview: working of Internet, Browsing the Internet, E-Mail, Components of E-Mail, Address Book, Troubleshooting in E-Mail, Browsers: Netscape Navigator, Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, Tor, Search Engines lik Google, Duck Duck Go etc, Visiting web sites: Downloading. Cyber Security: Introduction to Information System, Type of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, phishing, spamming, fake news, general issues related to cyber security, Business need, Ethical and Professional issues of security.	7
Suggested Readings: <ol style="list-style-type: none"> Sharma, A., "How to prepare for Data Interpretation and Logical Reasoning for the CAT" McGraw Hill Education Pvt. Ltd., New Delhi, India, 2011, Ed. 5, ISBN 978 2007 070 481 Aggarwal, R.S., "A Modern Approach to Verbal and Non-verbal Reasoning" S. Chand Publishers New Delhi, India, 2010, ISBN 10: 8121905516 Madan, Sushila, Introduction to Essential tools, Jain Book Agency, New Delhi/India, 2009, 5th ed.. Goel, Anita, Computer Fundamentals, Pearson Education, India, 2012 Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017 		
Suggested Continuous Internal Evaluation: Maximum Marks: 25 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks		



 Prof. Monika 21/5/22
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Co-curricular course: Semester-VI

Course Title: Communication Skills and Personality Development

Year: Third	Semester: VI	
Course Code: CCB601	Course Title: Communication Skills and Personality Development	
Course outcomes: <ul style="list-style-type: none"> • To understand the concept of Personality. • To learn what personal grooming pertains. • To learn to make good resume and prepare effectively for interview. • To learn to perform effectively in group discussions. • To explore communication beyond language. • To learn to manage oneself while communicating. • To acquire good communication skills and develop confidence. 		
Credits: 2	Co-curricular	
Max. Marks CIE: 25	Min. Passing Marks CIE: 10	
Max. Marks End Semester Examination: 75	Min. Passing Marks End Semester Examination: 30	
Total Max. Marks: 100	Total Min. Passing Marks: 40	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0		
Unit	Topics	No. of Lectures Total=30
I	PERSONALITY AND PERSONAL GROOMING Understanding Personality <ul style="list-style-type: none"> • Definition and Meaning of Personality • Types of Personality • Components of Personality • Determinants of Personality • Assessment of Personality Grooming Self <ul style="list-style-type: none"> • Dress for success • Make up & skin care • Hair care & styles for formal look • Art of accessorizing • Oral Hygiene 	7
II	INTERVIEW PREPARATION AND GROUP DISCUSSION <ul style="list-style-type: none"> • Meaning and Types of Interview [Face to Face, Telephonic, Video] • Interview procedure [Opening, Listening, Closure] • Preparation for Interview • Resume Writing • LinkedIn Etiquette • Meaning and methods of Group Discussion • Procedure of Group Discussion. • Group Discussion simulation • Group discussion common error 	8

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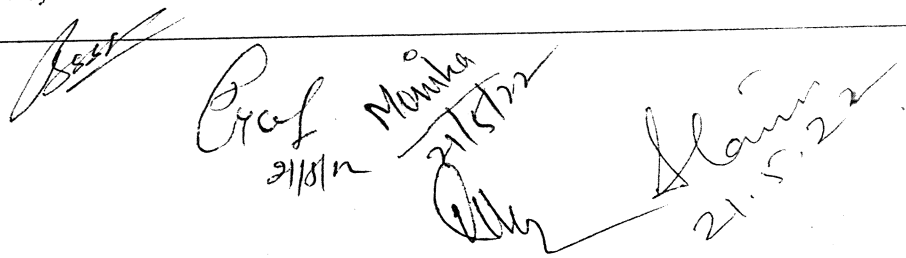
III	<p align="center">BODY LANGUAGE AND BEHAVIOUR</p> <ul style="list-style-type: none"> • Concept of human behavior • Individual and group behavior • Developing Self-Awareness • Behaviour and body language • Dimensions of body language: <ul style="list-style-type: none"> Proxemics Haptics Oculesics Paralanguage Kinesics Sign Language Chromatics Chronemics Olfactics • Cultural differences in Body Language • Business Etiquette & Body language • Body Language in the Post Corona Era • Virtual Meeting Etiquette • Social Media Etiquette 	7
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IV	<p align="center">ART OF GOOD COMMUNICATION</p> <ul style="list-style-type: none"> • Communication Process • Verbal and Non-verbal communication • 7 C's of effective communication • Barriers to communication • Paralinguistics <ul style="list-style-type: none"> Pitch Tone Volume Vocabulary Word stress Pause • Types of communication <ul style="list-style-type: none"> Assertive Aggressive Passive Aggressive • Listening Skills • Questioning Skills • Art of Small Talk • Email Writing 	8
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Suggested Readings:

1. Cloninger, S.C., "Theories of Personality : Understanding Person", Pearson, New York, 2008, 5th edition.
2. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition.
4. Adler R.B., Rodman G. & Hutchinson C.C. , "Understanding Human Communication", Oxford University Press : New York, 2011.
5. Suggestive digital platforms web links-

Suggested Continuous Internal Evaluation:
 Maximum Marks: 25
 One MCQ test/Quizzes (as decided by concerned teacher/HOD) carrying Maximum marks 20 and Viva-voce/ Class interaction of 5 marks



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DEPARTMENT OF BIOTECHNOLOGY
SYLLABUS OF VOCATIONAL COURSES
FOR B.SC. (IN FACULTY OF LIFE SCIENCE)

Under NEP-2020

VOCATIONAL COURSE PAPER TITLES

COURSE CODE	PAPER TITLE	TOTAL CREDIT SKILL/THEORY	SKILL MAX. MARKS	THEORY MAX. MARKS	TYPE OF COURSE INDEPENDENT OR POGRESSIVE
VOC 01	Plant Nursery Management	2 +1 =3	60	40	Both
VOC 02	Dairy Technology	2 +1 =3	60	40	Both
VOC 03	Green House Technology	2 +1 =33	60	40	Both
VOC 04	Organic Farming	2 +1 =3	60	40	Both
VOC 05	Nutrition and Health Care Sciences	2 +1 =3	60	40	Both
VOC 06	Mushroom Spawn Production and Cultivation	2 +1 =3	60	40	Independent
VOC 07	Mushroom Cultivation	2 +1 =3	60	40	Independent
VOC 08	Creative Photography	2 +1 =3	60	40	Independent
VOC 09	Multimedia and Animation	2 +1 =3	60	40	Both
VOC 10	Wall Painting and Mural Art	2 +1 =3	60	40	Independent
VOC 11	Creative Painting	2 +1 =3	60	40	Independent
VOC 12	Modern Technique For Plant Propagation	2 +1 =3	60	40	Both
VOC 13	Cultivation And Utilization of Medicinal and Aromatic Plants	2 +1 =3	60	40	Independent
VOC 14	Pathology Techniques	2 +1 =3	60	40	Independent
VOC 15	Descriptive Statistics Using Excel & 'R'	2 +1 =3	60	40	Independent

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Plant Nursery Management					
Title of course:		Plant Nursery Management			
Nodal Department of HEI to run course		Agriculture Skill Council of India			
Board Area/Sector-		Agriculture Skill Council of India			
Sub Sector-		Independent and Progressive			
Nature of Course-Independent and Progressive		Agriculture Skill Council of India			
Name of Suggestive Sector Skill Council		Agriculture Skill Council of India			
Aliened NSQF Level		4			
Expected fee of the Course-Free/Paid					
Stipend to Student expected from industry					
Number of Seats.....					
Course Code- VOPNM (VOPNM101, VOPNM102, VOPNM201, VOPNM202)		Credits-03(1 Theory,2 Practical)			
Max Mark		Minimum Marks. 35			
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.					
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.		Nursery grower, landscaper, Gardener, Gardening industries, Self- Nursery			
Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours =1 credit)	No. of skill Hours (Total 60 Hours=2 credits)
Credit-3					
Semester-1 VOPNM101					
I.	Introduction to gardening	General	Theory/ Practical	15 Hours	
II.	Types of Gardens	Skill	Theory/Practical		30 Hours
III.	Nursery methods and tools	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-2 VOPNM102					
I.	Propagation of indoor & Outdoor plants	General	Theory/ Practical	15 Hours	
II.	Principal and Practices of Landscape design for Home garden & Public Park	Skill	Theory/Practical		30 Hours
III.	Practicals	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-3 VOPNM201					
I.	Seed Propagation	General	Theory/ Practical	15 Hours	
II.	Common Fertigation,	Skill	Theory/Practical		30 Hours
III.	Practicals	Skill	Practical/Internship /Training		30 Hours
Credit-3					
Semester-4 VOPNM202					

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I.	Entrepreneurship	General	Theory/ Practical	15 Hours	
II.	protection & Management of Nursery	Skill	Theory/Practical		30 Hours
III.	Project Management & Marketing	Skill	Practical/Internship /Training		30 Hours

Suggested Readings: **NURSERY MANAGEMENT: Handbook for Beginners**
 Resource Book on Horticulture Nursery Management
 Establishment and Management of Plant Nursery System
 Practical Manual of Nursery Management

Suggested Digital platforms/web link for reading-
https://www.academia.edu/40648067/NURSERY_MANAGEMENT_Handbook_for_Beginners
<http://www.fdcn.nic.in/PDF/horticulture%20plant%20nursery.pdf>
https://www.researchgate.net/publication/326096694_Practical_Manual_of_Nursery_Management

Suggested OJT/internship/Training/Skill partner :

Course Pre-requisites:

- No pre-requisite required, open to all
- To study this Course, a student must have the Subject science and any other in class/12th/certificate/diploma.
- If progressive to study this course a student must have passed previous courses of this series.

Notes:

- Number of units in theory/practical may vary as per need.
- Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).
- Credit for theory=01(Teaching hours=15)
- Credit for internship/OJT/Training/Practical=02(Training hours =60)

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Title of course:	Dairy Technology
Nodal Department of HEI to run course	
Board Area/Sector-	Agriculture & Dairy Products
Sub Sector-	
Nature of Course-Independent and Progressive	Independent and Progressive
Name of Suggestive Sector Skill Council	
Aliened NSQF Level	4
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code- VODT (VODT101, VODT102, VODT201, VODT202)	Credits-03(1 Theory,2 Practical)
Max Mark <i>60Marks Skill + 40Marks Theory = 100 Total</i>	Minimum Marks. <i>35</i>
Name of proposed skill Partner (Please Specify, Name of industry, company etc. for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.)	Dairy Technician, Dairy product maker, dairy industry supporter, Dairy Operator Open Own Dairy/Shop

Syllabus:-

Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VODT101			3 Credits		
I.	Milk Procedure	General	Theory/Practical	15 Hours	
II.	Dairy equipment's	Skill	Practical		30 Hours
III.	Requirements of dairy industry	Skill	internship /Training		30 Hours
Semester-2 VODT101			3 Credits		
I.	Milk & Milk quality analysis	General	Theory/Practical	15 Hours	
II.	Dairy Equipment and their Maintenance	Skill	Practical		30 Hours
III.	Practicals	Skill	internship /Training		30 Hours
Semester-3 VODT101			3 Credits		
I.	Dairy Development And Cooperative System	General	Theory/Practical	15 Hours	
II.	Packaging and Distribution	Skill	Practical		30 Hours
III.	Fat & oil dairy products	Skill	internship /Training		30 Hours
Semester-4 VODT101			3 Credits		
I.	Dried Milk Products	General	Theory/Practical	15 Hours	
II.	Heat Desiccated	Skill	Practical		30 Hours

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	Milk Products				
III.	Concentrated Milk Products	Skill	internship /Training		30 Hours
Suggested Readings: By-Products Technology by Vijay Kumar Cheese Technology by S. K. Kanawjia & Yogesh Khetra Dairy Biotechnology by Sunita Grover V. K. Batish V. Padmanabha Reddy Dairy-Plant-Management-And-Pollution-Control by Vijaya Geetha Dairy Engineering by S. Ravi Kumar Fat Rich Dairy Products by Y. Kotilinga Reddy Yogesh Khetra M.H. Sathish Kumar Entrepreneurship Development and Industrial Consultancy A. K. Makwana A. K. Chauhan Ice Cream & Frozen Desserts A. Jana Suneeta Pinto P.R.S. Moorthy Market Milk by Latha Sabikhi PACKAGING OF DAIRY PRODUCTS Author H.G. Patel & Hiral Modha Department of Dairy Technology AAU, Anand M. Ranganadham TRADITIONAL DAIRY PRODUCTS M. Ranganadham					
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject science or any other .in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.					
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)					

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Dr. Hiral Modha
22.5.22

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03

Title of course:	Green House Technology
Nodal Department of HEI to run course	
Board Area/Sector-	Agriculture Skill Council of India
Sub Sector-	
Nature of Course-Independent and Progressive	Independent and Progressive
Name of Suggestive Sector Skill Council	Sector of Information Technology
Aliened NSQF Level	4
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code- VOGH (VOGHT101, VOGHT102, VOGHT201, VOGHT202)	Credits-03(1 Theory,2 Practical)
Max Mark 60 Marks Skill + 40 Marks Theory = 100	Minimum Marks. 35
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.	KVK , Green-house operator/helper/ grower Agriculture Industries Agri based Marketing industry

Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical/OJT/ internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOGHT101			Credit-3		
I.	Basics of Green House Technology	General	Theory/ Practical	15 Hours	
II.	Different types of green house	Skill	Theory/Practical		30 Hours
III.	Growing Media	Skill	Practical/Internship /Training		30 Hours
Semester-2 VOGHT102			Credit-3		
I.	Micro irrigation system used in green house	General	Theory/ Practical	15 Hours	
II.	Automation in Protected Cultivation	Skill	Theory/Practical		30 Hours
III.	Automation and monitoring systems in green house	Skill	Practical/Internship /Training		30 Hours
Semester-3 VOGHT201			Credit-3		
I.	Seed propagation	General	Theory/ Practical	15 Hours	

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II.	GHT Management	Skill	Theory/Practical		30 Hours
III.	Fertilizers use and management	Skill	Practical/Internship /Training		30 Hours
Semester-4 VOGHT202 Credit-3					
I.	Soil fertility and productivity	General	Theory/ Practical	15 Hours	
II.	Commercial vegetable seedling production	Skill	Theory/Practical		30 Hours
III.	Training Visits	Skill	Practical/Internship /Training		30 Hours

Suggested Readings: Design and Maintenance of Green House by Dr. R.F. Sutar
Greenhouse technology and management: Second Edition

Suggested Digital platforms/web link for reading- <https://agrimoon.com/design-and-maintenance-of-green-house-pdf-book-free/>
https://www.researchgate.net/publication/287291076_Greenhouse_technology_and_management_Second_Edition

Course Pre-requisites:

- No pre-requisite required, open to all
- To study this Course, a student must have the Subject Science .in class/12th/certificate/diploma.
- If progressive to study this course a student must have passed previous courses of this series.

Notes:

- Number of units in theory/practical may vary as per need.
- Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).
- Credit for theory=01(Teaching hours=15).
- Credit for internship/OJT/Training/Practical=02(Training hours =60)

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Title of course:		Organic Farming	
Nodal Department of HEI to run course		Agriculture Skill Council of India	
Board Area/Sector-		Agriculture Skill Council of India	
Sub Sector-		Independent and Progressive	
Nature of Course-Independent and Progressive		Agriculture Skill Council of India	
Name of Suggestive Sector Skill Council		Agriculture Skill Council of India	
Aliened NSQF Level		4	
Expected fee of the Course-Free/Paid			
Stipend to Student expected from industry			
Number of Seats.....			
Course Code- VOOF (VOOF101, VOOF102, VOOF201, VOOF202)		Credits-03(1 Theory,2 Practical)	
Max Mark <i>60 Marks Skill + 40 Marks Theory = 100</i> ^{Total}		Minimum Marks. <i>35</i>	
Name of proposed skill Partner (Please Specify, Name of industry, company etc for practical/training/internship/OJT.			
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.		Agri based Industry, Organic Product developer,	

Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total 15 Hours =1credit)	No. of skill Hours (Total=60 Hours=2 credits)
Semester-1 VOOF101					
I.	Basic Concept of Organic faming	General	Theory/ Practical	15 Hours	
II.	The Organic way of Farming	Skill	Theory/Practical		30 Hours
III.	Environmental Impacts of Conventional and Organic Farming	Skill	Practical/Internship /Training		30 Hours
Semester-2 VOOF102					
I.	Types of Farming	General	Theory/ Practical	15 Hours	
II.	Practicals	Skill	Theory/Practical		30 Hours
III.	Commercial production house	Skill	Practical/Internship /Training		30 Hours
Semester-3 VOOF201					
I.	Organic Manure	General	Theory/ Practical	15 Hours	
II.	Principles of Composting	Skill	Theory/Practical		30 Hours
III.	Green Manure	Skill	Practical/Internship /Training		30 Hours

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Semester-4 VOOF202					
I.	Recycling of Organic residues	General	Theory/ Practical	15 Hours	
II.	Impact and Introduction of Green technology	Skill	Theory/Practical		30 Hours
III.	Other Organic Farming Methods & Products	Skill	Practical/Internship /Training		30 Hours
Suggested Readings: Farmer's Handbook on Basic Agriculture Economics of Organic Farming					
Suggested Digital platforms/web link for reading https://ardhindie.com/book/read.php?file=Organic%20Farming https://www.manage.gov.in/publications/farmerbook.pdf https://orgprints.org/id/eprint/30486/1/Economics%20of%20Organic%20Farming%20-%20Book.pdf https://www.academia.edu/40648067/NURSERY_MANAGEMENT_Handbook_for_Beginners http://www.fdcn.nic.in/PDF/horticulture%20plant%20nursery.pdf https://www.researchgate.net/publication/326096694_Practical_Manual_of_Nursery_Management					
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject Science.in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.					
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)					

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05

NUTRITION AND HEALTH CARE SCIENCES	
Title of course:	
Nodal Department of HEI to run course	Health care
Board Area/Sector-	Nutrition
Sub Sector-	Independent and Progressive
Nature of Course-Independent and Progressive	Health care sector skill council
Name of Suggestive Sector Skill Council	4
Alienated NSQF Level	
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code- VOCNHCS (VOCNHCS101, VOCNHCS102, VOCNHCS201, VOCNHCS202)	Credits-03(1 Theory,2 Practical)
Max Mark <i>60 Marks Skill + 40 Marks Theory = 100</i>	Minimum Marks. <i>35</i>
Name of proposed skill Partner (Please Specify, Name of industry, company etc. for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc.)	Nursing staff, Hospital management Staff, Dietetics, Nutritionist in healthclinics & Gyms

Syllabus:-					
Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOCNHCS101					
I.	Basic concept of Nutrition	General	Theory/Practical	15 Hours	
II.	Human biology	Skill	Theory/Practical		30 Hours
III.	Laboratory Biochemistry	Skill	internship /Training		30 Hours
Semester-2 VOCNHCS102					
I.	Health indicators	General	Theory/Practical	15 Hours	
II.	Food & Nutrition	Skill	Practical		30 Hours
III.	Dietary Management of Disease	Skill	internship /Training		30 Hours
Semester-3 VOCNHCS201					
I.	Nutrition & Health status of Community	General	Theory/Practical	15 Hours	
II.	Approaches in Nutrition and Health education	Skill	Practical/ internship /Training		30 Hours
III.	Paramedic hospital techniques	Skill	Practical/ internship /Training		30 Hours
Semester-4 VOCNHCS202					
I.	Health Care: Yoga Techniques	General	Theory/Practical	15 Hours	
II.	Health Care: Preventive & Therapeutic techniques	Skill	Practical/ internship/Training		30 Hours
III.	Medical Pathology Laboratory	Skill	Practical/ internship /Training		30 Hours

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Suggested Readings: Food Technology Part -I by A. K. Singh P. N. Raju & A. Jana
Food Technology Part-II by A. K. Singh P. N. Raju & A. Jana
FOOD AND INDUSTRIAL MICROBIOLOGY Suja Senan R. K. Malik Shilpa Vij

Suggested Digital platforms/web link for reading- <http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=15>
<http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=444>

Course Pre-requisites:

- No pre-requisite required, open to all
- To study this Course, a student must have the Subject Science or any other in class/12th/certificate/diploma.
- If progressive to study this course a student must have passed previous courses of this series.

Notes:

- Number of units in theory/practical may vary as per need.
- Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).
- Credit for theory=01(Teaching hours=15)
- Credit for internship/OJT/Training/Practical=02(Training hours =60)

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Title of Course: Mushroom spawn production and cultivation

Nodal Department of HEl to run course

Broad Area/Sector: Agro-farming

Sub Sector: Mushroom cultivation

Nature of Course-Independent/Progressive: Independent

Name of suggestive Sector Skill Council: Agriculture Skill council of India, Gurugram122004

Aliened NSQF level: 4

Expected fees of the course- Free/Paid

Stipend to student expected from industry

Number of Seats

Course Code: Credits: 03 (1 Theory, 2 Practical)

Max. Marks: 60 Marks Skill + 40 Marks Theory = 100 **Min Marks:** 35

Name of proposed Skill Partner (Please specify Name of Industry, Company etc. for Practical/Training/internship/OJT)

Job prospects-Expected Fields of occupation where student will be able to get job after completing this course (Please specify name/type of industry) Entrepreneur, Food IndustMry, Mycologist. Mushroom Farms.

Unit	Topics	General/Skill component	Theory/Practical/OJT/Internship/Training	No of Theory Hrs(Total-15 Hrs=1 Credit)	No of Skill Hrs(Total-60Hrs=2 Credits)
I	Introduction of Mushroom & Types	General/Skill	Theory - 02 Practical- 01	(02 Hours)	(02 hours)
II	Principle of Mushroom Cultivation & Production	General/Skill	Theory - 05 Practical- 08	(05 hours)	(16 hours)
III	Growing condition for mushroom	General/Skill	Theory - 02 Practical- 12	(02 Hours)	(24 Hours)
IV	Pest diseases and growing mushroom outside	General/Skill	Theory - 02 Practical- 04	(02 Hours)	(08 Hours)
V	Harvesting, storing and utilization of mushroom	General/Skill	Theory - 02 Practical- 02	(02 Hours)	(04 Hours)
VI	Marketing of mushroom and special assignments	General/Skill	Theory - 02 Practical- 03	(02 Hours)	(06 Hours)

Suggested Readings:

1. Tripathi D.P., Oxford & IBH publishers - Mushroom cultivation.
2. Pathak Yadav Gour, Published by Agrobios – Mushroom Production and Processing.
3. S. Kannaiyan & K. Ramasamy, Today & Tomorrow's Printers and Publishers - Handbook of edible mushrooms

Suggested equivalent online courses: www.nhb.gov.in

Prof. Monika
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Title of course- Mushroom Cultivation	
Nodal Department of HEI to run course	
Broad Area/Sector-	Agriculture and Allied
Sub Sector-	Economic Agriculture Mycology
Nature of course - Independent / Progressive	Independent
Name of suggestive Sector Skill Council	Agriculture Skill Council of India
Aliened NSQF level	Level 3
Expected fees of the course-Free/Paid	
Stipend to student expected from industry	
Number of Seats-- <u>5</u> --	
Course Code:--	Credits- 03 (1 Theory, 2 Practical)
Max Marks. <u>100</u> . Minimum Marks... <u>35</u>	
Name of proposed skill Partner-	
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in	Self-employment: Owner of Mushroom farm, Wage employment: Worker in Mushroom farm.

Syllabus					
Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total-15 Hours=1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction to Mushroom cultivation	<ul style="list-style-type: none"> Knowledge of General Safety, health and hygiene. Importance of Mushroom, scope, past, present status & futureprospects. Pros & cons in Mushroom cultivation: why the Mushroom cultivation? Problems in mushroom cultivation & its remedies 	<ul style="list-style-type: none"> Selection and Processing of straw for bed preparation Sterilization processpractice. 	3 hour	10 hour
II	Process of Mushroom Cultivation	<ul style="list-style-type: none"> Mushroom for health: ingredients in mushroom, i.e. Protein, Carbohydrate, Fiber, Fat, Vitamins, Minerals etc. Types of Mushroom. Poisonous Mushroom. Cultivation of Paddy StrawMushroom and ingredients used Oyster Mushroom Cultivation andingredients used. Milky Mushroom Cultivation andingredients used. Button Mushroom cultivation andingredients used 	<ul style="list-style-type: none"> Preparation of beds for cultivation of various mushrooms and its maintenance Growing and Identification of viable Spawn 	8 hour	35 hour
III	Maintain the health and hygiene standards of Mushroom.	<ul style="list-style-type: none"> Post Harvesting care and processing Visit to Mushroom farms. 	<ul style="list-style-type: none"> Preservation of Mushroom. Economics of Mushroom cultivation and Marketing 	4 hour	15 hour

Suggested Readings:

- Lynch, Tavis., "Mushroom Cultivation" An illustrated guide to growing your own mushroom at Home.Quarto Publishing Groups USA, 2018.
- Bonyard, Britt and Lynch, Tavis., "The beginner's Guide to Mushroom". Quarto Publishing Groups USA, 2020

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Title of course- Creative Photography	
Nodal Department of HEI to run course-	
Broad Area/Sector-	Fine Arts and Allied
Sub Sector-	N S D
Nature of course -	Independent
Name of suggestive Sector Skill Council-	N S D
Aliened NSQF level:	1
Expected fees of the course -	
Stipend to student expected from industry	
Number of Seats-	
Course Code-	
Max Marks- 100 Minimum Marks - 35	Credits- 03 (1 Theory, 2 Practical)
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	Photo studios
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	Professional photography, Fashion photography, Product photography

Syllabus					
Unit	Topics	General/ Skill component	Theory/ Practical/OJT/ Internship/ Training	No of theory hours (Total-15 Hours= 1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction of photography	Teaching basic conceptsof photography	Theory	4	
II	Study of the basic functions of cameras	Practical exposure to professional camera	Practical		16
III	Camera, Lenses and Accessories	Theoretical aspects of camera lens and its accessories	Theory	5	
IV	Functional study of different lensesand other accessories	Practice exercises on lenses and its accessories	Practical		20
V	Principles of visual composition	Fundamentals of visual composition	Theory	6	
VI	Hands on Practice and creation of creative photography	Hands on experience on creative photography	Hands on practice and OJT		24

Readings:

Suggested

- Edward, "Photography: A Very Short Introduction", Oxford University Press, 2006.
1. Beaumont Newhall, "The History of Photography: 1839 to the present day", Museum Of Modern Art, 1982
 2. Beaumont Newhall, "The Beginner's Photography Guide", D K, 15 July 2016.
 3. D K, "Digital Photography Complete Course", D K, 1st September 2015.

Course Pre-requisites:

- To study this course, a student must have completed the class 12th examination
- If progressive, to study this course a student must have passed previous courses of this series.

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Title of course:	Multimedia and Animation
Nodal Department of HEI to run course	
Board Area/Sector-	Sector of Information Technology
Sub-Sector-	
Nature of Course-Independent and Progressive	Independent and Progressive
Name of Suggestive Sector Skill Council	Sector of Information Technology
Aliened NSQF Level	4
Expected fee of the Course-Free/Paid	
Stipend to Student expected from industry	
Number of Seats.....	
Course Code-VOMA (VOMA101, VOMA102, VOMA201, VOMA202)	Credits-03(1 Theory,2 Practical)
Max Mark <i>60 Marks Skill + 40 Marks Theory = 100</i>	Minimum Marks. <i>35</i>
Name of proposed skill Partner (Please Specify, Name of Industry, company etc for practical/training/internship/OJT.	
Job prospects- Expected field of Occupation where student will be able to Get job after the completing this course in (Please Specify, Name of industry, company etc).	Animator, Graphic Designer, Journalist, Media Assistant, Print & Advertisement Media

Syllabus:-

Unit	Topics	General/Skill Component	Theory/Practical /OJT/internship /Training	No. of Theory Hours (Total-15 Hours=1 credit)	No. of skill hours (Total=60 Hours=2 credits)
Semester-1 VOMA101 3 Credits					
I.	Basics of Animation	General	Theory/Practical	15 Hours	
II.	Skills for Animation Artist	Skill	Practical		30 Hours
III.	Introduction to equipment required for animation	Skill	internship /Training		30 Hours
Semester-2 VOMA102 3 Credits					
I.	Element of art	General	Theory/Practical	15 Hours	
II.	Graphic Designing	Skill	Practical		30 Hours
III.	Design	Skill	internship /Training		30 Hours
Semester-3 VOMA201 3 Credits					
I.	Photoshop, Coral Draw	General	Theory/Practical	15 Hours	
II.	Coral Draw	Skill	Practical		30 Hours
III.	Quark Xpress	Skill	internship /Training		30 Hours
Semester-4 VOMA202 3 Credits					
I.	Graphic algorithm	General	Practical		30 Hours
II.	Tools for editing	Skill	Practical		30 Hours

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III.	Automatic motion Control	Skill	Internship /Training	30 Hours
Suggested Readings: Introduction to Multimedia and Hypermedia MULTIMEDIA AND ITS APPLICATIONS by Pavithra Graphic Design and Multimedia By				
Suggested Digital platforms/web link for reading- http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=24 https://www.ebookphp.com/computer-graphics-multimedia-and-animation-epub-pdf/ http://www.eee.bham.ac.uk/spannm/Teaching%20docs/EE1F2/New%20Material/007177064x_chap01.pdf https://freebookcentre.net/ComputerScience-Books-Download/Computer-Graphics-and-Multimedia.html				
Course Pre-requisites: <ul style="list-style-type: none">• No pre-requisite required, open to all• To study this Course, a student must have the Subject Computer in class/12th/certificate/diploma.• If progressive to study this course a student must have passed previous courses of this series.				
Notes: <ul style="list-style-type: none">• Number of units in theory/practical may vary as per need.• Total credit Semester-3(it can be more credits, but student will get only 3 credits/semester or 5 credits/year).• Credit for theory=01(Teaching hours=15)• Credit for internship/OJT/Training/Practical=02(Training hours =60)				

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Title of course- Wall Painting and Mural Art	
Nodal Department of HEI to run course-	
Broad Area/Sector-	Fine Arts and Allied
Sub Sector-	N S D
Nature of course -	Independent
Name of suggestive Sector Skill Council-	N S D
Aliened-NSQF level:	1
Expected fees of the course -	
Stipend to student expected from industry	
Number of Seats-	
Course Code-	
Max Marks-100 Minimum Marks - 35	Credits- 03 (1 Theory, 2 Practical)
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	Architects and professional artists
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	Architects and professional artists

Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total- 15 Hours= 1 credit)	No of skill Hours (Total- 60 Hours= 2 credits)
I	Wall Painting and Mural Art: An overview	Explaining basics of wall painting and mural art	Theory	4	
II	Study of drawing objects, human figure, nature, birds, animals etc.	Practical exposure on studying drawing objects, human figure, nature etc.	Practical		14
III	Elements of drawing and design	Teaching basic concepts of design and drawing	Theory	5	
IV	Hands on Practice of layout development	Practice exercises on developing layout	Practical		16
V	Wall Paintings: Tools and techniques	Teaching basic Tools and techniques used in wall painting	Theory	6	
VI	Practice sessions for color application	Hands on experience on color applications on wall	OJT/ Internship		30

- Suggested Readings:**
1. Frenz Albrecht, Marar Krishna Kumar & Marar Ke. Ke. "Wall Paintings In North Kerala, India: 1000 Years of Temple Art, Arnoldsche, the University of Michigan, 2004
 2. Beach, Milo Cleveland, "Bundi Wall Paintings in Rajasthan: Rediscovered Treasures", Mercatorfonds, 2013.
 3. Tse, Theodore and Terence, "Painting Murals fast & easy", North Light Books, 19 May, 2005 publication.
 4. Bricca, Morgan, "The Mural Artist's Handbook", Morgan Mural Studio, 2020.
 5. Losifidis, K., Mural Art: Large Scale Art from Walls Around the World, Publikat, First Edition, June 30, 2008.
 6. Grund, Charles, Painting Murals Step by Step, North Light Books, 1st edition, 2 Jan, 2003

Course Pre-requisites: To study this course, a student must have completed the class 12th examination
 • If progressive, to study this course a student must have passed previous courses of this series.

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Title of course - Creative Painting	
Nodal Department of HEI to run course-	Fine Arts and Allied
Broad Area/Sector-	NSD
Sub Sector-	Independent
Nature of course -	NSD
Name of suggestive Sector Skill Council-	I
Aliened NSQF level:	
Expected fees of the course	
Stipend to student expected from industry	
Number of Seats-	
Course Code-	
Max Marks- 100 Minimum Marks - 35	Credits- 03 (1 Theory, 2 Practical)
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	Art Studios and freelance artist
Syllabus	

Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total- 15 Hours= 1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I	Introduction to creative painting	Teaching basics of creative painting	Theory	4	
II	Basic study of 2D objects	Practice on sketching 2D objects	Practical		14
III	Elements of painting	Explaining fundamentals of painting	Theory	5	
IV	Study of human figure and nature elements	Practice on sketching human figure and nature	Practical		16
V	Techniques in creative painting	Teaching theoretical concepts of creative painting	Theory	6	
VI	Hands on-Practice and creation of paintings	Practical exposure to creative paintings	OJT/ Internship		30

- Suggested Readings:
1. Sidaway Ian, "Mastering The Art of Drawing", J G Press, 1st October 2009.
 2. Norling Earnest R., "Perspective Made Easy", www.bnpublishing.com; 21 November 2007, Illustrated edition.
 3. Reyna Rubey De, "How TO Draw What You See", Watson-Guption, 1 September 1996, First edition.
 4. Ciardi Giovanni, "Figure Drawing: A Complete Guide", Search Press, 24th October 2016

Course Pre-requisites:

- To study this course, a student must have completed the class 12th examination

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Modern Techniques For Plant Propagation

Title of Course:

Nodal/Department of HEI to run course

Broad Area/Sector

Plant Propagation

Sub Sector

Nature of Course-Independent/Progressive

Name of suggestive Sector Skill Council

Alienated NSQF level

Expected fees of the course- Free/Paid

Stipend to student expected from industry

Number of Seats

Course Code:

Credits: 03 (1 Theory, 2 Practical)

Max. Marks: 60 Marks Skill + 40 Marks Theory = 100

Min Marks: ...35.....

Name of proposed Skill Partner (Please specify Name of Industry, Company etc. for Practical/Training/internship/OJT)

Job prospects-Expected Fields of occupation where student will be able to get job after completing this course (Please specify name/type of industry)

Organic Farming, Plant Designer

Syllabus

Unit	Topics	General/Skill component	Theory/Practical/OJT/Internship/Training	No of Theory Hrs(Total-15 Hrs=1 Credit)	No of Skill Hrs(Total-60 Hrs=2 Credits)
I	Introduction, Concept of Organic Farming, Elements of Organic Farming.			1	-----
II	Components of Composting, Vermicomposting, green manures, organic fertilisers and pesticides.			4	16
III	Methods of propagation of plants other than seeds eg:- grafting, layering etc.			2	8
IV	All about Microgreens			2	4
V	Other recent garden practices like bonsai, vertical gardens and kokedama etc.			5	9
VI	Learning how to reach the market with your products.			1	1

Suggested Readings: 1. Mamta Bansal, -Basics of Organic Farming, CBS publications

1. R.R.Sharma, -Textbook of Plant Propagation, CBS publications
2. Amilava Rakshit, Priyanka Raha, Nirmal-Manures, fertilisers and pesticides, CBS publications
4. Dr. Sumita Dodia-Elf Gardenia

Course Pre-requisites:

*No pre-requisite required, open to all:

*To study this course, a student must have the subject ANY in class 12th/Certificate/Diploma.

*If progressive, to study this course, a student must have passed previous courses of the series.

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Course Title: Cultivation and utilization of medicinal and aromatic plants

Credits: 03

Course Outcomes:

- Students will be able to learn and carry out the farming methods.
- Students will be able to explore the knowledge of traditional plants
- Students will be able to use them economically for the benefit of the society.

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 1-0-2

Unit	Theory Topics	No. of Lectures	Practical/Internship/ Training	No. of Lectures
I	Introduction – Indian System of Medicine, Medicinal Botany	2		
II	Cultivation and Utilization of Medicinal and Aromatic Plants:-	4	8 (16 Hours)	
III	Processing and Medicinal Uses of Herbal Plants Cultivation and Utilization of Medicinal and Aromatic Plants.	3	8 (16 Hours)	
IV	Screening and Standardization of Herbal Drugs.	2	5 (10 Hours)	
V	Neutraceutical (Natural Plant Products & Ethnobotany)	3	5 (10 Hours)	
VI	Quality Control of Herbal Medicine	1	4 (8 Hours)	

Suggested Readings:

1. Aromatic & Medicinal plants – Dr. M.P. Shiva, Alok Lehri, and Ms. Alka.
2. Indian Medicinal Plants – R.P. Rastogi and B.N. Malhotra.
3. Cultivation of Medicinal and Aromatic Crops – Farooqui Sreeram.
4. Handbook of medicinal plants – S.K. Bhattachariya.
5. Quality control and standardization of herbals – Dr. Dillip Kumar Jena, Dr. Pankaj Pradhan

This course can be opted as an vocational course by the students of following subjects: **Open for all**

Expected Fields of Occupation: Entrepreneur, Neutraceutical, Food Industry.

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Title of Course:- Pathology Techniques

Broad Area/Sector:- Lab Technology

Sub-sector:- Pathology testing basics

Nature of Course:- Independent

Name of Suggestive Skill Council: Technology skills in pathology

Maximum Marks:- 100 **Minimum Marks:-** 35 **Credits:-** 03(01 Theory, 02 Practical)

Name of Proposed Skill Partner: (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):-

Job Prospects-Expected Fields of Occupation where student will be able to get job after completing this course (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):- All Pathology labs ,Scientific Pathology

Syllabus					
Unit	Topics	General/Skill Component	Theory/Practical/OJT/Internship/Training	No. of Theory Hours (Total 15 Hours = 01 Credit)	No. of Skill Hours (Total 60 Hours = 02 Credit)
I	Sterilisation	Blood Test	6 months	15	30 X 2
II	Colorimeters	Urine Test			
III	Haematology	Blood Culture			
IV	Coagulation techniques	Cell Counting			
V	Examples of body fluids	Culture media preparation			
VI	Buffer preparations	Handling different instruments-microscope			

Suggested Readings:-
 1. Author's Name, Initials, "Book Title", Publisher name, City/country of publication, Year of publication. Edition No. if any .Short text book for med.laboratory techniques author Satish Gupte

- Course Pre-requisites:-**
- No pre-requisite required, Open to All.
 - To study this course, a student must have the subject Chemistry and Biology in class 12th /certificate.
 - If progressive, to study this course a student must have passed previous courses of this series.

Note:

- Number of units in Theory/Practical may vary as per need.
- Total Credits per Semester = 03(It can be more, but students will get only 03 credits/ semester or 06 credits/year
- Credits for Internship/OJT/Training/Practical = 02 (Training Hours = 60)

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Title of Course: DESCRIPTIVE STATISTICS USING EXCEL & 'R'

Nodal Department of HEI to Run Course:-

Broad Area/Sector:- DATA ANALYSIS

Sub-sector:-

Nature of Course:- Independent

Name of Suggestive Skill Council:

Aliened NSQF Level:

Expected Fees of the Corse: -

Stipend to Student Expected from Industry:-

Number of Seats:-

Course Code:-

Maximum Marks: - 100 **Minimum Marks:- 35** **Credits:- 03 (01 Theory, 02 Practical)**

Name of Proposed Skill Partner (Please specify, Name of Industry, Company etc. for Practical / Training/Internship/OJT):-

Job Prospects-Expected Fields of Occupation where student will be able to get job after completing this course (Please specify, Name of Industry, Company etc. for Practical/Training/Internship/OJT):-

Syllabus

Unit	Topics	General/Skill Component	Theory/ Practical/ OJT/ Internship/ Training	No. of Theory Hours (Total 15 Hours = 01 Credit)	No. of Skill Hours (Total 60 Hours = 02 Credit)
I	Introduction to 'R' & MS-Excel.	Familiarity with Software	Theory/Practical	02	05
II	Types of Data and Frequency Distribution	Data Handling	Theory/Practical	02	10
III	Graphical Representation of Data	Data Representation	Theory/Practical	03	15
IV	Measures of Central Tendency and Dispersion	Computational /Analytical Ability	Theory/Practical	05	15
V	Simple Correlation and Rank Correlation	Computational /Analytical Ability	Theory/Practical	03	15

Suggested Readings:-

1. Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
2. Crawley, M.J. (2017). The R Book, John Wiley & Sons.
3. Eckhouse, R.H. and Morris, L.R. (1975). Minicomputer Systems Organization, Programming and Applications, Prentice-Hall.
4. Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc.

Suggested Digital Platforms/Web Links for Readings:-

- <http://heecontent.upsdc.gov.in/SearchContent.aspx>
- <https://swayam.gov.in/explorer?searchText=statistics>
- <https://nptel.ac.in/course.html> <https://www.edx.org/search?q=statistics>
- <https://www.coursera.org/search?query=statistics&>

Note:

- Number of units in Theory/Practical may vary as per need.
- Total Credits per Semester = 03 (It can be more, but students will get only 03 credits/ semester or 06 credits/year)
- Credits for Internship/OJT/Training/Practical = 02 (Training Hours = 60)

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DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

LIST OF VOCATIONAL COURSES

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NAME OF VOCATIONAL COURSES

- 1- R.P English
- 2- Learning and Earning with R.P
- 3- Skill of Speaking
- 4- Speaking with Fun
- 5- A course in installation maintenance
and repair of Electrical and Electronic
Products.(For Second , third Semester or forth Semester)
- 6- Medical lab technology
- 7- Digital Marketing learning with earning
- 8- चुनाव विश्लेषक
- 9- दूर गाइड
- 10- Air Quality Management (Pollution)
- 11- Basic Computer in computer Application
- 12- Skill development in Sociology
- 13- Heritage Conservation (VOHC)
- 14- Circular Economy & Resource Management
- 15- Ecotourism & Hospitality (VOEH)
- 16- Library Science(VOLS)
- 17- Diary Technology (VODT)
- 18- Yoga Science (VOYS.)
- 19- Community Science(VOCS)
- 20- Multimedia and Animation (VOMA)

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LIST OF VOCATIONAL COURSES

21. Agribusiness Management(VOA BM)
22. Computer Office Management(VOCOM)
- 23- Analytical Instrument (VOAI)
- 24- Agri Food Processing(VOAFP)
- 25- Public Health Engineering (VOPHE)
- 26- Green House Technology (VOGHT)
- 27- Plant Nursery Management(VOPNM)
- 28- Organic farming & Products (VOOFP)
- 29- Nutrition & Health Care Science(VONHCS).
- 30- Export & Import Management
- 31- Public Relation Officer
- 32- Technology Advancement Bootcamp
- 33- Integrated Food Processing Course
- 34- Food Processing
- 35- Vermicompost Technology
- 36- Proficiency in Spoken English Programme
- 37- Basic Computer Skill
- 38- Chemistry of Volatile distillates used as fragrances for increase and hawan samagri.
- 39- Certificate Course in Tally/ Accounting
- 40- Certificate Course in Computer Basic
- 41- Digital Marketing
- 42- HR Analytics

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LIST OF VOCATIONAL COURSES

- | | |
|-----|---|
| 43- | Goods & Service Tax |
| 44- | E-Commerce |
| 45- | संगीत गायन प्रवेशिका |
| 46- | संगीत वादन (तबला) |
| 47- | संगीत नृत्य प्रवेशिका |
| 48- | संगीत वादन (कौशियो) |
| 49- | Certificate Course of Cutting and Scanning |
| 50- | Diploma in Data Entry & Office Automation |
| 51- | Diploma in Financial Accounting & Tally |
| 52- | Certificate in apiculture |
| 53- | Certificate in Pasciculture |
| 54- | Certificate in sericulture |
| 55- | Certificate courses on electrical appliances Maintenance and Designing of basic lab equipments. |
| 56- | Detection of Adulterants in common food. |
| 57- | Diploma in Industrial Pollution and waste water. |
| 58- | Electronics Technician |
| 59- | Animal Laboratory |
| 60- | Banking and Finance |
| 61- | Skilled Beekeeper |
| 62- | Pearl culture Technician |
| 63- | रेडियो के लिए लेखन एवं प्रस्तुतीकरण |
| 64- | कंप्यूटर. हिंदी भाषिक प्रयोजन एवं इंटरनेट के लिए सृजनात्मक लेखन |
| 65- | हिंदी साहित्य के समकालीन विमर्श एवं सृजनात्मक लेखन (महिलाओं के लिए सृजनात्मक लेखन) |

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LIST OF VOCATIONAL COURSES

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|-----|---|
| 66- | Tourism and heritage management |
| 67- | Music-Literature ,Arts ,Science |
| 68- | Sustainable Agriculture and Organic Farming |
| 69- | Laboratory water Quality attendant |
| 70- | Computational Physics |
| 71- | Radiation Physics:- Applications and Safety |
| 72- | Basic Instrumentation Physics |
| 73- | Health and Fitness Trainer |
| 74- | Creative Painting |
| 75- | Creative Photography |
| 76- | Designing Art and Craft |
| 77- | Fabric Painting |
| 78- | Flower Painting |
| 79- | Landscape Painting |
| 80- | Mural Art |
| 81- | Portrait Painting |
| 82- | Wall Painting |
| 83- | Wall Painting and Mural Art |
| 84- | Mushroom Cultivation |
| 85- | लेक-वार्ता और संस्कृति(डॉ शोफाली चतुर्वेदी एवं डॉ मधु श्रीवास्तव) |
| 86- | पटकथा लेखन |
| 87- | Comprehensive Programme on Stock Market |
| 88- | Fundamentals of Insurance |

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LIST OF VOCATIONAL COURSES

- 89- Fundamentals of Digital Marketing
- 90- Certificate Course on GST
- 91- Retail Management
- 92- Introduction of hospitality and Tourism Industry
- 93- Floriculture & Landscaping, Planning, Designing and Operation Management
- 94- Certificate Course in Mushroom Spawn Production and Cultivation
- 95- Modern Techniques For Plant propagation
- 96- Integrated Plant Protection
- 97- Certificate Course on Cultivation & Utilization of Medicinal & Aromatic Plants
- 98- Landscaping ,Planning, Designing and Operation Management
- 99- Plant Health Management
- 100- Pathology Techniques
- 101- Laboratory Skills& Standardization Methods
- 102- Basic of Laboratory Control
- 103- Fragrance & Flavor Development
- 104- Skills on Chemical Waste Management
- 105- Skills for Recovery and Reuse of Metals From Industrial Waste
- 106- Recovery and Reuse of Metals From Industrial Waste
- 107- Recovery and Reuse of Metals From Industrial Waste
- 108- Business English Communication
- 109- Descriptive Statistics Using Excel& R

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LIST OF VOCATIONAL COURSES

- 110- Accounts & Tally
- 111- Good & Service Tax (GST)
- 112- MS Office & Internet
- 113- Export Import Documentation
- 114- Guidance & Counseling
- 115- General Sericulture
- 116- MS Office & Networking
- 117- Certification in Organic Farming
- 118- Study of the Autism Skills of Agra
- 119- Teaching Skills Development Vocational Certificate Course
- 120- Basics of Electrician Trade
- 121- Basics of Electronics Mechanic Trade
- 122- Office Automation With Internet
- 123- Basic of computer and Information Technology
- 124- Fashion Technology-General Knowledge
- 125- Electronics Components and Devices
- 126- Industrial Safety
- 127- Self Employed Tailor
- 128- Yoga Instructor
- 129- Data Entry Operator
- 130- Plant Nursery Management
- 131- Village and Cottage Industries Skill and Entrepreneurship Development

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LIST OF VOCATIONAL COURSES

- 132- Yogic Science (PDS WFT 101)
- 133- Wellness Fitness Training (PDS WFT 201)
- 134- Medical Plants of local areas and their application
- 135- Techniques in biofertilizers production

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