

SCHEME

OF

STUDIES AND

EXAMINATIONS

B.TECH. BIO-TECHNOLOGY

2012-13 ONWARDS

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 1ST YEAR (SEMESTER – I) (Common for all branches)
Credit Based Scheme w.e.f. 2012-13

| S. No. | Course No. | Course Title | Teach-ing Schedule | | | Marks of Class work | Examination Marks | | Total | Credit | Durati on of Exam | |
|--------------|------------|--|--------------------|-----------|----------|---------------------|-------------------|------------|------------|------------|-------------------|--|
| | | | L | T | P | | Theor y | Practi cal | | | | |
| 1 | HUM 101B | COMMUNICATIVE ENGLISH | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 | |
| 2 | MATH 101B | MATHEMATICS-I | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 | |
| 3 | PHY 101B | ENGINEERING PHYSICS-I | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 | |
| 4 | ME101B | MANUFACTURING PROCESSES (Gr-A) | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 | |
| | CH101 B | OR ENGINEERING CHEMISTRY (Gr-B) | 3 | 1 | | 25 | 75 | - | | | | |
| 5 | EE101B | PRINCIPLES OF ELECTRICAL ENGINEERING (Gr-A) | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 | |
| | CSE101B | OR INTRODUCTION TO COMPUTERS & PROGRAMMING (Gr-B) | 3 | 1 | | 25 | 75 | - | | | | |
| 6 | ME103B | ENGINEERING GRAPHICS & DRAWING (Gr-A) | 1 | - | 4 | 40 | - | 60 | 100 | 3 | 3 | |
| | ME105B | OR ELEMENTS OF MECHANICAL ENGINEERING (Gr-B) | 3 | 1 | - | 25 | 75 | - | 100 | 4 | | |
| 7 | PHY103B | PHYSICS LAB-I | - | - | 2 | 20 | | 30 | 50 | 1 | 3 | |
| 8 | ME 107B | WORKSHOP PRACTICE (Gr-A) | - | - | 4 | 40 | | 60 | 100 | 2 | 3 | |
| | CH103B | OR CHEMISTRY LAB (Gr-B) | - | - | 2 | 20 | | 30 | 50 | 1 | | |
| 9 | EE103B | PRINCIPLES OF ELECTRICAL ENGINEERING LAB (Gr-A) | - | - | 2 | 20 | | 30 | 50 | 1 | 3 | |
| | CSE103B | OR COMPUTER PROGRAMMING LAB (Gr-B) | - | - | 2 | 20 | | 30 | 50 | 1 | | |
| 10 | ME109B | ELEMENTS OF MECHANICAL ENGINEERING LAB (Gr-B) | - | - | 2 | 20 | | 30 | 50 | 1 | 3 | |
| Total | | | Gr-A | 16 | 5 | 12 | 245 | 375 | 180 | 800 | 27 | |
| | | | Gr-B | 19 | 6 | 8 | 230 | 450 | 120 | 800 | 28 | |

Note:

- 1 Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of sports is given in General Proficiency & Ethics Syllabus.
- 2 The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
- 3 Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 1ST YEAR (SEMESTER-II) (Common for all branches)
Credit Based Scheme w.e.f. 2012-13

| S. No. | Course No. | Course Title | Teaching Schedule | | | Marks of Class work | Examination Marks | | Total | Credit | Duration of Exam |
|--------|------------|---|-------------------|---|---|---------------------|-------------------|-----------|-------|--------|------------------|
| | | | L | T | P | | Theory | Practical | | | |
| 1. | MATH102B | MATHEMATICS-II | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 |
| 2 | PHY102B | ENGINEERING PHYSICS-II | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 |
| 3 | ME101 B | MANUFACTURING PROCESSES (Gr-B) | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 |
| | CH101 B | ENGINEERING CHEMISTRY (Gr-A) | 3 | 1 | | 25 | 75 | - | | | |
| 4 | EE101B | PRINCIPLES OF ELECTRICAL ENGINEERING (Gr-B) | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 |
| | CSE101B | INTRODUCTION TO COMPUTERS & PROGRAMMING (Gr-A) | 3 | 1 | | 25 | 75 | - | | | |
| 5 | ECE102B | BASICS OF ELECTRONICS ENGINEERING | 3 | 1 | | 25 | 75 | - | 100 | 4 | 3 |
| | BT102B | BASICS OF BIO TECHNOLOGY | | | | | | | | | |
| | HUM102 B | ORAL COMMUNICATION SKILLS | | | | | | | | | |
| | CE102 B | BASICS OF CIVIL ENGINEERING | | | | | | | | | |
| 6 | ME103B | ENGINEERING GRAPHICS & DRAWING (Gr-B) | 1 | - | 4 | 40 | - | 60 | 100 | 3 | 3 |
| | ME105B | ELEMENTS OF MECHANICAL ENGINEERING (Gr-A) | 3 | 1 | - | 25 | 75 | - | 100 | 4 | |
| 7 | PHY104B | PHYSICS LAB-II | - | - | 2 | 20 | | 30 | 50 | 1 | 3 |
| 8 | ME 107B | WORKSHOP PRACTICE (Gr-B) | - | - | 4 | 40 | | 60 | 100 | 2 | 3 |
| | CH103B | CHEMISTRY LAB (Gr-A) | - | - | 2 | 20 | | 30 | 50 | 1 | |
| 9 | EE103B | PRINCIPLES OF ELECTRICAL ENGINEERING LAB (Gr-B) | - | - | 2 | 20 | | 30 | 50 | 1 | 3 |
| | CSE103B | COMPUTER PROGRAMMING LAB (Gr-A) | - | - | 2 | 20 | | 30 | 50 | | |
| 10 | ME109B | ELEMENTS OF MECHANICAL ENGINEERING LAB (Gr-A) | - | - | 2 | 20 | | 30 | 50 | 1 | 3 |

| | | | | | | | | | | | |
|--------------|---------|------------------------------|-------------|-----------|----------|-----------|------------|------------|------------|------------|-----------|
| 11 | GP 102B | GENERAL PROFICIENCY & ETHICS | 1 | - | - | - | - | 50 | 50 | 2 | 3 |
| Total | | | Gr-B | 17 | 5 | 12 | 245 | 375 | 230 | 850 | 29 |
| | | | Gr-A | 19 | 6 | 8 | 230 | 450 | 170 | 850 | 30 |

Note:

- Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency Syllabus.
- Each student has to undergo a workshop of at least 4 weeks (80-100 hours) at the end of II semester during summer vacations. **Out of four weeks, two weeks would be dedicated to general skills and two weeks training for specialized discipline/ department.** The evaluation of this training shall be carried out in the III semester.
- The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
- Electronic gadgets including cellular phones are not allowed in the examination.
- Elective course HUM102B (oral Communication Skills) is deleted w.e.f. the session 2013-14.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY (MURTHAL) SONEPAT
SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 2nd YEAR (SEMESTER – III) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2012-2013

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Examination Marks | | Total Marks | Credits | Duration of Exam In hours |
|---------------|-----------------------------|-------------------|----------|-----------|-----------|---------------------|-------------------|------------|-------------|-----------|---------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| BT201B | CELL BIOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT203B | MICROBIOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT205B | BIOCHEMISTRY-I | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT207B | GENETICS | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT209B | ORGANIC CHEMISTRY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT211B | CELL BIOLOGY & GENETICS LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT213B | MICROBIOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT215B | BIOCHEMISTRY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT217B | ORGANIC CHEMISTRY LAB | - | - | 2 | 2 | 20 | - | 30 | 50 | 1 | 3 |
| BT219B | WORKSHOP | - | - | 2 | 2 | 50 | - | - | 50 | 2 | 3 |
| TOTAL | | 15 | 5 | 16 | 36 | 255 | 375 | 120 | 750 | 29 | |

NOTE:

- Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of sports is given in General Proficiency syllabus.
- Assessment of Workshop, undergone in summer vacations at the end of IInd semester, will be based on seminar, viva-voce, report and certificate of the inhouse workshop obtained by the student from the department.
- The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of

calculator is prohibited in the examination.

4. Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2012-13

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Exam. Schedule | | Total Marks | Credits | Duration of Exam. In hours |
|--------------|--|-------------------|----------|-----------|-----------|---------------------|----------------|------------|-------------|-----------|----------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| GES201B | ENVIRONMENTAL STUDIES (Common for all branches) (Gr-A) | 3 | - | - | 3 | - | 75 | - | 75 | - | 3 |
| BT202B | MOLECULAR BIOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT204B | IMMUNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT206B | BIO-ANALYTICAL TECHNIQUES | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT208B | INDUSTRIAL MICROBIOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT210B | BIOCHEMISTRY-II | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT212B | MOLECULAR BIOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 4 |
| BT214B | IMMUNOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT216B | BIO-ANALYTICAL TECHNIQUES LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT218B | INDUSTRIAL MICROBIOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 4 |
| GES203B | ENVIRONMENTAL STUDIES FIELD WORK (Common for all branches) (Gr-A) | - | - | - | - | - | - | 25 | 25 | - | - |
| GPBT202B | GENERAL PROFICIENCY & ETHICS | 1 | - | - | - | - | - | 75 | 75 | 2 | 3 |
| TOTAL | | 19 | 5 | 16 | 40 | 205 | 450 | 220 | 875 | 30 | |

NOTE:

1. Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency syllabus.
2. The Environmental studies (GES201B) and Environment Studies Field work (GES203B) are compulsory & qualifying courses only.
3. Each student has to undergo Professional Training of at least 4 weeks from the industry, institute, research lab, training center etc. during summer vacation and its evaluation shall be carried out in the V Semester.
4. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
5. Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B. TECH. 3rd YEAR (SEMESTER - V) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2012-2013

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Exam. Schedule | | Total Marks | Credits | Duration of Exam. In hours |
|--------------|-------------------------------|-------------------|----------|-----------|-----------|---------------------|----------------|-----------|-------------|-----------|----------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| BT301B | RECOMBINANT DNA TECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT303B | BIOREACTOR ANALYSIS & DESIGN | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT305B | BIOPROCESS ENGG. | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT307B | DOWNSTREAM PROCESSING | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT309B | DIAGNOSTIC TECHNIQUES | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT311B | BIOSTATISTICS | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT313B | RECOMBINANT DNA TECH. LAB. | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT315B | FEREMENTATION TECHNOLOGY LAB. | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT317B | DIAGNOSTIC TECHNIQUES LAB. | - | - | 2 | 2 | 20 | - | 30 | 50 | 1 | 3 |
| BT319B | PROFESSIONAL TRAINING -I | - | - | 2 | 2 | 50 | - | - | 50 | 2 | 3 |
| TOTAL | | 18 | 6 | 12 | 36 | 260 | 450 | 90 | 800 | 31 | |

NOTE:

1. Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of sports is given in General Proficiency syllabus.

2. Assessment of Professional Training-I, undergone at the end of IV Semester, will be based on seminar, viva-voce, report and certificate of the Professional Training obtained by the student from the industry, institute, research lab, training center etc.
3. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
4. Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 3rd YEAR (SEMESTER – VI) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2012-13

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Exam. Schedule | | Total Marks | Credits | Duration of Exam. In hours |
|------------|--|-------------------|---|---|-------|---------------------|----------------|-----------|-------------|---------|----------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| BT302B | PLANT BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT304B | ANIMAL BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT306B | ENZYME BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT308B | ENVIRONMENTAL BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT310B | FOOD BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT312B | CELL & TISSUE CULTURE LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT314B | ENZYME & FOOD BIOTECHNOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| BT316B | ENVIRONMENTAL BIOTECHNOLOGY LAB | - | - | 4 | 4 | 20 | - | 30 | 50 | 2 | 3 |
| HUM302B | REPORT WRITING SKILLS (Common for all branches) | 1 | - | - | 1 | 25 | 50 | - | 75 | 1 | 2 |
| HUM304B | ORAL PRESENTATION SKILLS (Common for all branches) | - | - | 2 | 2 | 20 | - | 30 | 50 | 1 | 2 |
| GPBT302B | GENERAL PROFICIENCY & ETHICS | 1 | - | - | - | - | - | 75 | 75 | 2 | 3 |

| | | | | | | | | | | |
|--------------|-----------|----------|-----------|-----------|------------|------------|------------|------------|-----------|--|
| TOTAL | 17 | 5 | 14 | 36 | 230 | 425 | 195 | 850 | 30 | |
|--------------|-----------|----------|-----------|-----------|------------|------------|------------|------------|-----------|--|

NOTE:

1. Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency syllabus.
2. Each student has to undergo Professional Training of at least 4 weeks from the industry, institute, research lab, training center etc. during summer vacation and its evaluation shall be carried out in the VII Semester.
3. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
4. Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 4th YEAR (SEMESTER – VII) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2011-12

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Exam. Schedule | | Total Marks | Credits | Duration of Exam. In hours |
|---------------|----------------------------------|-------------------|----------|-----------|-----------|---------------------|----------------|-----------|-------------|-----------|----------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| BT401B | BIOINFORMATICS | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT403B | DRUG AND VACCINE DEVELOPMENT | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT405B | BIOSENSORS | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT407B | MICROBIAL BIOTECHNOLOGY | 3 | 1 | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| OPEN ELECTIVE | | 4 | - | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT409B | BIOINOFRMATICS LAB | - | - | 2 | 2 | 20 | - | 30 | 50 | 1 | 3 |
| BT411B | DRUG AND VACCINE DEVELOPMENT LAB | - | - | 2 | 2 | 20 | - | 30 | 50 | 1 | 3 |
| BT413B | PROJECT | - | - | 4 | 4 | 100 | - | | 100 | 4 | - |
| BT415B | PROFESSIONAL TRAINING - II | - | - | 2 | 2 | 50 | - | | 50 | 2 | - |
| TOTAL | | 16 | 4 | 10 | 30 | 315 | 375 | 60 | 750 | 28 | |

List of Open Electives

| | | | | | |
|---|----------|-------------------------------|----|---------|-------------------------------|
| 1 | MEI 623B | ENTREPRENEURSHIP | 6 | BT401B | BIOINFORMATICS |
| 2 | BME451B | MEDICAL INSTRUMENTATION | 7 | AE417B | MODERN VEHICLE TECHNOLOGY |
| 3 | ECE305B | CONSUMER ELECTRONICS | 8 | CE451B | POLLUTION & CONTROL |
| 4 | EE451B | ENERGY AUDIT | 9 | CSE411B | MANAGEMENT INFORMATION SYSTEM |
| 5 | EEE457B | ENERGY RESOURCES & TECHNOLOGY | 10 | IT 413B | CYBER SECURITY |

NOTE:

1. Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of sports is given in General Proficiency syllabus.

- Students will be permitted to opt for any one elective run by the other department. However, the department shall offer those elective for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. The minimum strength of the students should be 20 to run an elective course.
- Assessment of Professional Training – II, undergone at the end of VI semester, will be based on seminar, viva voce, report and certificate of Professional Training obtained by the students from the industry, institute, research lab, training center etc.
- Project will commence in 7th semester where the students will identify the project problem, complete design, procure the material, start the fabrication, complete the survey etc. depending upon the nature of problem. Project will continue in next semester.
- The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
- Electronic gadgets including cellular phones are not allowed in the examination.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL
SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 4th YEAR (SEMESTER – VIII) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2011-12

| Course No. | Course Title | Teaching Schedule | | | | Marks of Class Work | Exam. Schedule | | Total Marks | Credits | Duration of Exam. In hours |
|--------------|------------------------------------|-------------------|---|-----------|-----------|---------------------|----------------|------------|-------------|-----------|----------------------------|
| | | L | T | P | Total | | Theory | Practical | | | |
| BT402B | DNA MICROARRAY TECHNOLOGY | 4 | - | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT404B | STEM CELL TECHNOLOGY | 4 | - | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| | DEPT ELECTIVE –I | 4 | - | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| | DEPT ELECTIVE –II | 4 | - | - | 4 | 25 | 75 | - | 100 | 4 | 3 |
| BT414B | SEMINAR | - | - | 2 | 2 | 50 | - | - | 50 | 2 | 3 |
| BT415B | PROJECT | - | - | 8 | 8 | 75 | - | 125 | 200 | 8 | 3 |
| GFBT402B | GENERAL FITNESS FOR THE PROFESSION | 1 | - | - | - | - | - | 100 | 100 | 4 | 3 |
| TOTAL | | 17 | | 10 | 27 | 225 | 300 | 225 | 750 | 30 | |

DEPT. ELECTIVE-I

DEPT. ELECTIVE-II

| | | | |
|--------|--|--------|----------------------------------|
| BT452B | BIOPHARMACEUTICAL TECHNOLOGY | BT464B | BIOCATALYSTS & TRANSFORMATION |
| BT454B | HUMAN GENOME | BT466B | PROTEIN ENGINEERING |
| BT456B | VIROLOGY | BT468B | UNIT OPERATIONS IN BIOTECHNOLOGY |
| BT458B | BIOETHICS & INTELLECTUAL PROPERTY RIGHTS | BT462B | BIOFERTILIZERS & BIOPESTICIDES |

NOTE:

- Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Fitness for the Profession syllabus.
- Project involving design, fabrication, testing, computer simulation, case studies etc., which had been commenced by

students in VII semester will be completed in the VIII semester.

3. For the course BT414B -Semianr, a student will select a topic from emerging areas of Biotechnology and study it independently. Student will give a seminar talk on the topic.
4. The evaluation of the student for his/her General Fitness for the Profession shall be carried out by a team consisting of Dean of faculty, Chairperson of the department and external examiner appointed by the University.
5. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
6. Electronic gadgets including cellular phones are not allowed in the examination.

SYLLABUS

HUM 101B COMMUNICATIVE ENGLISH
B. TECH. SEMESTER - I (Common for all Branches)

| | | | | | | |
|----------|----------|-----------|----------------|--------------------------------|----------|------------------|
| L | T | P | Credits | Class Work | : | 25 Marks |
| 3 | 1 | -- | 4 | Examination | : | 75 Marks |
| | | | | Total | : | 100 Marks |
| | | | | Duration of Examination | : | 3 Hours |

Objective

The course aims at developing the desired language (English) skills of students of engineering and technology so that they become proficient in communication to excel in their professional lives. The course has been designed so as to enhance their linguistic and communicative competence.

Course Content

UNIT I

Communicative Grammar:

- A) Spotting the errors pertaining to tenses, conditional sentences, Concord – grammatical concord, notional concord and the principle of proximity b/w subject and verb
- B) Voice, Reported Speech.

UNIT II

Language through Literature:

Linguistic Reading of the following texts

- A) 'Kabuliwallah' by Rabindranath Tagore*
- B) 'Am I Blue?' by Alice Walker*
- C) 'If You are Wrong, Admit It' by Dale Carnegie*
- D) 'Engine Trouble' by R.K. Narayan*

The prescribed texts will be used as case studies for various components of the syllabus. * the Source is given in the list of Texts Books given below.

UNIT III

Group Communication:

- A) Communication: concept, Process and Barriers
- B) Communicating using Standard Pronunciation with the help of IPA
- C) Formal Speaking with peers (e.g. discussion, talks on current issues in a class)
- D) Writing official letters on issues concerning students and social life
- E) Writing small reports on scientific issues, IT issues, University fests/programmes
- F) E-mail writing and writing for web

UNIT IV

Communicative Creativity:

- A) Comprehension: Extracting, interpreting, summarizing, reviewing and analyzing the prescribed texts.
- B) Composition: Developing themes and situations through role play activities or dialogue writing. Contd.

TEXT BOOKS

1. Quirk, Randolph, Sidney Greenbaum, Geoffrey Leech & Jan Svartvik. *A Comprehensive Grammar of the English Language*. London: Longman, 1989
2. Communicative English for Engineers and Professionals by Nitin Bhatnagar & Mamta Bhatnagar New Delhi: Pearson / Longman
3. Crystal, David. *Rediscover Grammar*. London: Longman/Pearson, 1988.
4. *Tagore, Rabinder. "Kabuliwallah", *Famous Indian Stories*. Ed. M.G.Narsimha Murthy .Mumbai: Orient Blackswan, 2009. (Web source: www.angelfire.com)
5. * Walker, Alice. "Am I Blue", *An Anthology of Short Stories* . Ed. Usha Bande .New Delhi: OUP , 2004. (Web source- www.old.li.scr.u.edu)
6. *Narayanan .K.R. "Engine Trouble", *Contemporary English Prose* .Ed. K.P.K.Menon. New York: OUP,1976. (Web Source- www.scribd.com)
7. *Carnegie, Dale. "If you are wrong admit it", *An Anthology of Modern Prose*. Ed Manmohan K.Bhatnagar.Delhi :Macmillan India Ltd,2006.

SUGGESTED READING

1. Pink, M.A. and S.E. Thomas. *English Grammar, Composition and Correspondence*. Delhi: S. Chand and Sons
2. McRae, John and Roy Boardman. *Reading Between the Lines*. Delh: Foundation Books (Cambridge University Press)
3. Sharma, Sangeeta and Binod Mishra. *Communication Skills for Engineers and scientists*. Delhi: PHI, 2009
4. Fitikides, T.J. *Common Mistakes in English*. Essex: Pearson Education, 1936, 6th edition 2000.

SCHEME OF END SEMESTER EXAMINATION (MAJOR TEST)

Theory

1. The duration of the exam will be 3 hours.
2. The Question Paper for this theory course shall have seven questions in all covering all the units of the syllabus..
3. The student is required to attempt all the seven questions.
4. Questions No. 1 based on Unit I is of **15** marks. It may be in the form of 'Do as directed: trace the error, choose the correct alternative, supply the correct alternative/ s, change the voice, convert the speech from direct to indirect or vice-versa'.
5. Question no 2 and 3 based on prescribed texts in Unit II. Question no 2 of **10** marks is to evaluate the comprehension of the text through short answer questions or a long answer question to assess the students' reading comprehension, interpretative and analytical abilities. Question no 3 of **15** marks will judge the linguistic aspect of the text such as using a particular word in its various syntactic forms like noun, adjective, verb etc.; matching the lists of words and their explanation; providing opposite/ similar meanings and other grammar components prescribed in Unit I of the syllabus.
6. Question no 4 based on Unit III is of **10** marks. It may be in the form of transcription of words given, describe an event, classmate, discuss an issue etc.
7. Question no 5 based on Unit III is of **10** marks. It requires the student to frame either a small report on a topic given or write the given official letter, or e-mail a message.

8. Question no 6 based on unit IV is of **10** marks. It evaluates the Comprehension and Interpretation of the texts prescribed in Unit II. The vocabulary, general understanding and interpretation of the content may be evaluated in the form of question answer exercise, culling out important points, suggesting a suitable topic/title, summarising and interpreting.
9. Question No. 7 based on unit IV is of **5** marks. It requires the student to develop a hypothetical situation in a dialogue form, or to develop an outline, key expression, for role play activity.

MATH 101B MATHEMATICS - I

B. TECH. SEMESTER - I (Common for all Branches)

| | | | | | | |
|----------|----------|-----------|----------------|--|--------------------------------|--------------------|
| L | T | P | Credits | | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | | Examination | : 75 Marks |
| | | | | | Total | : 100 Marks |
| | | | | | Duration of Examination | : 3 Hours |

UNIT-I

Infinite series : Convergence and divergence, Comparison, D' Alembert's ratio, Integral, Raabe's, Logarithmic and Cauchy root tests, Alternating series, Absolute and conditional convergence.

Applications of Differentiation: Taylor's and Maclaurin's series, Asymptotes, Curvature Asymptotes.

UNIT-II

Partial Differentiation & its Applications: Functions of two or more variables; partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions, Jacobians, Higher order partial derivatives.

Homogeneous functions, Euler's theorem, Taylor's series for functions of two variables (without proof), maxima-minima of function of two variables, Lagrange's method of undetermined multipliers, Differentiation under integral sign.

UNIT-III

Applications of Single & Multiple Integration: Applications of single integration to find volume of solids and surface area of solids of revolution. Double integral, change of order of integration, Double integral in polar coordinates, Applications of double integral to find area enclosed by plane curves and volume of solids of revolution.

Triple integral, volume of solids, change of variables, Beta and gamma functions and relationship between them.

UNIT-IV

Vector Calculus: Differentiation of vectors, scalar and vector point functions Gradient of a scalar field and directional derivative, divergence and curl of a vector field and their physical interpretations.

Integration of vectors, line integral, surface integral, volume integral, Green, Stoke's and Gauss theorems (without proof) and their simple applications.

TEXT BOOKS :

1. Advanced Engineering Mathematics: F. Kreyszig.

2. Higher Engineering Mathematics: B.S. Grewal.

REFERENCE BOOKS:

1. Engineering Mathematics Part-I: S.S. Sastry.
2. Differential and Integral Calculus: Piskunov.
3. Advanced Engineering Mathematics: R.K. Jain and S.R.K.Iyengar
4. Advanced Engg. Mathematics: Michael D. Greenberg

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

PHY 101B ENGINEERING PHYSICS - I
B. TECH. SEMESTER - I (Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

PHYSICAL OPTICS:

Interference: Division of wave front-Fresnel's Biprism, Division of amplitude – Newton's rings, Michelson interferometer, applications.

Diffraction : Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, Plane transmission diffraction grating and its spectra, dispersive and resolving powers.

Polarization : Polarised and unpolarized light, double refraction, Nicol prism, quarter and half wave plates, Plane, Elliptically & circularly polarised light, Polarimetry: Biquartz and Laurent's half-shade polarimeters.

UNIT-II

LASER & FIBRE OPTICS: Introduction, Spontaneous and stimulated emissions, Laser action, characteristics of laser beam, Ruby laser, He-Ne, Nd-Yag and semiconductor lasers, applications of laser.

Introduction, Propagation of light in fibres, Types of fiber (pulse & continuous), numerical aperture, Modes of propagation in optical fibre, application of optical fibre.

ACOUSTIC OF BUILDINGS: Introduction, Reverberation, Sabine's formula for reverberation time, Absorption coefficient and its measurements, factors affecting the architectural acoustics and their remedy, Sound absorbing materials.

UNIT-III

TRANSMISSION OF HEAT AND THERMAL RADIATION

Modes of transmission of heat, Thermal conductivity, Rectilinear flow of heat through a rod, Radial flow of heat through a spherical shell, determination of Thermal conductivity of good and bad conductors.

Black body, Emissive and Absorptive Powers, Wein's Displacement Law, Kirchhoff's Law, Stefan's Law, Determination of Stefan's Constant.

UNIT-IV

NUCLEAR & ELEMENTARY IDEA OF PARTICLE PHYSICS

Outline of interaction of charged particles and of Gamma-rays with matter. Counters: Gas filled counters (Ionization Chamber, Proportional Counter and G M Counter). Detector: Scintillation detector, Semiconductor detectors (p-n junction detector), Biological effects of nuclear radiation.

Introduction to elementary particles, Interaction in particle physics: strong, electromagnetic, weak and gravitational. .

TEXT BOOKS :

1. A text book of Optics – Brij Lal and Subramanyam
2. Perspectives of Modern Physics - Arthur Beiser (TMH)
3. Modern Engineering Physics – A.S. Vasudeva (S. Chand)
4. Engineering Physics by R.K. Gaur and S.L. Gupta
5. Engineering Physics by H.K Malik and A.K. Singh (Tata McGraw Hill).
7. Engineering Physics by S.P. Taneja (Chand Pub.)

REFERENCE BOOKS:

- 1.. Physics Vol-I & II – Resnick & Halliday (Wiley Eastern)
2. Heat and Thermodynamics – M.N. Saha & B.N. Srivastava
3. Nuclear Physics Principles and Applications by John Lilley(Wiley-India).

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

ME 101B MANUFACTURING PROCESSES

B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

Introduction: Introduction to Manufacturing Processes and their Classification , automation in manufacturing, Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accidents, Methods of Safety, Electric Safety Measures, First Aid.
Plant Layout, Principles of Plant Layout, Objectives of Layout, Types of Plant and shop layouts and their Advantages.

UNIT-II

Engineering Materials: General Properties and Applications of Engineering Materials, Mild Steel, Medium Carbon Steel, High Carbon Steel, High Speed Steel and Cast Iron, Non-Ferrous Materials, Shop's Tools Materials, Super Alloys or High Temperature Materials
Foundry: Introduction to Casting Processes, Basic Steps in Casting Process, Pattern, Types of Patterns, Pattern allowances, Risers, Runners, Gates, Molding Sand and its composition, Sand Preparation, Molding Methods, Core Sands and Core Making, Core Assembly, Mold Assembly, Melting (Cupola) and Pouring, Fettling, Casting Defects and Remedies. Testing of Castings

UNIT-III

Cold Working (Sheet Metal Work): Sheet Metal Operations, Measuring, Layout Marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining - Advantages and Limitations. Hot Working Processes: Introduction to Hot Working, Principles of Hot Working Processes, Forging, Rolling, Extrusion, Wire Drawing.

Introduction to Machine Tools: Specifications and Uses of commonly used Machine Tools in a Workshop such as Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Nomenclature of a Single Points Cutting Tool and Tool Wear, Mechanics of Chips Formation, Type of Chips, Use of Coolants in machining.

UNIT-IV

Welding: Introduction to Welding, Classification of Welding Processes, Gas Welding: Oxy-Acetylene Welding, Resistance Welding; Spot and Seam Welding, Arc Welding: Metal Arc, TIG & MIG Welding, Welding Defects and Remedies, Soldering & Brazing, Comparisons among Welding, Brazing and Soldering
Surface Finishing Processes, Introduction to Heat Treatment Processes, Estimating of Manufacturing Cost

Text Books:

1. Workshop Technology Vol. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
2. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
3. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill.

Reference Books:

1. Manufacturing Science - Amitabha Ghosh & Ashok Kumar Malik, - East-West Press.
2. Manufacturing Process and Systems - Ostwald, Munoz, John Wiley.
3. Workshop Technology, Vol. 1, 2 & 3 – Chapman, WAJ, Edward Arnold.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

CH 101B ENGINEERING CHEMISTRY**B. TECH. SEMESTER – I/II (Common for all Branches)**

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

Thermodynamics –Second law, concept of entropy ,entropy change for ideal gas, free energy and work functions, free energy change ,chemical potential, Gibb’s Helmholtz equation, Clausius –Clapeyron equation. Related numerical problems with above topics.

Phase-rule- Terminology, Derivation of Gibb’s Phase Rule equation ,One component system(water system), Two components systems, system with Eutectic point (Pb-Ag), system with congruent melting point (Zn-Mg), system with incongruent melting point (Na-K), Applications of above systems. Elementary idea of Zone refining and Zone levelling

UNIT-II

Water and its treatment- Hardness of water and its determination, units of hardness, alkalinity of water and its determination, related numerical problems ,water softening, Ion-exchange process, mixed bed demineralisation, desalination of water by using different methods.

Corrosion and its prevention: Galvanic & concentration cell, dry and wet corrosion, Electrochemical theory of corrosion, Galvanic corrosion, Pitting corrosion , differential aeration corrosion, water line corrosion, stress corrosion, factor effecting corrosion, Preventing measures, electroless Plating of Ni and Cu.

UNIT-III

Polymers and Polymerization: Organic polymers, polymerisation, various types of polymerisation, effect of structure on properties of polymers, preparation properties and technical applications of thermoplastics (PE, PVC, PVA, Teflon), thermosets (PF, UF & MF) and elastomers (Synthetic Rubber including SBR, Buna-S, Buna-N, Thiokol & Polyurethanes) , Inorganic polymers (general properties) , Glass transition temperature, silicones

Composite Materials & their application: optical fibres, Fullerenes ,organic electronic material ,composite materials & their classification, constituents of composites, role of interface in composite performance and durability, fiber –Reinforced composite, advantage and applications of composites.

UNIT-IV

Lubricants and fuels: Friction, mechanism of lubrication, classification and properties of lubricants and selection of Lubricants, Definition and classification of fuel, Calorific value and methods of its determination.

Analytical methods: Thermal methods; Principle, method and application of TGA,DTA & DSC, interaction of E.M radiation with a molecule and origin of spectrum, Vibrational & electronic spectra (Experimental details are excluded), spectrophotometry, , conductometric titrations, elementary discussion on Flame-photometry.

TEXT/ REFERENCE BOOKS:

1. Physical Chemistry, P.W. Atkins (ELBS, Oxford Press).

2. Physical Chemistry, W.J. Moore (Orient-Longman).
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD (East-West Press).
4. Chemistry in Engineering & Tech., Vol.I& II, Rajaram, Kuriacose (TMH)
5. Engineering Chemistry, ShashiChawla (DhanpatRai and co.)
6. Engineering Chemistry, P.C. Jain, Monica Jain (DhanpatRai & Co.).
7. Engineering chemistry, S.S Dara (S.chand&co.)

Note:

In the semester examination, the Examiners will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

**EE 101B PRINCIPLES OF ELECTRICAL ENGINEERING
B. TECH. SEMESTER – I/II (Common for all Branches)**

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-1

D.C. Circuit Analysis: Basic concepts of electric circuits, Ohm's Law, Independent energy sources, Dependent energy sources, passive elements, circuit properties, Kirchoff's laws, applications of Kirchoff's laws, Nodal and Loop methods of Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta or delta-star transformation, Applications of network theorems P-spice for DC circuit analysis.

UNIT-2

A.C. Circuits: Sinusoidal signal, Phasors, polar & rectangular, exponential & trigonometric representations, Resistance, Inductance & Capacitance components, behavior of these components in A.C. circuits, Phasor relationship for circuit elements, Impedance & Admittance, instantaneous & peak values, average and RMS values, active power, reactive power, apparent power, power factor, complex power, behavior of AC series, parallel circuits, RL, RC & RLC A.C. circuits (series and parallel), Resonance-series and parallel R-L-C Circuits, Q-factor, cut-off frequencies & bandwidth.

UNIT-3

Three Phase Circuits: Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by two wattmeter method.

Measuring Instruments: Principle, Construction & working of moving coil type voltmeter & ammeter, moving iron type voltmeter & ammeter, Electrodynamic type wattmeter, single-phase induction type energy meter.

UNIT-4

Transformers: Ampere's law, Mutual Inductance, Construction, Working principle and phasor diagrams of Single-phase Transformer, Emf equation, Equivalent circuit, testing, efficiency and regulation of single-phase transformer, Auto transformer.

Rotating Machines: Construction and working principle of dc motor and generator and its characteristics. Construction and working principle of 3-phase Induction machines & 3-phase synchronous machines, torque-speed characteristics.

TEXT BOOKS:

1. Basic Electrical Engg (2nd Edition) : Kothari & Nagarath, TMH
2. Electrical Technology (Vol-I): B.L Theraja & A K Theraja, S.Chand
3. Fundamental of electrical Engineering, Rajendra Prasad, PHI, Edition 2005.
4. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition

5. Basic Electrical Engineering, S.N. Singh, PHI

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals: Deltoro, PHI
2. Basic Electrical Engineering (TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
3. Basic Electrical Engineering, T.K. Nagsarkar & M.S. Sukhija, Oxford
4. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH
5. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.

Note: In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

CSE 101B INTRODUCTION TO COMPUTERS AND PROGRAMMING

B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

An introduction of Computer System: Anatomy of a digital Computer, Different Units of Computer System, Classification of Computer Systems, Radix Number systems. Binary codes: BCD, Gray, EBCDIC, ASCII

Operating System: Operating System Concepts, Operating System services, Types of Operating Systems.

Introduction to PC Operating Systems: Unix/Linux, DOS, Windows.

UNIT-II

Programming Languages and algorithms: Machine, Assembly and High Level Language; Assembler, Linker, Loader, Compiler, Interpreter, debuggers, Programming fundamentals: problem definition, algorithms, flowcharts and their symbols

Computer Networks: Basic concepts of Computer Networks, Working of Internet and its Major features. Network Topologies: Bus, Star, Ring, Hybrid, Tree, Complete, Irregular; Types of Networks: LAN, MAN and WAN.

Electronic Mail: advantages and disadvantages, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, Newsgroups, mailing lists, chat rooms.

UNIT-III

Basics of ‘C’ Language

C Fundamentals, Basic data types, local and external variables and scope, formatted input/ output, expressions, selection statements, loops and their applications; arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications, Structures, Unions and Enumerations.

UNIT-IV

Advanced Features of ‘C’ Language

preprocessor directives, macro definition, conditional compilation, storage classes, type’s qualifiers, Low level programming (Bitwise operators, Bit fields in structures, other low level techniques), error handling, file operations(low level/high level).

BOOKS

1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.
3. Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH

4. Theory and problem of programming with C, Byron C Gottfried, TMH
5. Using Computers and Information by Jack B. Rochester, 1996, Que Education & Training.
6. C Programming – A modern approach by K.N. King, 1996, WW Norton & Co.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

ME103B ENGINEERING GRAPHICS AND DRAWING
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 40 Marks |
| 1 | -- | 4 | 3 | Examination | : 60Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT I

Basics of Engineering Graphics and Drawing – Drawing Papers, Minidrafter, Pencils. Drawing Paper Layout, Title Block, Types of Lines, Lettering, Dimensioning, types of Projections; First and Third Angle systems of Orthographic Projections. Projection of Points in different Quadrants.

Projections of Straight Lines – Contained by both Reference Planes, Contained by one and inclined to other Reference Plane, Contained by one and Parallel to other Reference Plane, Parallel to both Reference Plane, Perpendicular to one of the Reference Planes, Inclined to one Plane but Parallel to the other Reference Planes, Inclined to both the Reference Planes, True Length of a Line and its Inclination with Reference Planes, Traces of a Line.

UNIT II

Projections of Planes – Parallel to one Reference Plane, Inclined to one Plane but Perpendicular to the other, Inclined to both Reference Planes.

Projections of Polyhedral Solids and Solids of Revolution- in simple positions with axis perpendicular to a Reference Plane, with axis parallel to both Reference Planes, with axis parallel to one Reference Plane and inclined to the other Reference Plane, Projections of sections of Prisms, Pyramids, Cylinders and Cones. True Shape of Sections of Solids.

UNIT III

Development - Development of Surfaces of various Solids objects.

Free Hand Sketching - Orthographic Views from Isometric, Views of Simple Machine Components such as Brackets, Bearing Blocks, Guiding Blocks and Simple Couplings and Pipe Joints.

UNIT IV

Isometric Projections - Introduction, Isometric Scale, Isometric Views and Drawing of various Plane and Solids objects. Perspective drawing and oblique view.

Orthographic Drawings - Screw Threads, Bolts, Nuts and Washers, Bolted, Riveted and Welded Joints

Text Books:

1. Engineering Drawing: MB Shah and BC Rana, Pearsons
2. Engineering Graphics and Drafting: P.S. Gill, S.K. Kataria and Sons.

Reference Books:

1. A Text Book of Engineering Drawing: RK Dhawan, S Chand & Company
2. Engineering Drawing Plane and Solid Geometry : N.D. Bhatt, Charotar Publishing House.

Note:

1. For class work, the students shall be assigned to prepare at least ten drawing sheets covering all units and each topic of the syllabus.
2. For practical examination, the examiner will set a question paper containing total eight questions, two questions from each unit covering each topic of the syllabus; students are required to attempt five questions at least one from each unit.

ME 105 B ELEMENTS OF MECHANICAL ENGINEERING
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

Thermodynamics- Elementary definitions in thermodynamics, fundamentals of first and 2nd law of thermodynamic- concept of internal energy, enthalpy and entropy, heat pump and refrigerator, elementary numerical problems.

Properties of Steam & Boilers: properties of steam, use of steam tables and mollier diagram, measurement of dryness fraction of steam, Carnot and Rankin cycle, elementary numerical problems. Classification of boilers, Comparison of water and fire tube boilers mounting and accessories with their functions, Constructional and operational details of Cochran and Babcock and Wilcox boilers, elementary numerical problems.

Steam Turbines and Condensers: Classification of turbines and their working principles, Types of condensers and their uses.

UNIT-II

I.C. Engines and Gas Turbines: Introduction, Classification, Constructional details and working of two-stroke and four-stroke diesel and petrol engines, Efficiency of Otto & Diesel cycles , Working principle of gas turbine, elementary numerical problems.

Refrigeration and air conditioning- rating of refrigeration machine, coefficient of performance, simple vapor compression cycle, fundamentals of air conditioning, use of Psychrometric charts.

UNIT-III

Water Turbines and Pumps : Introduction, Classification, Construction details and working principle of Pelton, Francis and Kaplan turbines, Classification of water pumps and construction detail & working principle of centrifugal pump.

Simple Lifting Machines: Definition of machine, Velocity ratio, Mechanical advantage, Efficiency, Laws of machines, Reversibility of machine, Wheel and axle, Differential pulley block, Single, double and triple start worm and worm wheel, Single and double purchase winch crabs, Simple and compound screw jacks, elementary numerical problems.

UNIT-IV

Introduction to Power transmission and Devices: Belt drive, Rope drive, Chain drive, Types of gear and

Gear train, Types and function of clutches, Types and function of brakes.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poisson's ratio, stresses and strains in simple and compound bars under axial loading, Stress-strain diagrams, Hooke's law, Elastic constants & their relationships. Concept of shear force and bending moments in beams, elementary numerical problems.

TEXT BOOKS:

1. Hydraulic and Fluid Mechanics – Modi and Seth, Pub. – Standard Book House, New Delhi
2. Engineering Thermodynamics – C.P. Arora, Pub. - TMH, New Delhi
3. Thermal Engineering – A.S. Sarad, Pub. - Satya Prakashan, New Delhi.
4. Engineering Mechanics – K.L. Kumar, Pub. - TMH, New Delhi.
5. Theory of Machines – S.S. Rattan, Pub. – TMH, New Delhi.

REFERENCE BOOKS:

1. Strength of Materials – Popov, Pub. - PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub.- Metropolitan, Allahbad.
3. Thermal Science and Engineering – D.S. Kumar, Pub. – Kateria & Sons, New Delhi.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

PHY103B PHYSICS LAB - I
B. TECH. SEMESTER - I (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

Note: Students will be required to perform 10 experiments in a semester.

LIST OF EXPERIMENTS

1. To find the wavelength of sodium light by using Newton's rings experimental setup.
2. To find the wavelength of sodium light by Fresnel's biprism experimental setup
3. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
4. To find the refractive index and Cauchy's constants of a prism by using spectrometer.
5. To find the wavelength of sodium light by using Michelson interferometer.
6. To find the resolving power of a telescope.
7. To find the pitch of a screw using He-Ne laser.
8. To find the specific rotation of sugar solution by using a polarimeter.
9. To compare the capacitances of two capacitors by De'sauty bridge.
10. To find the flashing and quenching potentials of Argon and also to find the capacitance of unknown capacitor.
11. To study the photo conducting cell and hence to verify the inverse square law.
12. To find the temperature co-efficient of resistance by using platinum resistance thermometer and Callender and Griffith bridge.
13. To find the frequency of A.C. mains by using sonometer.
14. To find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method.
15. To determine the value of Stefan's constant.
16. To find the coefficient of thermal conductivity of a good conductor by Searle's method.
17. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton method.

RECOMMENDED BOOKS :

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

ME107B WORKSHOP PRACTICE
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| -- | -- | 4 | 2 |

| | |
|--------------------------------|--------------------|
| Class Work | : 40 Marks |
| Examination | : 60Marks |
| Total | : 100 Marks |
| Duration of Examination | : 3 Hours |

LIST OF EXPERIMENTS / JOBS

1. To study different types of measuring tools/instruments used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.
2. To study different types of machine tools (lathe, shaper, planer, slotter, milling, drilling machines).
3. To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare lay out on a metal sheet by making and prepare rectangular tray, pipe shaped components e.g. funnel.
6. To prepare joints for welding suitable for butt welding and lap welding.
7. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
8. To prepare simple engineering components/ shapes by forging.
9. To prepare mold and core assembly, to put metal in the mold and fettle the casting.
10. To prepare horizontal surface/ vertical surface/ curved surface/ slots or V-grooves on a shaper/ planner.
11. To prepare a job involving side and face milling on a milling machine.
12. To study of CNC lathe, CNC Milling and EDM Machines.

- Note:**
1. **At least ten experiments/ jobs are to be performed/ prepared by students in the semester.**
 2. **At least 8 experiments/ jobs should be performed / prepared from the above list, remaining two may either be performed/ prepared from the above list or designed and set as per the scope of the syllabus of Manufacturing Processes.**

CH 103B CHEMISTRY LAB
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20 Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

LIST OF EXPERIMENTS

1. Determination of Ca⁺⁺ and Mg⁺⁺ hardness of water sample using EDTA solution.
2. Determination of alkalinity of water sample.
3. Determination of dissolved oxygen (DO) in the given water sample.
4. To find the melting and eutectic point for a two component system by using method of cooling curve.
5. Determination of viscosity of lubricant by red wood viscometer (No. 1 & No. 2).
6. To determine Flash point & Fire point of an oil by Pensky-Marten's flash point apparatus and by Abel's closed cup apparatus..
7. To prepare Phenol-formaldehyde and urea- formaldehyde resin.
8. To find out saponification No. of an oil.
9. Determination of concentration of KMnO₄ solution spectrophotometrically.
10. Determination of strength of HCl solution by titrating it against NaOH solution conductometrically.
11. To determine amount of sodium and potassium in a given water sample by flame photometer
12. Estimation of total iron in an iron alloy.

Suggested Books:

1. A Text book on Experiments and Calculation –Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd.
2. Essential of Experimental Engineering chemistry, Shashi Chawla, Dhanpat Rai Publishing Co.
3. Theory & Practice Applied Chemistry – O.P.Virmani, A.K. Narula(New Age).

Note:

1. The student will be required to perform 10 experiments/ exercises from the above list and any other two experiments designed by the department based on the theory course (course code101B Course Name Chemistry)
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronic gadgets including Cellular phones are not allowed in the examination.

EE 103B PRINCIPLES OF ELECTRICAL ENGINEERING LAB
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20 Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

LIST OF EXPERIMENTS

1. To verify KCL and KVL.
2. To verify Thevenin's & Norton's Theorems.
3. To verify maximum power transfer theorem in D.C. Circuit.
4. To verify reciprocity theorem.
5. To verify Superposition theorem.
6. To study frequency response of a series R-L-C circuit and determine resonant frequency & Q- factor for various Values of R, L, C.
7. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q -Factor for various values of R, L, C.
8. To perform direct load test of a transformer and plot efficiency Vs load characteristic.
9. To perform direct load test of a D.C. shunt generator and plot load voltage Vs load current curve.
10. To study various type of meters.
11. .Measurement of power by three voltmeters / three ammeters method.
12. Measurement of power in a three phase system by two watt meter method.

Note:

1. **At least 10 experiments are to be performed by students in the semester.**
2. **At least 8 experiments should be performed from the above list; remaining two experiments may either be performed from the above list or designed and set by the Dept. as per the scope of the syllabus of EE101B.**

CSE 103B COMPUTER PROGRAMMING LAB
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20 Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

LIST OF PRACTICAL PROBLEMS

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average male height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices.
7. Write a program to sort numbers using the Quicksort Algorithm.
8. Represent a deck of playing cards using arrays.
9. Write a program to check that the input string is a palindrome or not.
10. Write a program to read a string and write it in reverse order.
11. Write a program to concatenate two strings.
12. Write a program which manipulates structures (write, read, and update records).
13. Write a program which creates a file and writes into it supplied input.
14. Write a program which manipulates structures into files (write, read, and update records).

Note: At least 5 to 10 more exercises to be given by the teacher concerned

ME109B ELEMENTS OF MECHANICAL ENGINEERING LAB
B. TECH. SEMESTER – I/II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20 Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

LIST OF EXPERIMENTS

1. To study Cochran & Babcock & Wilcox boilers.
2. To study the working & function of mountings & accessories in boilers.
3. To study 2-Stroke & 4-Stroke diesel engines.
4. To study 2-Stroke & 4-Stroke petrol engines.
5. To calculate the V.R., M.A. & efficiency of single, double & triple start worm & worm wheel.
6. To calculate the V.R., M.A. & efficiency of single & double purchase winch crabs.
7. To draw the SF & BM diagrams of a simply supported beam with concentrated loads.
8. To study the simple & compound screw jacks and find their MA, VR & efficiency.
9. To study the constructional features & working of Pelton Turbine.
10. To prepare stress-strain diagram for mild steel & cast iron specimens under tension and compression respectively on a Universal testing machine.

Note: 1. Total ten experiments are to be performed in the Semester.

2. At least eight experiments should be performed from the above list. Remaining three experiments should be performed as designed & set as per the scope of the syllabus of ME – 101: Elements of Mechanical Engineering.

MATH102B MATHEMATICS - II

B. TECH. SEMESTER - II (Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 75 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I

Ordinary Differential Equations & its Applications: Exact differential equations. Equations reducible to exact differential equations. Applications of Differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, heat flow and orthogonal trajectories.

Linear differential equations of second and higher order. Complete solution, complementary function and particular integral, method of variation of parameters to find particular Integral, Cauchy's and Legendre's linear equations, simultaneous linear equations with constant co-efficients.

UNIT-II

Laplace Transforms and its Applications : Laplace transforms of elementary functions, properties of Laplace transforms, existence conditions, transforms of derivatives, transforms of integrals, multiplication by t^n , division by t . Evaluation of integrals by Laplace transforms. Laplace transform of Unit step function, unit impulse function and periodic function. Inverse transforms, convolution theorem, application to linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT-III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity.

Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions, application to flow problems. Integration of complex functions. Cauchy-Integral theorem and formula.

Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeros and singularities of complex functions, Residues

UNIT-IV

Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac-delta function.

TEXT BOOKS :

1. Advanced Engg. Mathematics F Kreyszig
2. Higher Engg. Mathematics B.S. Grewal

REFERENCE BOOKS:

1. Differential Equations – H.T.H. Piaggio.
2. Elements of Partial Differential Equations – I.N. Sneddon.
3. Advanced Engineering Mathematics – R.K. Jain, S.R.K. Iyengar.
4. Advanced Engg. Mathematics – Michael D. Greenberg.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

PHY 102B ENGINEERING PHYSICS – II**B. TECH. SEMESTER - II (Common for all Branches)**

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75 Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT-I**ELECTRODYNAMICS & QUANTUM PHYSICS**

Introduction, Displacement current, Equation of continuity, Gauss's Law in dielectric, applications of Gauss's law, Maxwell's equations (both differential and integral form), plane e.m. wave equations in free space, dielectric and conducting medium; Poynting vector.

Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts, Black Body radiations, Planck's Law of radiation and its limitations, Group velocity and phase velocity, Schrodinger wave equations, Application of Schrodinger Equations (Particle in a box).

UNIT-II**CRYSTAL STRUCTURE**

Space Lattice, unit cell and translation vectors, Miller indices, Bravais lattice structure in 3D, simple crystal structure (NaCl, ZnS and CsCl₂), Elementary idea of reciprocal lattice, Ewald Construction, Experimental x-ray diffraction method, Laue method, powder Method.

FREE ELECTRON THEORY

Elements of classical free electron theory, Drude's Theory of Conduction and its limitations, quantum theory of free electrons, Fermi level, Density of states, Fermi-Dirac distribution function, Thermionic emission, Richardson's equation.

UNIT-III**BAND THEORY OF SOLIDS**

Origin of energy bands, Kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Concept of effective mass and holes, Classification of solids into metals, Semiconductors and insulators, Fermi energy and its variation with temperature, Conduction in Intrinsic and Extrinsic Semiconductors. Hall Effect and its Applications.

UNIT-IV**SUPERCONDUCTIVITY & NANOSCIENCE**

Introduction to superconductivity, Critical temperature, Meissner Effect, Types of Superconductor, London Equations, penetration depth and coherence length, BCS Theory(qualitative ideas), High temperature superconductors.

Concept of Nano-materials, Size dependence of band gap, Top-down and bottom-up approach for preparing nano-materials, MEMS & NEMS, Properties and applications of Fullerene, Graphene, CNT, Nanowires, Nano-composites, Quantum dots..

TEXT BOOKS :

1. Solid State Physics – S.O.Pillai (6th Edition, New Age).
2. Quantum Mechanics – Ghatak & Loknathan.
3. Fundamentals of Solid State Physics – B.S.Saxena, R.C.Gupta & P.N.Saxena (Pragati Prakashan).
4. Solid State Physics by H. Ibach & H. Luth, Springer, Berlin.
5. Engineering Physics by H.K Malik and A.K. Singh (Tata McGraw Hill).
6. Engineering Physics by S.P. Taneja (Chand Pub.)

REFERENCE BOOKS :

1. Introduction to Solid State Physics (VII Ed.) - Charles Kittel (John Wiley).
2. Quantum Mechanics – Powell and Crasemann (Oxford & IBH)
3. Classical Electrodynamics by S.P. Puri (Narosa)
4. Nano-technology- Molecularly Designed Materials: G. M. Chow & K. E. Gonsalves (American Chemical society).

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

ECE 102B BASICS OF ELECTRONICS ENGINEERING
B. TECH. SEMESTER – II (OPTIONAL- Common for all Branches)

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

UNIT I

Semiconductor Physics, Diodes and Applications: Basic concepts, intrinsic and extrinsic semiconductors, diffusion and drift currents ,Hall effect and its applications-pn junction under open circuit, reverse bias and forward bias conditions, p-n junction in the breakdown region, ideal diode, types of diodes –zener diode, varactor diode, LED and photodiode. Rectifier (half wave and full wave).

Amplifiers: Introduction of different types of BJT amplifiers & their characteristics.

UNIT II

Operational Amplifiers: OP-amps, its characteristics, inverting, non-inverting, summing, averaging, scaling ,difference, integrator and differentiator amplifiers.

Power Supplies: Introduction and working of switched mode power supply (SMPS), voltage regulator.

UNIT III

Digital Electronics: Binary, Octal and Hexadecimal number system and conversion, Boolean algebra, truth tables of logic gates AND, OR,NOT,EX-OR,EX-NOR, NAND, NOR AND their implementation using diodes transistors, switches and lamps, Universal gates.

Electronic Instruments: Transducers, Role, importance and applications of general purpose test instruments viz. multi meter (digital and analog), cathode ray oscilloscope (CRO), function/ signal generator.

UNIT IV

Communication System: Modulation, need of modulation, Block diagram of basic communication system, overview of AM, FM and PM.

Microprocessor: Basics of 8085 & its architecture. Instruction set, Interrupts, Addressing modes.

Reference Books:

1. Sedra A S and Smith K C. “Microelectronic Circuits” New York.Oxford University Press, New York
2. Tocci R J and widner N S “Digital Systems” – Principles and Applications”, Pearson Education India , new Delhi .
3. Cooper and Helfric, “Modern Electronic Instrumentation and Measuring Techniques”. Prentice Hall of India, New Delhi.
4. Boylestad and Nashelesky, “Electronic Devices and Circuit Theory”, Pearson Education India, New Delhi
5. Millman and Grabel, “Microelectronics”, Tata McGraw Hill
6. Millman and Halkias, “Electronics Devices and Circuits”. Tata McGraw Hill

7. Kennedy and Davis, "Electronic Communication Systems", Tata McGraw Hill
8. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publishing.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

BT102B BASICS OF BIOTECHNOLOGY
B. TECH. SEMESTER – II (OPTIONAL- Common for all Branches)

| | | | | | | |
|----------|----------|----------|----------------|--------------------------------|----------|------------------|
| L | T | P | Credits | Class Work | : | 25 Marks |
| 3 | 1 | -- | 4 | Examination | : | 75Marks |
| | | | | Total | : | 100 Marks |
| | | | | Duration of Examination | : | 3 Hours |

UNIT – I

Introduction: Nature and scope of Biotechnology.

Cell Structure and Function: Prokaryotes and Eukaryotes- cell wall, cell membrane, nucleus, mitochondria, chloroplast, ribosome, vacuoles, bacteria and viruses: brief descriptions.

Biomolecules: A brief account of structure and functions of carbohydrates, lipids, proteins.

UNIT- II

Cell Division: Mitosis and meiosis

Genes and chromosomes: Classical- Mendel's laws and chromosomes, nature of genetic material, DNA and RNA as genetic material, concept of organization of genetic material into chromosomes.

DNA replication: DNA polymerases, replication mechanism.

UNIT-III

Gene Expression: Central dogma, genetic code, gene expression-a brief account of transcription and translation, housekeeping genes, mutations and their molecular basis.

Genetic Engineering: An introduction to genetic engineering: cloning (vectors, enzymes), DNA and genomic libraries, transgenics, DNA fingerprinting, genomics.

UNIT – IV

Applications of Biotechnology : Bioprocess and fermentation technology, cell culture, enzyme technology, biological fuel generation, single cell protein, sewage treatment, environmental biotechnology, biotechnology and medicine, biotechnology in agriculture & forestry industry, food and beverage technology, production of biological inventions, safety in biotechnology.

TEXT/ REFERENCE BOOKS:

- Biotechnology, Smith, Cambridge Press.
- Modern Concepts of Biotechnology, H. D. Kumar, Vikas Publishing House (P) Ltd.
- Elements of Biotechnology, P. K. Gupta, Rastogi Publications.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed

**HUM102B ORAL COMMUNICATION SKILLS
B. TECH. SEMESTER – II (OPTIONAL- Common for all Branches)**

| | | | | | |
|----------|----------|-----------|----------------|--------------------------------|--------------------|
| L | T | P | Credits | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | Examination | : 75Marks |
| | | | | Total | : 100 Marks |
| | | | | Duration of Examination | : 3 Hours |

OBJECTIVE

To train students to have proficiency in oral communication through interpersonal communicative situations.

COURSE CONTENT

UNIT I

Essentials of Speaking Skills:

Familiarity with phonetic sound symbols; Transcription of simple words using International Phonetic Alphabet; Use of dictionary to cultivate standard pronunciation and develop phonetic discrimination

UNIT II

Speaking Skills:

Need and Significance of Effective Oral Communication; Practice of Conversation – Interpersonal and Telephonic Conversation; Formal Group Discussion

UNIT III

Non-Verbal Elements in Oral Communication Skills:

Reading Face, eyes, gesture and body posture, time, space and culture in communicative situations; practicing verbal and non-verbal communication (Body Language) to acquire effective Oral communication;

UNIT IV

Listening Skills:

Essentials of Good Listening, Types of Listening, Barriers in Effective listening, Exercises in Listening to Talk Shows, Speech Reviews; Practice in English Sounds and Speech using RP/MRP

RECOMMENDED READING

1. Buck, Gary. *Assessing Listening*. Delhi: Foundation Books (Cambridge University Press), 200.

2. Balasubramanian, T. *A Textbook of English Phonetics for Indian Students*. Chennai: MacMillan,1981 (rpt 2007).
3. Gangal, J.K. *A Practical Course in Spoken English*. New Delhi: PHI, 2011
4. Raman, Meenakshi and Sangeeta Sharma. *Communication Skills*. Delhi: OUP, 2011
5. Ribbens, Geoff and Richard Thompson. *Body Language*. New York: Hodder & Stoughton, 2007.

CE 102B BASICS OF CIVIL ENGINEERING
B. TECH. SEMESTER – II (OPTIONAL- Common for all Branches)

| | | | | | | |
|----------|----------|-----------|----------------|--|--------------------------------|--------------------|
| L | T | P | Credits | | Class Work | : 25 Marks |
| 3 | 1 | -- | 4 | | Examination | : 75Marks |
| | | | | | Total | : 100 Marks |
| | | | | | Duration of Examination | : 3 Hours |

UNIT - I

Materials for Construction: Stones, Sands, Lime, Bricks, Timber, Steel their Classification and Properties. Different Types of Cement and their Properties, manufacturing of Cement, Concrete, and properties of Concrete, Ingredient of Concrete and Their Functions

Component parts of a Building, Foundation, Masonry Works, Doors and Windows, Floors, Roofs, DPC, Building Services

UNIT - II

Surveying , Introduction to Surveying: Definition, importance, classification of surveys, Principle, Leveling: definitions of terms used in leveling, different types of levels, Contours, Definition, representation of reliefs, horizontal equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient, uses of contour maps, Introduction to GIS, GPS and Remote sensing.

UNIT - III

Transportation: Various modes and means of transportation, Different types of transport systems, Importance of road transport, History of Road Development, Indian Road Congress. Main features of 20 years road development plans in India, PMGSY

Sources of power, estimation of water power, water budget equation, necessity and importance of harnessing small hydro power plants, Dams, Types of Dams, Location and Impact assessment of a Dam project.

UNIT - IV

Geotechnical Engineering: History and its applications, Soil Properties, Classification of Soil, Geotechnical and Geophysical investigation of Soil.

Irrigation Engineering: Necessity, advantages, disadvantages, impact of irrigation on human environment, need and development of irrigation in India.

Text Books:

1. Basic Civil Engineering, Satheesh Gopi, Pearson.
2. Basic Civil Engineering, Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kr. Jain, Firewall Medi

Reference Books:

1. Surveying by Prof. N. Singh, Tata McGraw Hill, New Delhi
2. Basic Civil Engineering, Rakesh Beohar, Firewall Media
3. Highway Engg. by S. K. Khanna & C.e.G.Justo, Nem Chand & Bros,Roorkee

4. Water Resources Engineering by Linseley and Franzini
5. Basic Civil Engineering, L.G. Kulkarni A. D. Pawar S. P. Nitsure, Technical Publications.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

PHY104B PHYSICS LAB - II
B. TECH. SEMESTER - II (Common for all Branches)

| | | | | | |
|----------|----------|----------|----------------|--------------------------------|-------------------|
| L | T | P | Credits | Class Work | : 20 Marks |
| -- | -- | 2 | 1 | Examination | : 30Marks |
| | | | | Total | : 50 Marks |
| | | | | Duration of Examination | : 3 Hours |

Note: Students will be required to perform 10 experiments in a semester.

LIST OF EXPERIMENTS

1. To find the low resistance by Carey - Foster's bridge.
2. To find the resistance of a galvanometer by Thomson's constant deflection method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionisation potential of Argon/Mercury using a thyratron tube.
8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photoelectric cell.
11. To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
12. To find the value of Hall Co-efficient of semi-conductor.
13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.
16. To verify the Truth Table of various Logic Gates.

RECOMMENDED BOOKS :

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

GP102B GENERAL PROFICIENCY & ETHICS
B. TECH. SEMESTER – II (Common for all Branches)

| | | | | | |
|----------|-----------|-----------|----------------|--------------------|-------------------|
| L | T | P | Credits | Examination | : 50 Marks |
| 1 | -- | -- | 2 | Total | : 50 Marks |

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him / her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

A. The student will present a written report before the committee with following in view:

The student will present before the committee his/ her achievements during the current academic session in the form of a written report highlighting followings:

- I. Academic Performance -----
- II. Extra Curricular Activities / Community Service, Hostel Activities **(8 Marks)**
- III. Technical Activities / Industrial, Educational tour **(8 Marks)**
- IV. Sports/games **(4 Marks)**
- V. Moral values & Ethics **(10 Marks)**

NOTE: Report submitted by the students should be typed on both sides of the paper.

B. A student will support his/ her achievement and verbal & communicative skill through presentation before the committee. **(20 Marks)**

C. Moral values & Ethics

Syllabus- Introduction to Value Education. Understanding ethics, value system, happiness, prosperity.

A minor test/ Quiz will be conducted and it will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

The evaluation of this course will be made by the following Committee.

University Departments:

| | | |
|---|-------------------------------|----------|
| 1 | Chairperson of the Department | Chairman |
| 2 | Senior Most Faculty Counselor | Member |
| 3 | Vice- Chancellor's Nominee | Member |

Affiliated Colleges:

| | | |
|---|---|----------|
| 1 | Director/Principal | Chairman |
| 2 | Head of the Department/Sr. Faculty | Member |
| 3 | External Examiner to be appointed by the University | Member |

Note: Remuneration will be paid to the external examiner only (at par with the other practical examinations).

**B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT201B: CELL BIOLOGY**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Cell: An introduction and classification of organisms by cell structure, cytosol, compartmentation of eukaryotic cells, cell fractionation.

Cell membrane and Permeability: Chemical components of biological membranes, organization and fluidity of membrane components, the membrane as a dynamic entity of cell, signaling, cell recognition and membrane transport.

UNIT - II

Membrane Vacuolar System, Cytoskeleton and cell motility: Structure and function of microtubules, microfilaments, intermediate filaments. **Endoplasmic reticulum:** Structure, function including role in protein segregation.

Golgi complex: Structure, biogenesis and functions including role in protein secretion.

Lysosomes, vacuoles and microbodies: Structure and functions.

UNIT-III

Ribosomes: Structure and function including role in protein synthesis.

Mitochondria: Structure, genomes, biogenesis, functions.

Chloroplasts: Structure, genomes, biogenesis, functions.

Nucleus: Structure, cell cycle (Interphase & M phases), mechanism of cell cycle.

Extracellular matrix: composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function.

UNIT - IV

Muscle contraction: Different muscle types in the body, structural proteins of muscles, energetics and regulation of muscle contraction.

Neurons and Neurotransmission: Resting potential, action potential, synaptic transmission, neurotransmitters and receptors, generation of action potential by sensory stimuli and mechanism of nerve-impulses.

Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics of cancer cells, molecular basis of cancer.

TEXT / REFERENCE BOOKS:

- Molecular Biology of Cell, ed. Albert et al, Garland Publishing, Inc.
- Cell Biology, ed. Smith and Wood, Chapman and Hall
- Cell Biology: Organelle structure and function, ed. D.E. Sadava, Jones & Bartlett Publishers.
- Cell and Molecular Biology, ed. EDP. De Robertis and EMF DeRoberties, Lippincot Williams & Wilkins Pvt Ltd.
- Molecular cell Biology, ed. Harvey Lodish and D .Baltimore W.H Freeman & Co. 4th ed.2000.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – III (BIOTECHNOLOGY) BT203B: MICROBIOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Fundamentals of Microbiology: Scope and relevance of microbiology, evolution of microbiology and its historical developments, .microbes in human welfare and disease causation.

Classification of Microorganisms: Microbial taxonomy, criteria used for microbial classification including molecular approaches, microbial phylogeny and current classification system of bacteria.

UNIT - II

Microbial Diversity- Distribution & Characterization: Morphology and cell structure of major groups of microorganisms. e.g. bacteria, fungi and viruses, unique features of algae and protozoa.

Cultivation & Maintenance of Microorganism: Nutritional categories of microorganisms, methods of isolation, purification, preservation & maintenance of micro-organisms.

UNIT – III

Microbial Growth and Metabolism: Growth requirements, culture medium and types, growth curve, generation time, synchronous, batch and continuous culture, chemostat and turbidostat, measurement of growth and factors affecting growth, microbial growth kinetics.

Bacterial reproduction: Various modes of bacterial reproduction -Transformation, transduction & conjugation.

Control of Microorganism: Physical & chemical agents.

UNIT – IV

Water Microbiology: Bacterial pollutants of water, coliform group, sewage composition and its disposal strategy.

Food Microbiology: Important microorganisms in food microbiology- moulds, yeast and bacteria, major food borne infections and intoxicants, preservation of various types of foods, spoilage of food.

TEXT/ REFERENCE BOOKS:

- Microbiology, ed. Prescott et al., 2003, Mc Graw Hill, USA.
- Microbiology, ed. Pelczar et al., Tata Mc Graw Hill, New Delhi.
- Food Microbiology, ed. Adams & Moss, 1996, CBS Publishers, New Delhi.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT205B: BIOCHEMISTRY- I

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: Introduction to Biochemistry, water as biological solvent, weak acids and bases, pH, buffers, Handerson-Hasselbach equation, physiological buffers.

Carbohydrates: structure, function and properties, ring structure and mutarotation, homo & hetero polysaccharides, mucopolysaccharides, bacterial cell wall polysaccharides, glycoproteins and their biological functions, blood group substances.

UNIT - II

Amino acids & Proteins: Nomenclature, Classification, function and chemical structure of amino acids, general reactions of amino acids, physicochemical properties of amino acids with their titration curve, reaction with ninhydrin, amino acids as zwitter ions and isoelectric point.

Proteins: Types of proteins and their classification, acid base properties and titration of proteins, forces stabilizing protein structure and shape, structure (primary, secondary, tertiary and quaternary; structure of peptide bond, Ramachandran Plot), properties and biological functions of proteins, protein denaturation, renaturation, purification of proteins, salting in and salting out of proteins.

UNIT - III

Lipids: Classification, structure, biological functions of lipids, nomenclature and properties of fatty acids and triglycerides, hydrolysis of fats, rancidity of fats, iodine no. and acid value.

Phospholipids: structure and properties of different types of phospholipids, sphingomyelins, glycolipids, cerebrosides, gangliosides, prostaglandins, **Cholesterol:** Structure and biological properties, utilization of cholesterol.

UNIT - IV

Nucleic acids: structure and functions, physical & chemical properties of nucleic acids, structure and properties of purine & pyrimidine bases, nucleosides & nucleotides, biologically important nucleotides, biological function of DNA & RNA species, double helical model of DNA structure and forces responsible for it, A, B, & Z –DNA, denaturation and annealing of DNA.

TEXT / REFERENCE BOOKS:

- Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Principles of Biochemistry (Hardcover) By Geoffrey Zubay. Publisher: McGraw Hill College.
- Biochemistry By Lubert Stryer. WH Freeman and Co.
- Biochemistry and Molecular biology. By William H. Elliott and Daphne C. Elliott. Oxford University Press.

- Fundamentals of Biochemistry: Life at the Molecular Level [Import] (Hardcover) By Donald Voet, Judith G. Voet and Charlotte W. Pratt. Publisher: Wiley.
- Principles of Biochemistry (Paperback) By Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and David Rawn. Pearson Education.
- Biochemistry By U. S. Satyanarayana

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – III (BIOTECHNOLOGY) BT207B: GENETICS

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction and History: Introduction, concept and theories of inheritance.

Principles of Heredity and Variation: Mendel and his experiments, monohybrid crosses, dihybrid crosses, modifications of standard Mendelian ratios, incomplete dominance and codominance, lethal genes, epistasis, multiple alleles, probability in prediction and analysis of genetic data.

Genes and chromosomes: Chromosomal theory of inheritance, chromosomes- general features, morphology & molecular organization, structure of bacterial & eukaryotic chromosomes, euchromatin & heterochromatin, nucleosome model, polytene and lampbrush chromosomes.

UNIT - II

Sex determination and sex linkage: Sex determination mechanisms, inheritance of white eye in *Drosophila*, nondisjunction of X chromosome, sex-linked, sex-limited and sex-influenced inheritance.

Gene Linkage, Crossing Over & Chromosome Mapping: Linkage and recombination of genes in a chromosome, crossing over and genetic mapping, gene mapping from three-point test crosses, mapping by tetrad analysis, somatic cell hybridization and mapping.

Extranuclear Inheritance: Organelle heredity, evolutionary origin of organelles, cytoplasmic transmission of symbionts, maternal effect in snail shell coiling.

UNIT- III

Gene Mutation and DNA Repair: Characteristics and classification of mutations, detection of mutations, spontaneous and induced mutation, physical and chemical mutagens, tautomeric shifts, DNA repair- an introduction.

Chromosomal aberrations: Variations in chromosome structure- deletion, duplication, inversion, translocation, variations in chromosome number- euploidy & aneuploidy.

UNIT - IV

Transposable Genetic Elements: Genetic instability and discovery of transposable elements, transposable elements in bacteria & eukaryotes, genetic and evolutionary significance of transposable elements.

Population Genetics and Evolution: Allele frequencies & genotype frequencies, Random mating & Hardy – Weinberg principle, inbreeding, factors affecting gene frequencies- mutation, migration, random genetic drift, natural selection.

Quantitative Genetics: Quantitative inheritance, multiple factor hypothesis, analysis of quantitative traits.

TEXT / REFERENCE BOOKS:

- Genetics, ed. D.L. Hartl, Jones & Bartlett Publishers, Boston.
- Genetics, ed. Russell, P.J. 1998, Addison Wesley Longman, Inc. California, U.S.A.
- Genetics, ed. Brooker. R.J.1999, Analysis and Principles. AW. Longman, Inc, California
- Basic Genetics, ed. Miglani, G.S.2000. Narosa Publishing House, New Delhi.
- Principles of Genetics, Gardner, Simmons and Snustad, John Wiley & Sons.
- Concepts of Genetics, W.S. Klug, M.R. Cummings, C.A. Spencer and M.A. Palladino. Pearson Publications.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – III (BIOTECHNOLOGY)**BT209B: ORGANIC CHEMISTRY**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Types of Organic Reactions: Substitution, addition, elimination, rearrangement reactions: Wagner–Meerwin rearrangement, cope rearrangement, hyper conjugation: concept & consequences.

IUPAC Nomenclature: Systematic IUPAC nomenclature of alkenes alkynes cycloalkanes, aromatics, bicyclic and polyfunctional organic compounds, bond line notation.

UNIT - II

Hydrogen Bonding: Nature, type, stability and its importance in organic compound nodes, P⁺D⁻ bonding, ylids (S&P), Wittig reaction, biological methylating reagents, tautomerism– concept, ring chain tautomerism., ring chain isomerism, properties, reactions of keto enol tautomers, epoxides: properties & nucleophilic ring opening of epoxides and crown ethers.

Stereo Chemistry: Classification of stereoisomers, diastereoisomers, separation of enantiomers, absolute configuration (R & S), projection formulae, stereochemistry of compounds containing two asymmetric C-atoms, stereochemistry of biphenyls, geometrical isomerism - concept, E & Z nomenclature.

UNIT- III

Carbonyl Compounds: Nature & structure of carbonyl group, relative reactivities of carbonyl compounds, hydration & addition of alcohol to aldehydes and ketones, addition of ammonia & ammonia derivatives to aldehydes & ketones, Wolff–Kishner reduction & its mechanism, aldol condensation, Claisen condensation, Reformatsky reaction & Perkin reaction.

Acid Derivatives: Acid catalysed & base catalysed, hydrolysis of esters & acid amides amono-lyses & alcoholysis of esters.

UNIT - IV

Polymers: Classification of polymers functionality, chain growth and step growth, polymers, co-ordination polymerization, epoxy resins, urea formaldehyde resins, natural rubber & its vulcanizations, elastomers.

Reducing Agents: Applications in organic chemistry with special emphasis on LiAlH₄, NaBH₄, Pt / Ni / H₂, Metal / NH₃, solution, diimide, hydroboration, tri-n-butyl tin hydride.

Peptide Bond Synthesis: Protection of N-terminal & C-terminal of amino acids, formation of peptide bonds, solid phase peptide synthesis.

TEXT / REFERENCE BOOKS:

- Organic chemistry, ed. I. L. FINAR
- Modern organic chemistry, ed. D.R.Boyed.
- Organic chemistry, ed. Paula Yurkanis Bruice.
- Principle of organic synthesis, ed. Richard Norman & James M Coxon.
- Reaction mechanism, ed. O.P. Aggarwal.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT211B: CELL BIOLOGY AND GENETICS LAB**

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Study of general rules and instrumentation used in cell biology.
2. Microscopy: Structure of prokaryotic and eukaryotic cells.
3. Killing, fixation, cryofixation and preservation of biological material for cytological studies.
4. Preparation of various stains for cytological studies.
5. Microtomy, histology of various organ systems (nervous, digestive, reproductive, respiratory and circulatory system).
6. Mitochondrial staining and enzyme localization (histochemistry & immuno-histochemistry).
7. Cell division in onion root tip/ insect gonads.
8. Isoenzyme patterns (LDH etc) (starch gel electrophoresis).
9. Isolation of UV induced auxotrophic mutants.
10. Problems on probability and population genetics.
11. Problems based on interaction of genes.
12. Problems based on linkage/ sex- linked inheritance.

TEXT / REFERENCE BOOKS:

- Principles and techniques of Practical Biochemistry, ed. K. Wilson & J. Walker 1994, Cambridge University Press, Cambridge, U.K.

- Introductory Practical Biochemistry, ed. S.K Sawhney & Randhir Singh 2000, Narosa Publishing House, New Delhi.
- An introduction to Practical Biochemistry ed. David T. Plummer 1988, McGraw –Hill, Book Company, U.K.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory courses: BT201B (Cell Biology) and BT-207B (Genetics).

B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT213B: MICROBIOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Microscopy: Use of microscopes, microscopic examination of microorganisms.
2. Micrometry: Microscopic measurement of microorganisms.
3. Staining methods: Gram, Spore, Capsule and Lactophenol cotton blue.
4. Preparation and sterilization of culture media.
5. Isolation and enumeration of microorganisms from different sources: soil, air, water.
6. Pure culture techniques – Streak plate, Pour plate, Spread plate.
7. Measurements of growth and study of effect of various factors on growth of microorganisms: temp., pH, salt concentration, U.V. & R.H.
8. Biochemical tests useful in bacterial taxonomy.
9. Water microbiology – BOD, multiple tube fermentation tests.
10. Milk Microbiology–SPC, testing the quality of milk.

TEXT / REFERENCE BOOKS:

- Experiments in microbiology, plant pathology, tissue culture & mushroom production technology, ed. Aneja K.R, 2001, New Age International Publishers, New Delhi.
- Microbiology –A Lab manual, ed. Cappuccino J. & Sherman N, 2000, Addison Wesley California, USA.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT203B (Microbiology).

**B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT215B: BIOCHEMISTRY LAB**

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Preparation of buffers and measurement of pH.
2. Determination of acid value of lipid samples.
3. Determination of saponification of lipid samples.
4. Determination of iodine number of lipid samples.
5. Determination of protein in given sample by Lowry method.
6. Qualitative and quantitative tests for carbohydrates.
7. Determination of RNA by orcinol method.
8. Determination of DNA by diphenylamine method.
9. Analysis of blood / urine samples for sugars / urea / bile pigments.
10. Assay of enzyme activities – alkaline phosphatase /peroxidase /oxidase.

TEXT /REFERENCE BOOKS:

- An Introduction to Practical Biochemistry, ed. S.K. Sawhney & Randhir Singh, 2002, Narosa Pub. House, N. Delhi

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT205B (Biochemistry- I).

B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT217B: ORGANIC CHEMISTRY LAB

L T P Credits
0 0 2 1

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Derivitization of polysugars such as agarose with cyanogen bromide for binding with protein.
2. Derivitization of polystyrene to generate carboxyl groups.
3. Derivitization of polystyrene to generate amino groups.
4. Derivitization of polystyrene to generate aldehyde groups.
5. Derivitization of polysugars to generate aldehyde group & establish covalent linkage of protein through amino & carboxyl groups.
6. Sialinization of solid phases such as polyester, glass polystyrene to provide amino groups.
7. Covalent linkage of proteins to solid phase through carbodiimide reaction.
8. Estimation of reactive amino groups on solid phase.
9. Estimation of reactive aldehyde groups on solid phase.
10. Estimation of reactive carboxyl groups on solid phase.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT209B (Organic Chemistry).

B. TECH. SEMESTER – III (BIOTECHNOLOGY)
BT219B: WORKSHOP

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| - | - | 2 | 2 |

Class Work Marks : 50 Marks

Total Marks : 50 Marks

Each student has to undergo a workshop at least 4 weeks (80-100 hours) at the end of II semester during summer vacations. **Out of the four weeks, two weeks would be dedicated to general skills and two weeks training for specialized discipline/ department.** The evaluation of this training shall be carried out in the III semester.

List of Experiments/ Exercises:

1. To become familiar with the general practices, safety guidelines and precautions to be followed in a biotechnology laboratory.
2. To study the principle and functioning of various instruments used in a microbiology, molecular biology and biochemistry laboratory.
3. To study the principle and functioning of various types of microscopes.
4. To study and learn about the different types of media required for microbiological work.
5. To learn to prepare commonly used buffer and stock solutions and to perform calculations involved in the solution- making of all molecular biology experiments.
6. To learn to prepare standard curves/ graphs for quantitative estimations of unknown samples.
7. To learn about the basics of plant tissue culture: reagents, media and methodology.
8. Any work assigned in electrical workshop, computer hardware/ language lab, electronics workshop, biomedical hardware, automobile workshop etc.

Note:

1. The student shall submit a typed report.
2. Training will be evaluated on the spot out of 20 marks.

3. The report will be evaluated in the III semester by a committee consisting of two teachers. The student will interact with the committee through presentation to demonstrate his/ her learning. The basis of evaluation will primarily be the knowledge and exposure of students on different kinds of machines/ instruments/ tools etc. The committee will evaluate out of 30 marks.
4. The committee shall submit the awards out of 50 marks.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
GES201B: ENVIRONMENTAL STUDIES

L T P Credits
 3 - - -

Class Work Marks : --
 Exam Marks : 75
 Total Marks : 75
 Duration of Exam : 3 Hrs.

UNIT – I

The Multidisciplinary nature of environmental studies, Definition, scope and importance. Need for Public awareness

UNIT – II

NATURAL RESOURCES:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation: deforestation, case studies, Timber exploitation, mining, dams and their effects and forests tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources; case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
 - Role of an individual in conservation of natural resources.
 - Equitable use of resources for sustainable lifestyles.

UNIT- III

ECOSYSTEMS:

- Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following eco-system:
 - a) Forest ecosystem, Grassland ecosystem, Desert ecosystem.

- b) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT- IV

BIODIVERSITY AND ITS CONSERVATIONS:

- Introduction – Definition: Genetic, species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.

UNIT – V

ENVIRONMENTAL POLLUTION:

Definition, causes, effects and control, measures of:

Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal Pollution, Nuclear hazards

- Solid waste management: Causes effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: Floods, earthquake, cyclone and landslides.

UNIT – VI

SOCIAL ISSUES AND THE ENVIRONMENT:

- a) From unsustainable to sustainable development
- b) Urban problems related to energy
- c) Water conservation, rain water harvesting, watershed management
- d) Resettlement and rehabilitation of people; its problems and concerns, case studies
- e) Environmental ethics: Issues and possible solutions
- f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies
- g) Wasteland reclamation, Consumerism and waste products
- h) Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act
- i) Issues involved in enforcement of environmental legislation, Public awareness

UNIT – VII

Human population and the Environment., Population growth, variation among nations.

Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Woman and Child Welfare.

Role of Information Technology in Environment and human health.

Case Studies.

REFERENCES:

1. Agarwal, K.C. 2001, Environmental Biology, Nidi Pub. Ltd. Bikaner.
2. Bharucha, Franch, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India .

3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai. 1195p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment @.
8. Gleick, H.P., 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security, Stockholm Env. Institute, Oxford Univ., Press 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Helhi 284p.
12. McKinney, M.L. & Schoch, R.M. 1996, Environmental Sciences Systems & Solutions, Web enhanced Edition 639p.
13. Mhaskar A.K., Mater Hazardous, Tekchno-Sciences Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Dutta, A.K. 1987, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
17. Sharma, B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Sciences (TB).
20. Trivedi, R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II Enviro Media (R).
21. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II Enviro Media (R).
22. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno Sciences Pub. (TB).
23. Wagner K.D., 1998, Environmental Management, W.B. Saunders Co. Philadelphia, USA 499p.
24. A text book environmental education G.V.S. Publishers by Dr. J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

Note: 1. Examiner will set eight questions. Students will be required to attempt five Questions.
2. The awards of this paper shall not be counted in the award of the Degree/DMC.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT202B: MOLECULAR BIOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Genetic Material: Chemical nature, structure & properties of genetic material, DNA as the genetic material- experimental evidences, structure of DNA, alternative forms of DNA, RNA as genetic material, genomic organization/ packaging of genetic material, nucleosome model.

From genes to genomes: Genome size, content and evolutionary complexity, C-value paradox, split genes, exons & introns, repetitive & nonrepetitive DNA, overlapping genes.

UNIT - II

DNA replication and repair: Origin of DNA replication, replication of bacterial & eukaryotic chromosomes, rolling circle replication, DNA polymerases, mechanism of DNA replication and its regulation, telomere replication, DNA repair mechanisms: photoreactivation, excision, mismatch, post replication recombination repair, SOS repair.

Gene Expression I- Transcription: Transcription in prokaryotes and eukaryotes- transcriptional unit, bacterial and eukaryotic RNA polymerases, role of sigma factor, promoter recognition, initiation, elongation & termination of transcription, role of transcription factors, promoters and enhancers.

RNA Processing: Processing of rRNA, tRNA and mRNA, poly-A tailing, 5' capping, nuclear splicing, RNA editing.

UNIT - III

Gene Expression II- Translation: Genetic code, wobble hypothesis, ribosomal RNA and ribosome organization, transfer RNA, translation process- initiation, elongation, termination, comparison of eukaryotic and prokaryotic protein synthesis systems.

Post- translational modifications: A brief account.

Protein Translocation and Localization: Translocation of proteins across ER membrane, protein modifications and folding in ER, transport into mitochondria, chloroplast, nucleus and peroxisomes, molecular chaperones.

UNIT - IV

Regulation of Gene Expression: Regulation in prokaryotes, operon concept, *lac*, *trp* and *ara* operon, catabolite repression, attenuation, gene regulation in eukaryotes- methylation & acetylation, hormonal control of gene expression, RNA silencing.

Signal Transduction: Signaling molecules and cell-surface receptors, intracellular signal transduction, second messengers, concept of G- proteins cytokine receptors, tyrosine kinases and MAP kinase pathways.

TEXT / REFERENCE BOOKS:

- Genes, ed. Benjamin Lewin, Oxford University Press, U.K.
- Genomes, ed. T.A. Brown, John Wiley & Sons Pvt. Ltd.
- Molecular biology of Cell, ed. Bruce Alberts, James D.Watson, Garland Publishing.
- Molecular Cell Biology, ed. H. Lodish and Baltimore, W.H., 2000, Freeman &Co.
- Cell & Molecular Biology, ed. E.D.P. Robertis.
- Essential of Molecular Biology, ed. Malacinski, Freifelder Jones, Bartlet Publisher.
- Cell & Molecular Biology, Concepts & Experiments, ed. Gerald Karp, John Wiley & Sons.
- The cell – a molecular approach, ed. Cooper, A.S.M. Press.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B.TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT204B: IMMUNOLOGY**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT I

Basic Immunology: Types of immunity, innate and acquired immunities, cells and organs of immune system B- Lymphocytes and T- Lymphocytes, primary and secondary lymphoid organs, humoral and cell mediated immune response, hematopoiesis and inflammation.

UNIT II

Immune System: Antigens, haptens, superantigens, immunoglobulins- structure and function, antigenic determinants, isotype, allotype & idiotype, monoclonal Ab, hybridoma technology, organization and expression of immunoglobulin genes, generation of Ab diversity, class switching.

Generation of B-Cell and T-Cell Responses: Major histocompatibility complex, peptide binding by class I and class II molecules, T-Cell receptor, antigen processing and presentation, B- and T-cell activation and differentiation, signalling pathways.

UNIT III

Immunological Techniques: Immunodiffusion and immunoprecipitation reactions, immunoelectrophoresis, ELISA, radio immunoassay, immunofluorescence.

Immune Effector Responses: Cytokines: properties, role of T- helper cells in cytokine production, cell mediated effector responses, complement system.

UNIT IV

Immune system in Health & Disease: Hypersensitive reactions, auto immunity, immune response to infectious diseases, tumor immunity, tissue and organ transplant, immunodeficiency, vaccines.

TEXT / REFERENCE BOOKS:

- Immunology, ed. R.A. Goldsby, T. J. Kindt, B.A. Osborne, W.H. Freeman & Company, New York.
- Essential of Immunology, ed. Ivon Roitt, Peter Delves, Blackswell, Scientific Publications. Oxford.

- Fundamental of immunology, ed. Paul W.E. Raven press, New York.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY) **BT206B: BIO-ANALYTICAL TECHNIQUES**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

Microscopy: Light, electron (scanning & transmission), phase contrast, fluorescence microscopy, freeze–fracture techniques, specific staining of organelles or marker enzymes.

Ultracentrifugation: Sedimentation of macromolecules, centrifugation techniques and their applications, differential centrifugation, zonal, density gradient and ultracentrifugation techniques.

UNIT – II

Electrophoresis: Paper and gel electrophoresis, immuno electrophoresis, enzyme linked Immunosorbent assay (ELISA), Isoelectric focusing, 2-D electrophoresis, capillary electrophoresis.

Chromatography: Paper chromatography and thin layer chromatography, (TLC), adsorption, partition, ion-exchange, reverse phase, gel filtration, affinity, gas chromatography, High pressure liquid chromatography (HPLC).

UNIT – III

Spectrophotometry: Basic concepts and brief description of application of U.V./ Visible, IR, NMR, ESR, Fluorescence, Raman, Mass spectroscopy in structure determination of organic and bio molecules, X-ray diffraction (diffraction by fibrous proteins, globular proteins and molecular crystals), CD and ORD.

UNIT – IV

Radioisotope Techniques: Nature of radioactivity, properties of α , β and γ rays, measurement of radioactivity, use of radioisotopes in research, in vivo and in vitro labelling techniques, double labelling, instruments for monitoring radioactivity, quenching, internal standard channel ratio, external standard ratio, emulsion counting radioactive decay, auto radiography, radioimmunoassay.

TEXT/ REFERENCE BOOKS:

- Biological Spectroscopy: Campbell and Durek.
- Physical Biochemistry, ed. by D. Friefelder, W.H. Freeman and company U.S.A.
- Introduction to instrumental analysis, ed. Robert. D. Braun, 1987. McGraw Hill, U.K.

- Analytical Chemistry for technicians, ed. John Kenkel, 1994, Lewis Publishers. Boca Raton, U.S.A.
- Principles and Techniques of Practical Biochemistry, ed. K. Wilson and J. Walker, 1994, Cambridge University Press, Cambridge.
- Biophysical Chemistry: Principle and Techniques, ed. A.Upadhyay, K.Upadhyay and N. Nath, 1998, Himalya Publication House, Delhi.
- Physical Biochemistry, ed. K.E. Vanholde, 1985, Prentice Hall Inc., New Jersey.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY) BT208B: INDUSTRIAL MICROBIOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: Important historical developments, objectives & scope of the topic.

Fermentation Processes: Principle, range & components of fermentation processes, types of fermentation, purification of fermentation products.

Sources, isolation, screening, preservation & maintenance of industrially important microbes: Improvement of industrially important microorganisms, selection of mutants, use of r DNA technology.

UNIT – II

Process Technology for Various Products: Primary metabolites (ethanol, acetone, butanol, citric acid, vinegar, dextran), production of alcoholic beverages (wine & beer), microbial production of industrial enzymes– cellulose, amylase, protease, production of secondary metabolites – antibiotics, (e.g. penicillin, streptomycin and tetracycline), production of vaccines.

UNIT – III

Applications of Industrial Microbiology- I: Bio-pesticides and biofertilizers, mode of action of B.T. toxin, classification and isolation of *cry* genes from *Bacillus thuringiensis*, & microbial protein (Quorn), microbes and biofuels, microbial diversity assessment tools and techniques

UNIT-IV

Applications of Industrial Microbiology- I: Biofilm formation and ecological implication, microbe-plant interactions, examples and importance, endophytes associated with agricultural crops, tree and medicinal plants, microbial genomics and metabolomics, microbe as biosensor, bioremediation and industrial waste management.

TEXT / REFERENCE BOOKS:

- Industrial Microbiology, ed. L.E. Casida, 1989, Wiley Eastern Ltd.

- Industrial Microbiology, ed. Prescott & Dunn, 1987, CBS. Publishers.
- Biotechnology: A hand book of Industrial Microbiology, ed. W. Crueger & A. Crueger.
- Enzymes: Biochemistry, Biotechnology & Clinical Chemistry, ed. T. Palmer, R.Wood publishers.
- Process Engineering in Biotechnology. ed. Jackson, Prentice Hall.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY) BT210B: BIOCHEMISTRY- II

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

Carbohydrate Metabolism: Glycolysis reactions, energetics and regulation, fate of pyruvate under aerobic and anaerobic conditions, pentose phosphate pathway and its significance, gluconeogenesis pathway and its regulation, biosynthesis of lactose, sucrose and starch, glycogenolysis and glycogenesis, control of glycogen metabolism, maintenance of blood glucose levels, pyruvate dehydrogenase and its regulation, TCA cycle: reactions, regulation and amphibolic nature, glyoxalate cycle, photosynthesis.

UNIT – II

Lipid Metabolism: Degradation of triacylglycerols by lipases, fatty acid activation, transport of fatty acyl CoA into mitochondria, beta-oxidation of saturated fatty acids, oxidation of unsaturated and odd carbon fatty acids, regulation of fatty acids oxidation, alpha & omega oxidation of fatty acids, peroxisomal beta-oxidation & formation & utilization of ketone bodies, acetyl CoA carboxylase, transport of acetyl CoA from: mitochondrial matrix to cytosol, biosynthesis of saturated fatty acids, elongation and desaturation of fatty acids, biosynthesis of tri acylglycerols, regulation of fatty acid metabolism.

UNIT – III

Protein and Amino Acid Metabolism: Essential & non essential amino acids, degradation & biosynthesis of amino acid, urea cycle: reactions, regulation and its linkage with the citric acid cycle, nitrogen cycle, regulation of amino acid biosynthesis.

UNIT – IV

Nucleic Acid Metabolism: De novo-biosynthesis of purine and pyrimidine nucleotides, regulation of purine and pyrimidine nucleotide biosynthesis, salvage pathways of purines and pyrimidines, formation of deoxyribonucleotides, catabolism of purines and pyrimidines.

Integration of Metabolism: Mitochondrial electron transport chain, mechanism of mitochondrial oxidative phosphorylation, hypotheses of oxidative phosphorylation, inhibitors and uncouplers of oxidative phosphorylation.

TEXT / REFERENCE BOOKS:

- Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Principles of Biochemistry (Hardcover) By Geoffrey Zubay. Publisher: McGraw Hill College.
- Biochemistry. By Lubert Stryer. WH Freeman and Co.
- Biochemistry (Hardcover) 3rd Ed. By Donald J. Voet and Judith G. Voet. John Wiley and Sons.
- Biochemistry and Molecular biology. By William H. Elliott and Daphne C. Elliott. Oxford University Press.
- Fundamentals of Biochemistry: Life at the Molecular Level [Import] (Hardcover) By Donald Voet, Judith G. Voet and Charlotte W. Pratt. Publisher: Wiley.
- Principles of Biochemistry (Paperback) By Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and David Rawn. Pearson Education.
- Biochemistry By U. S. Satyanarayana.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT212B: MOLECULAR BIOLOGY LAB**

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Isolation of plasmid DNA from prokaryotic cell.
2. Isolation of genomic DNA from prokaryotic cells.
3. Isolation of DNA from eukaryotic cells.
4. Qualitative and quantitative estimation of DNA: spectrophotometric/electrophoretic.
5. Gel electrophoretic separation of DNA & molecular weight determination.
6. Gel electrophoretic separation of RNA.
7. Isolation of proteins from eukaryotic cells.
8. Gel electrophoretic separation of proteins.
9. PCR amplification of DNA: visualization by gel electrophoresis.
10. Restriction mapping of plasmid DNA, involving single & double digestion of the plasmid with restriction enzyme.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT202B (Molecular Biology).

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT214B: IMMUNOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Routine techniques in handling laboratory animals: Feeding, cleaning & bleeding procedures for mice/ rabbit.
2. Preparation and administration of antigens.
3. Isolation and purification of immunoglobulins.
4. To perform single radial immunodiffusion test.
5. To perform differential leukocyte count of the given blood sample.
6. To perform double immunodiffusion test.
7. To perform Indirect/Dot ELISA.
8. To detect the blood group of the given blood sample.
9. To perform total leukocyte count of the given blood sample
10. To perform immunoelectrophoresis.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT204B (Immunology).

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT216B: BIO-ANALYTICAL TECHNIQUES LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Verification of Beer Lambert Law.
2. Separation of amino acids by paper chromatography.
3. Separation of sugars by paper chromatography.
4. Extraction of lipids from tissues and their separations by using TLC.
5. Partial purification of an enzyme by ammonium sulphate fractionation, Ion exchange & gel filtration chromatography of proteins.
6. Determination of molecular weight of an enzyme by gel filtration.
7. Isolation of proteins.
8. Separation of proteins by SDS-PAGE.
9. Disc gel electrophoretic separation of isoenzymes.
10. Study the enzyme linked immunosorbent assays (ELISA) and conduct suitable practical.

TEXT /REFERENCE BOOKS:

- Principles & Techniques of Practical Biochemistry, ed. K. Wilson & J. Walker, 1994, Cambridge University Press, Cambridge.
- Introductory Practical Biochemistry, ed., S.K. Sawhney & Randhir Singh, 2000, Narosa Publishing House, New Delhi.
- An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw Hill, Book Company. U.K.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT206B (Bio-Analytical Techniques).

B. TECH. SEMESTER – IV (BIOTECHNOLOGY) BT218B: INDUSTRIAL MICROBIOLOGY LAB

L T P Credits
- - 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Sterilization techniques (media, air, water).
2. Construction of various fermenters (Bioreactors).
3. Identification of industrially important microorganism e.g. molds, yeasts & bacteria.
4. Production of various products in the lab.- alcohol, wine , celluloses, proteases & bread.
5. Isolation of antibiotic producing microorganisms from the soil.
6. Penicillin production & testing of antimicrobial activity.
7. Isolation of streptomycin – resistant mutants by replica plating method.
8. Determination of cell growth: bacteria, fungi.
9. Qualitative estimation of various industrially important enzymes produced by various microbes.
10. Quantitative estimation of various industrially important enzymes produced by various microbes.

TEXT / REFERENCE BOOKS:

- Fermentations & Biochemical Hand Book, Principles, Process Design and Equipments. H.C. Vogel, Noyes, 1983.

- Exp. in Microbiology, Plant Pathology, Biotechnology, ed. Aneja K.R., 2003, New Age International Publishers, New Delhi.
- Microbiology lab. Manual, ed. Cappuccino J. & Sheeman N., 2004, Wesley, California.
- Manual of Industrial Microbiology & Biotechnology, Denain Daeivs J.E., 1999, ASM Press.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT208B (Industrial Microbiology).

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
BT203B: ENVIRONMENTAL STUDIES FIELD WORK

L T P Credits
 - - - 0

Field Work Marks : 25
 Total Marks : 25

FIELD WORK:

- Visit to a local area to document environmental assets – river/ forest/ grassland/ hill/ mountain.
- Visit to a local polluted site-Urban/ Rural/ Industrial/ Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc. (Field work equal to 5 lectures hours).

Note: The awards of this paper shall not be counted in the award of the Degree/ DMC.

B. TECH. SEMESTER – IV (BIOTECHNOLOGY)
GPBT202B: GENERAL PROFICIENCY & ETHICS

L T P Credits
1 - - 2

Exam Marks : 75 Marks
Total Marks : 75 Marks

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him/ her and will help them in terms of career guidance, personal difficulties.

A. The student will present a written report before the committee with following in view:

The student will present before the committee his/ her achievements during the current academic session in the form of a written report highlighting followings:

- | | | |
|-----|--|-------------------|
| I. | Academic Performance | ----- |
| II. | Extra Curricular Activities / Community Service, Hostel Activities | (8 Marks) |
| III | Technical Activities / Industrial, Educational tour | (8 Marks) |
| IV | Sports/games | (14 Marks) |
| V | Moral values & Ethics | (15 Marks) |

NOTE: Report submitted by the students should be typed on both sides of the paper.

B A student will support his/ her achievement and verbal & communicative skill through presentation before the committee. **(30 Marks)**

C. Moral values & Ethics

Syllabus- Process for Value Education, self-evaluation concept and process.

A minor test will be conducted during the semester and it will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

The evaluation of this course will be made by the following Committee.

University Departments:

| | | |
|---|-------------------------------|----------|
| 1 | Chairperson of the Department | Chairman |
| 2 | Senior Most Faculty Counselor | Member |
| 3 | Vice- Chancellor's Nominee | Member |

Affiliated Colleges:

| | | |
|---|---|----------|
| 1 | Director/Principal | Chairman |
| 2 | Head of the Department/Sr. Faculty | Member |
| 3 | External Examiner to be appointed by the University | Member |

Note: Remuneration will be paid to the external examiner only (at par with the other practical examinations).

**B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT301B: RECOMBINANT DNA TECHNOLOGY**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT- I

Genetic Engineering: Introduction, scope, milestones and guidelines, history of genetic engineering.

Tools of Recombinant DNA: Restriction endonucleases, modification enzymes and markers, hybridization, linkers and adapters, isoschizomers & isocaudomers.

DNA amplification: Polymerase chain reaction, principle, applications and variants of PCR.

UNIT – II

Gene cloning: Genomic DNA & cDNA library, construction of gene libraries, isolation of gene from library, cloning vectors, molecular probes, analysis of gene expression, site directed mutagenesis.

DNA Chip Technology - Microarrays and DNA chips, advantages of DNA chips in biotechnology.

UNIT – III

Gene Expression: Vector and host engineering, gene expression in bacteria, yeasts, mammalian cells and plants.

Gene Modification Techniques: Blotting techniques- northern, southern, western blotting techniques, processing of recombinant proteins, transposon and gene tagging.

UNIT – IV

Gene Therapy: Strategies of gene delivery in plants and animals, Augmented Gene Therapy and targeted gene therapy.

Applications of Recombinant DNA Technology: DNA fingerprinting and generation of novel proteins.

TEXT / REFERENCE BOOKS:

- Recombinant DNA, ed. James D Watson and Michael Gilman, 2001, W. H Freeman and Company NY.
- Molecular Biotechnology: Principles and Application of Recombinant DNA, ed. Bernard R Glick and Jack J. Pasternak, ASM press Washington DC.
- Genetic Engineering, ed. Kavita B Alhuwalia, New Age International (P) Ltd.

- An Introduction to Genetic Engineering, ed. Desmond S.T. Nicholl, Cambridge University Press.
- Genetic Engineering: An introduction to Gene analysis and exploitation in eukaryotes, ed.Kingsman and Kingsman.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER-V (BIOTECHNOLOGY)
BT303B: BIOREACTOR ANALYSIS AND DESIGN**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

Types of Reactors: Batch, plug flow reactor (PFR), continuous stirred tank reactor (CSTR), Fluidized bed reactor, bubble column, air lift fermenter, mechanical design of bioreactors.

Concept of Ideal and Non-ideal Reactors: Ideal and non ideal reactors, residence time distribution, models of non-ideal reactors- plug flow with axial dispersion, tanks-in-series model, chemostat model with cell growth kinetics

UNIT- II

Plug Flow Reactors: Plug flow reactor for microbial processes, optimization of reactor systems, reactors for solid state fermentation.

Multiphase Bioreactors: packed bed with immobilized enzymes or microbial cells, three phases fluidized bed trickling bed reactor, design and analysis of above reactor systems.

UNIT-III

Gas Liquid Reactors: Gas liquid reactors, unconventional bioreactors- hollow fiber reactor, membrane reactor and perfusion reactor for animal and plant cell culture.

UNIT-IV

High Performance Bioreactors: Sterile and non sterile operations- reactors in series with and without recycle, design of reactors.

TEXT / REFERENCE BOOKS:

- Landfill Bioreactor Design & Operation, ed. Debra R. Reinhant, Timothy G. Townsend and Tim Townsend, 1997, Lewis Publishers, Inc.

- Multiphase Bioreactor Design, ed. Joaquim M.S. Cabral, Manuel Mota, Johannes Tramper CRC Press, New York.
- Biological Treatment of Hazardous Wastes, ed. Prof. Gordon Lewandowshi and Dr. Louis DeFilippi, 1997, Publisher: Wiley-Interscience.
- Bioreactor & Ex Situ Biological Treatment Technologies – 5, ed. Bruce allerman, Bruce C Allerman Andrea Leeson, 1999, Published by Battelle Pr.
- Bioreaction Engineering: Modeling & control, ed. K Schugerl, and K.H. Bellgardt, 2000, Springer Verlag.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – V (BIOTECHNOLOGY) BT305B: BIOPROCESS ENGINEERING

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

Introduction: Introduction, history and role of bioprocess engineering in biotechnology industries, Concept of unit operation & unit processes.

Introduction to Engineering calculation: Variables, their dimensions and units, dimensionally homogeneous and non-homogeneous equations, standard conditions and ideal gases, physical and chemical property data, basics of materials and energy balances in a macroscopic view point.

UNIT-II

Thermodynamics of Bioprocesses: Introduction, activity coefficients and phase equilibrium, thermodynamics in describing biological processes, concept of coupling in biological processes, thermodynamics of coupled biochemical reactions, thermodynamics of active and passive transport, thermoanalysis of oxidative phosphorylation, stability of non-equilibrium stationery states.

UNIT - III

Fluid Mechanics: Principle of microbial nutrition, formulation of culture media, selective media, factors influencing the choice of various carbon and nitrogen sources, vitamins, minerals, precursors and antifoam agents, importance of pH, fluid verses solids, fluid static's mass and energy balance in fluid flow, Bernoulli's equation, flow past immersed bodies and drag coefficient, sterilization of process fluids, recovering and purifying products, integration of reaction and separation.

Heat Transfer and Mass Transfer: a brief introduction.

UNIT-IV

Principles and design of processes involving biochemical reactions: aerobic and anaerobic respiration and fermentation (involving pure and mixed cultures), shake flask, batch and continuous operations, solid state fermentations and their reactor designs, primary and secondary metabolites, energy balances and biochemical kinetics.

Biological production consideration: large scale production, enzyme kinetics, cell growth, energetics and mass transfer, production of penicillin, streptomycin, tetracycline and other antibiotics.

TEXT / REFERENCE BOOKS:

- Bioprocess Engineering, ed., Shuler ML and Kargi F, 2002, Prentice Hall PTR, New Jersey
- Bioprocessing, ed. Ward, O.P. 1991, New York
- Kinetics & Thermodynamics in Biochemistry, ed. Bray & White.
- Non Equilibrium Thermodynamics in Biophysics, ed. Katchalasky & Curran.
- Process Engineering in Biotechnology, ed. A.T. Jackson
- Bioprocess Technology Fundamentals, ed. Baily and Ollis
- Biochemical Reactors, ed. B. Atkinsom
- Chemical Engineering, ed., J.M. Coulson and J.F. Richardson Pergamon Press.
- Bioprocess Engineering: Systems, equipments and facilities, ed. K.B. Lydersen, N.A.D'elia and K.L. Nelson, 1994, John Wiley & Sons, New York.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT307B: DOWNSTREAM PROCESSING**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction and Overview: History and scope of downstream processing in biotechnology, problems, requirement of purification, overview of a bioprocess including upstream and downstream processing, characteristics of biotechnology products, classes of bioproducts, physicochemical basis of bioseparation.

UNIT-II

Principles and Operation: Principles, operation, design and scale-up of the mechanical methods, cell disintegration, separation of particulate by filtration, centrifugation, settling, sedimentation, decanting and microfiltration, primary isolation methods including solvent extraction, sorption, precipitation, ultrafiltration and reverse osmosis, application of above methods in purification of antibiotics and enzymes, purification methods- fractional precipitation, electrophoresis, electro dialysis and various kinds of chromatography.

UNIT-III

Emerging Separation Techniques: Dynamic immobilization, reverse osmosis, super critical fluid extraction evaporation, super liquid extraction and foam based separation, separation of intracellular, extracellular, heat and photosensitive materials, product recovery trains- a few examples.

UNIT-IV

Downstream Processes and Effluent Treatment: Applications of unit operations in downstream with special reference to membrane separations & extractive fermentation, anaerobic and aerobic treatment of effluents, typical examples for downstream processing and effluent disposal in process industries.

TEXT / REFERENCE BOOKS:

- Biochemical Engineering Fundamentals, ed. J E Bailey and D F Ollis, 1986, McGraw Hill.

- Principles of fermentation technology, ed. P F Stanbury and A Whitaker, 1984, Pergamon press.
- Unit Operation of Chemical Engineering, ed. W.L. McCabe, J .C. Smith and P. Harriott, 2000, McGraw Hill.
- Separation Process Principles, ed. J.D.Seader & E.J Henley, 1998, John Wiley & Sons.
- Bioseparation: Downstream Processing for Biotechnology, ed. P.A. Belter, E.L Cussler and W.S. Hu, 1998, John Wiley & Sons.
- Bioseparations Science and Engineering, ed. R.G. Harrison, P. Todd, S.R. Rudge and D.P Petrides, 2003, Oxford Press.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – V (BIOTECHNOLOGY)

BT309B: DIAGNOSTIC TECHNIQUES

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Introduction and Basic Considerations: Immunological diagnostic procedures- isolation and characterization of antibodies, antigen-antibody reactions, immuno assay systems, signal amplification systems, reagent formulation and their shelf life evaluation.

Enzyme-Linked Immunosorbent Assay (ELISA) system: Applications in clinical diagnosis and prognosis of various diseases, membrane based rapid immuno assays.

UNIT – II

Monoclonal Antibodies: Formation and selection of hybrid cells, screening for specific antibodies producing hybrid cell lines.

Applications of Monoclonal Antibodies: Detection of polypeptide hormones, tumor markers and cytokines, diagnosis of infectious diseases and drug monitoring, detection of miscellaneous targets.

DNA Diagnostic Systems: Nucleic acid hybridization assay systems, basic considerations, production of various types of hybridization probes, diagnosis of *Plasmodium falciparum*, *Mycobacterium tuberculosis*, *Trypanosoma cruzi* and sickle cell by DNA hybridization.

UNIT-III

Non-radioactive Hybridization procedures: Use of chromogenic or chemiluminescent substrates and specific enzymes for detecting signal amplification.

Special diagnostic tools: DNA finger printing and Random Amplified Polymorphic DNA (RAPD) as diagnostic tools.

UNIT-IV

Molecular Diagnosis of Genetic Diseases: Significance in prenatal diagnosis, diagnosis before onset of symptoms and identification of carriers of hereditary disorders.

PCR / OLA Procedures: Diagnosis of hereditary diseases caused by mutations not affecting restriction endonuclease sites, genotyping with fluorescence labeled PCR primers, detection of mutations at different sites within one gene.

TEXT / REFERENCE BOOKS:

- Essentials of Diagnostic Microbiology, ed. Lissa Anne Shimeld.
- Diagnostic Microbiology, ed. Balley and Scott
- Recombinant DNA, ed. James D Watson and Michael Gilman, 2001, W. H Freeman and Company New York.
- Molecular Biotechnology: Principles Application of Recombinant DNA, ed. Bernard R Glick and Jack J. Pasternak, ASM press Washington DC.
- Methodology of immunochemical and immuno-logical research, ed. Kwapinski-Willey inter science.
- A handbook of practical immunology, ed. G.P Talwar, Vikas Publishing house Pvt Ltd.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT311B: BIOSTATISTICS**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT I

Introduction: Basic quantitative methods– mean, median, mode, standard deviation, standard error, range, variance, descriptive statistics of location, dispersion and related parameters.

Presentation of data in biology: Samples and variables, frequency distributions, graphical presentation of data by histogram, frequency curve and cumulative frequency curves.

UNIT II

Basic Probability and Probability Distributions: Random distributions, Binomial, Poisson, and Normal distributions.

Sampling: Concept of population and sample, random sample, methods of taking a simple random sample.

Regression and Correlation: Bivariate data- simple correlation and regression coefficients and their relation, limits of correlation coefficient, effect of change of origin and scale on correlation coefficient, linear regression and equations of line of regression, association and independence of attributes.

UNIT - III

Estimation, Hypothesis Testing: Sampling distribution of mean and standard error, confidence limits for means, t-, chi-square and F- distribution, confidence limits for variances, paired and unpaired t-test for correlation and regression coefficients, T-test for comparison of variances of two populations, Chi-square test for independence of attributes, Goodness of fit and homogeneity of samples.

UNIT IV

Experimental Designs: Principles of experimental designs, completely randomized, randomized block and latin square designs, simple factorial experiments of 2², 2³, 2⁴ and 2³² types, confounding in factorial experiments, analysis of variance (ANOVA) and its use in the analysis of RBD, analysis of covariance.

Applications of statistical methods in biotechnology.

TEXT / REFERENCE BOOKS:

- An introduction to biostatistics, ed. Glover, T. and K. Mitchell, 2002, McGraw-Hill, New York.
- Fundamentals of Biostatistics, ed. Bernard Rosner, 1999, Duxbury Press.
- Fundamental of Biostatistics, ed. Veer Bala Rastogi, Rastogi Publication
- Statistical methods in biology. By: Norman T.J. Bailey (3rd Edition), 1995, Cambridge University Press.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT313B: RECOMBINANT DNA TECHNOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Isolation of plasmid DNA.
2. Isolation of prokaryotic genomic DNA.
3. Isolation of genomic DNA from plants.
4. Restriction endonuclease profile analysis.
5. Restriction endonuclease digestion of any vector.
6. Dephosphorylation of RE enzyme digested vector.
7. Construction of recombinant DNA.
8. Transformation of E. coli cells with rDNA and verification of cloned DNA.
9. Polyacrylamide gel electrophoresis (PAGE) of proteins.
10. Southern hybridization/ Northern hybridization.

TEXT / REFERENCE BOOKS:

- Molecular Cloning – A laboratory manual, ed. J. Sambrook and D.W. Russell, 2001, Cold Spring Harbor laboratory Press, New York
- DNA cloning: A Practical Approach, ed. Glover and Hames

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT301B (Recombinant DNA Technology).

B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT315B: FERMENTATION TECHNOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Isolation and screening of microorganisms for cellulase/amylase production.
2. Microbial production of glutamic acid.
3. Isolation and screening of microorganisms involved in degradation of xenobiotics.
4. Production, purification and bioassay of Rifamycin/Streptomycin.
5. Production, distillation and estimation of ethanol using various organic wastes/ raw material (e.g. agro wastes, different fruit juices, etc.) from free cells of yeast/ ethanol fermentation using yeast.
6. Study of factors affecting bioprocesses in submerged fermenters: pH, O₂, temperature, ingredients, foam etc.
7. Production, extraction and bioassay of thuricide.
8. Laboratory scale production of biofertilizers (Nitrogen fixers/Phosphate solubilizers).
9. Microbial production, purification, qualitative and quantitative estimation of polysaccharides from *Leuconostoc mesenteroides*/ *Pseudomonas*.
10. Microbial production of single cell protein by algae/bacteria/yeast.
11. Study the design and operation of a bioreactor.
12. Study the design and operation of downstream processing.

TEXT/ REFERENCE BOOKS:

- Biotechnological Innovations in Chemical Synthesis. BIOTOL. Publishers/ Butterworth - Heinemann.
- Industrial Microbiology by G. Reed (Ed), CBS Publishers (AVI Publishing Co.)
- Biology of Industrial Microorganisms by A.L. Demain.
- Genetics and Biotechnology of Industrial Microorganisms by C.I. Hershenberg, S.W. Queener and Q. Hegeman. Publisher. ASM. Ewens ET. Al. 1998. Bioremediation Principles. Mac Graw Hill.
- Annual Reports in Fermentation Processes by D. Pearlman, Academic Press.
- Fundamentals of Biochemical Engineering by Bailey and Ollis
- Manual of Industrial Microbiology and Biotechnology 2nd edition by Davis J.E. and Demain A.L. ASM publications

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory courses: BT303B (Bioreactor Analysis and Design), 305B (Bioprocess Engineering) and 307B (Downstream Processing).

B. TECH. SEMESTER – V (BIOTECHNOLOGY)
BT317B: DIAGNOSTIC TECHNIQUES LAB

L T P Credits
0 0 2 1

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Perform the technique of ELISA.
2. Study the technique of Random Amplified Polymorphic DNA as (RAPD) diagnostic tool
3. To study the significance of PCR in disease diagnosis.
4. Detection of pathogens by SRID and DID.
5. Study techniques of Immunoblot.
6. Study the diagnosis of VDRL by immunoassay.
7. DNA primer probe selection – use commercially available probes to amplify gene fragment in clinical samples.
8. Calculate LC_{50} / LD_{50} for a toxicant.
9. Diagnosis of typhoid by Widal test.
10. Detection of microbial pathogens by immunoelectrophoresis.

TEXT / REFERENCE BOOKS:

- Antibodies: A laboratory manual, ed. Harlow and David Lane, 1988, Cold Spring Harbor laboratory Press.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT309B (Diagnostic Techniques).

B. TECH. SEMESTER – V (BIOTECHNOLOGY) BT319B: PROFESSIONAL TRAINING- I

L T P Credits
- - 2 1

Class Work Marks : 50
Exam Marks : -
Total Marks : 50

At the end of 4th semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.

The typed report should be in a prescribed format.

The report will be evaluated in the V Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The student will interact with the committee through presentation to demonstrate his/her learning.

Teachers associated with evaluation work will be assigned 2 periods per week load.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)
BT302B: PLANT BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: Scope of plant biotechnology, cryo and organogenic differentiation of plant cells, types of culture: seed, embryo, callus, organ, cell and protoplast culture.

Micropropagation: Axillary bud proliferation, meristem and shoot tip culture, bud culture, organogenesis, embryogenesis, advantages and disadvantages of micropropagation.

Cell Suspension and Secondary Metabolites: Types of Suspension cultures and applications. Production of secondary metabolites-Applications and problems associated with their production.

UNIT - II

In-vitro production of haploids: Androgenic methods, anther culture, microspore culture, factors effecting regeneration, significance and use of haploids, ploidy level and chromosome doubling, diploidization, gynogenic haploids, factors affecting gynogenesis.

Somaclonal variation: Nomenclature, methods, applications, basis and disadvantages, gametoclonal variation.

UNIT - III

Protoplast Isolation and fusion: Methods of protoplast isolation, protoplast development, somatic hybridization, identification and selection of hybrid cells, cybrids, potential of somatic hybridization, limitations.

Germplasm storage and Cryopreservation: Nomenclature, method, cryoprotectants, pretreatment, freezing, storage, thawing, determination of survival, applications of cryopreservation.

UNIT - IV

Plant Molecular Biology: Plant gene structure as a discontinuous gene, control sequences.

Gene transfer in plants: Transient and stable gene expression, marker genes, selectable and scorable markers.

Gene transfer methods: Direct and indirect methods of gene transfer. *Agrobacterium* mediated gene transfer, vectorless or direct DNA transfer, physical and chemical methods of gene transfer.

Transgenics in crop improvement: Resistance to biotic stresses- insect, virus and disease (fungus and bacterium) resistance, resistance to abiotic stresses, herbicide resistance, transgenic plants as bioreactors and edible vaccines, commercial transgenic crops.

TEXT / REFERENCE BOOKS:

- Introduction to Plant Biotechnology, ed. H.S Chawla, Oxford and IBH Publishers, New Delhi.
- Handbook of Plant Biotechnology, Vol. I and II. By Paul Christou and Harry Clee. John Wiley and Sons, Ltd.
- Molecular Biotechnology: Principles and Applications of recombinat DNA, ed. Bernard R Glick, Jack.J. Pasternak, ASM press Washington DC.
- Plant Biotechnology: The genetic Manipulation of plants by Adrian Slater, Nigel W. Scott, Mark R.Fowler, Oxford University Press.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)

BT304B: ANIMAL BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: History and scope of animal biotechnology.

Basic techniques of animal cell culture & their applications: Balanced salt solutions and simple growth media, serum quality and cell culture, animal cell lines, organ cell culture and its applications.

UNIT – II

Preservation and maintenance of animal cell lines: Cryopreservation and transport of animal germplasm (i.e. semen, ovum and embryos)

Transgenic animals: Methodology– retroviral vector method, DNA microinjection method and engineered embryonic stem cell method, cloning by nuclear transfer, yeast artificial chromosome transgenesis, *in vitro* fertilization and embryo transfer.

UNIT -III

Molecular biological techniques: Rapid diagnosis of genetic diseases and gene therapy, molecular maps of animal genomes, chemical carcinogenesis and transfection, oncogenes and antioncogenes.

UNIT-IV

Gene cloning: Techniques for mammalian cells, establishment of immortal cell lines, cloning in mammalian cells, expression of mammalian genes in prokaryotic and eukaryotic systems, extinction of gene function by antisense RNA and DNA.

TEXT / REFERENCE BOOKS:

- Molecular Biotechnology, ed. Old and Primrose.

- Molecular Biotechnology: Principles and Applications of recombinant DNA, ed. Bernard R. Glick, Jack. J. Pasternak, ASM press Washington DC.
- Animal Cell biotechnology, ed. R.E. Spier and J.D Griffiths, 1988, Academic press, U.S.A.
- Living resources for Biotechnology of Animal cells, ed. A. Doyle, R. Hay and B.E. Kirsop, 1990, Cambridge University Press, Cambridge, U.K.
- Animal Biotechnology, ed. Murray Moo-Young, 1989, Pergamon Press, Oxford.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)

BT306B: ENZYME BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Enzymes: Introduction, nomenclature and classification of enzymes, mechanism of action, isolation and purification of enzymes, mol. wt. determination and characterization, enzyme specificity: types & theories (lock & key, induced fit & three point attachment), applications of enzymes in industrial, medical, analytical, chemical, pharmaceutical and food sector.

UNIT-II

Immobilized Enzymes: Methods of immobilization, kinetics of immobilized enzymes, free vs immobilized enzymes, economic argument for immobilization, effect of solute partition and diffusion on it, applications of immobilized enzymes.

UNIT- III

Enzymes and Bioreactors: Bioreactors using immobilised enzymes (enzyme reactor, membrane reactor, continuous flow reactors, packed bed reactor, continuous flow stirred tank reactor, fluidised bed reactor), immobilized enzyme processes.
Biocatalysts: Advantages of enzyme vs chemical catalysts, enzyme vs fermentation, applications of biocatalysts: industry, medicine & analysis, enzyme business in India and abroad.

UNIT- IV

Large scale/ Industrial uses of enzymes: Enzyme used in detergents, use of proteases in food, leather and wool industries, production of glucose syrup from starch using starch hydrolyzing enzymes, production of syrup containing maltose, enzyme in sucrose industry, glucose from cellulose, lactose in dairy industry, glucose oxidase and catalase in food industry and medical application of enzymes.

Enzyme reactions in organic media, design and construction of novel enzymes, artificial enzymes, basic principles of biosensors and their applications.

TEXT/ REFERENCE BOOKS:

- Fundamentals of Enzymology by Prives and Stevens Oxford Press (1999)
- Principles of enzymology, for Food Science 1972 by JR Whitkar, M Dekker Publishers.
- Biochemical Engineering, ed. James M. Lee, 1992, Prentice Hall.
- Design and Analysis of immobilised Enzyme flow Reactors, ed. W.R Vieth etal.
- Principles of Enzymology for Technological Applications, ed. Butterworth, 1993, Heinemann Ltd. Oxford.
- Enzymes in Industry: Production and Applications, ed. W. Gerhartz, 1990, VCH Publishers, New York.
- Biocatalysts for Industry, ed. J.S Dordrick, 1991, Plenum press, New York.
- Enzyme Technology, ed. M.F. Chablin and C. Buoke, 1990, Cambridge University Press Cambridge.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)
BT308B: ENVIRONMENTAL BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Environment: Introduction, basic concept and issues, current status of biotechnology in environment protection, approaches for management methodology and limitations.

Environment Pollution: types of pollution in air, water and soil, water as a scarce natural resource, sources of pollution, measurement, collection and treatment.

UNIT- II

Microbiology of Waste Water Treatment: Waste water collection, treatments – physical, chemical and biological process, aerobic and anaerobic process, activated sludge, oxidation ditches, filters, rotating discs and drums, and bioreactors, treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotics industries.

UNIT – III

Microbiology of degradation of xenobiotics: Xenobiotic compounds, hazardous wastes, Biodegradation, ecological consideration, biological detoxification, biotechnological management.

Bioremediation: Introduction, types, advantages, systems, applications and current market, restoration of degraded soil and waste land, biopesticides in integrated pest management and solid waste management.

UNIT-IV

Global Environmental Problems: Ozone depletion, UV-B, green house effect, acid rain, their impact and management.

Novel Methods for Pollution Control: Vermitechnology, waste water treatment using aquatic plants, root zone treatment, aiming for biodegradable and ecofriendly products.

TEXT / REFERENCE BOOKS:

- Waste water Engineering Treatment and Disposal and Reuse, ed. Metcalf & Eddy.
- Water Pollution Management hand Book, ed. Lepathak.
- Waste Water Management, ed. Arceivala.
- Environment Biotechnology, ed. C.F. Forster and D.A. J. Wase.
- New Processes of Waste water treatment and recovery, ed. G. Mattock, Ellis Horwood.
- Biochemical Engineering fundamentals, ed. J.E. Bailey and D F Ollis, 1986, McGraw-Hill. Chapters 12 & 14
- Environment Biotechnology, ed. Jogdand.
- Comprehensive Biotechnology, ed. Murray Moo- Young (Editor) Pergamon Press.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY) BT310B: FOOD BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Historical Background: History of microorganisms in food, historical developments.

Sources, Types, Incidence, and Behavior of Microorganisms in Foods: Role and significance of microorganisms, primary sources of microorganisms found in foods, synopsis of common food-borne bacteria, synopsis of genera of molds common to foods, synopsis of genera of yeasts common to foods.

UNIT-II

Intrinsic and extrinsic parameters of foods, food additives like colouring, flavours and vitamins.

Determining Microorganisms and their Products in Foods: Culture, microscopic and sampling methods, conventional, SPC, membrane filters, microscopic colony counts, agar droplets, dry films, MPN, DMC, dye reduction, roll tubes, , enumeration and detection of food borne organisms, physical, chemical and immunological methods.

UNIT-III

Bioassay, alcoholic beverages and fermented foods. Microbiological examination of surfaces and sampling, metabolically injured organism

New Protein Foods: Single cell protein (SCP), mushroom, food yeast's, algal proteins.

Food Borne Diseases: Bacterial and viral.

UNIT-IV

Food Spoilage: Spoilage of fruits and vegetables, microbial spoilage of vegetables, spoilage of fruits, spoilage of fresh and processed meats, poultry, sea foods, spoilage of miscellaneous foods, food preservation, characteristics of radiations of

interest in food preservation, destruction of microorganisms and applications, radappertization, radioirradiation and radurization of food, legal status of food irradiation.

Storage and Stability of Food Preservation: High and low temperature, drying, pathogens, psychrotrophs, thermophiles and radiation resistance microorganisms, brief account of food borne diseases.

TEXT / REFERENCE BOOKS:

- Modern Food Micro-Biology, ed. J.M. Jay, 1986, Van Nostrand Reinhold Company, New York.
- Food Microbiology, ed. Adams & Moss 1996, CBS Publishers, New Delhi

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VI (BIOTECHNOLOGY)
BT312B: CELL & TISSUE CULTURE LAB**

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Preparation of liquid and solid plant tissue culture media.
2. To induce roots at the base of shoots to get plantlet.
3. Transplantation of rooted shoots to soil.
4. Induction of callus.
5. Protoplast isolation and culture.
6. Anther culture and production of haploid.
7. Induction of somatic embryos using carrot.
8. Transformation of a plant species using *Agrobacterium tumefaciens*.
9. Isolation of genomic DNA from plants.
10. Primary cell culture of human lymphocytes.
11. Induction of interferon in cell culture.
12. Culture of fibroblast and epithelial cells.

TEXT / REFERENCE BOOKS:

- Culture of Animal Cells – A manual of basic techniques, ed. R.I Freshney, John Wiley & Sons, New York.
- Experiments in Plant Tissue Culture, ed. J.H. Dodde and I.W. Robert, 1998.
- Practicals in Plant Biotechnology, ed. H.S. Chawla, Oxford & IBH Publications, New Delhi.
- Plant Tissue Culture: Theory and Practice, ed. S.S. Bhojwani and M.K. Razdan, 1996, Elsevier Science, Netherlands.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT302B (Plant Biotechnology) and BT304B (Animal Biotechnology).

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)
BT314B: ENZYME & FOOD BIOTECHNOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Purification of an enzyme (oxalate oxidase) by gel filtration and ion exchange chromatography.
2. Testing of purity of purified enzyme (oxalate oxidase).
3. Determination of the molecular weight of enzymes by gel filtration method.
4. Immobilization of an enzyme (alkaline phosphatase) on an insoluble and soluble support.
5. To examine the effect of pH, substrate and temperature on enzyme activity.
6. To check the quality of the given milk sample by MBRT.
7. To isolate, enumerate and purify bacteria and fungi in the given food samples.
8. To characterize the food borne bacteria by biochemical tests.
9. To test the potability of water by MPN.
10. To analyze air of food processing facility for microbial load.
11. To assess the sanitary quality of contact surfaces.
12. To detect adulteration in food.

TEXT / REFERENCE BOOKS:

- Enzymes in Industry: Production and Applications, ed. W. Gerhartz, 1990, VCH Publishers, New York.
- Biocatalyst for Industry, ed. J.S Dordrick, 1991, Plenum press, New York.
- Modern Food Microbiology, ed. J.M. Jay, 1986, Van Nostrand Reinhold, New York.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT306B (Enzyme Biotechnology) and BT310B (Food Biotechnology).

B. TECH. SEMESTER – VI (BIOTECHNOLOGY)
BT316B: ENVIRONMENTAL BIOTECHNOLOGY LAB

L T P Credits
0 0 4 2

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Determination of water TDS, salinity, alkalinity, hardness and BOD.
2. Determination of BOD.
3. Estimation of heavy metals in water/soil samples.
3. Estimation of nitrate, phosphate and sulphate in drinking water.
4. Determination of chemical oxygen demand (COD) of sewage samples.
5. Isolation of xenobiont degrading bacteria by selective enrichment techniques.
6. Degradation of aromatic hydrocarbons by bacteria.
7. Study on biogenic methane production in different habitats.
8. Isolation and enrichment of the microorganisms for the degradation of harmful environmental pollutants.
9. Effect of sulphur dioxide on crop plants.

10. Survey of degradative plasmids in microbes growing in polluted environment.

TEXT / REFERENCE BOOKS:

- Water Pollution Management hand Book, ed. Lepathak.
- Environmental Biotechnology, 2007. BC Bhattacharyya & Ritu Banerjee. Ed. Oxford University Press.
- Waste Water Management, ed. Arceivala.
- Environment Biotechnology, ed. C.F. Forster and D.A. J. Wase.
- New Processes of Waste water treatment and recovery, ed. G. Mattock and Ellis Horwood.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT308B (Environmental Biotechnology).

HUM 302B REPORT WRITING SKILLS
B. TECH. SEMESTER – VI (Common for all branches)

| L | T | P | Credit |
|---|---|----|--------|
| 1 | - | -- | 1 |

| | |
|--------------------------------|-------------------|
| Class Work | : 25 Marks |
| Examination | : 50 Marks |
| Total | : 75 Marks |
| Duration of Examination | : 2 Hours |

OBJECTIVE

The course aims at developing competence for report writing with a focus on its complex writing techniques and procedures.

UNIT I

Report Writing

Reports: meaning, their importance and types, Structure of reports, Formats of reports, Use of illustrations.

UNIT II

Writing of Business and Technical Reports:

Preliminary steps and procedure of writing report, writing various types of reports on technical, business related topics

RECOMMENDED READING

1. Borowick, Jerome. N. *Technical Communication and its Applications*. New Delhi: PHI, 2000
2. Guffey, Mary Ellen. *Business Communication: Process & Product*. USA: South western College Publishing, 2000.
3. Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

SCHEME OF END SEMESTER EXAMINATION (MAJOR TEST) AND INSTRUCTIONS FOR THE EXAMINER

1. The duration of the exam will be 2 hours.

2. The Question Paper for this theory course shall have three questions in all covering both the units. All will be compulsory with internal choice.
3. Question no. 1 will be of 10 marks. The question may have two/ three parts with enough internal choice, covering various components of both the Units.
4. Question no 2 with internal choice will be of 10 marks covering contents of the Unit I. It will be theoretical in nature.
5. Question no 3 will have two parts of 15 marks each. The student will be asked to write reports on business and technical subject/ issue covering contents of Unit II. The emphasis would be on testing the actual report writing on a given business and technical situation/ subject in letter format.

HUM 304B ORAL PRESENTATION SKILLS
B. TECH. SEMESTER – VI (Common for all branches)

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| -- | -- | 2 | 1 |

| | |
|--------------------------------|-------------------|
| Class Work | : 20 Marks |
| Examination | : 30 Marks |
| Total | : 50 Marks |
| Duration of Examination | : 2 Hours |

OBJECTIVE

To enable students to develop their speaking skills with professional proficiency

Oral Presentations:

Group Discussion; Mock interviews

Note for the Teacher:

The teacher concerned, by devising her/ his method, must preview and review the student's spoken proficiency at the beginning and end of the semester respectively to find the efficacy of the course and degree of improvement in the student.

RECOMMENDED READING

1. Konar, Nira. *English Language Laboratories: A Comprehensive Manual*. Delhi: PHI, 2011
2. Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

SCHEME OF END SEMESTER EXAMINATION (Practical)

An external Practical exam of 30 marks of 2 hour duration for the course will be conducted by an external examiner appointed by the competent authority of the University's.

NOTE: Students will be tested for their oral communication competence making them participate in Group discussion, mock situations for interview. Students may also be evaluated through a viva conducted by an external examiner.

B. TECH. SEMESTER – VI (BIOTECHNOLOGY) GPBT302B: GENERAL PROFICIENCY & ETHICS

L T P Credits
1 - - 2

Exam Marks : 75 Marks
Total Marks : 75 Marks

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

A. The student will present a written report before the committee with following in view:

The student will present before the committee his/ her achievements during the current academic session in the form of a written report highlighting followings:

- | | | |
|-----|--|-------------------|
| I. | Academic Performance | ----- |
| II. | Extra Curricular Activities / Community Service, Hostel Activities | (8 Marks) |
| III | Technical Activities / Industrial, Educational tour | (8 Marks) |
| IV | Sports/games | (14 Marks) |
| V | Moral values & Ethics | (15 Marks) |

NOTE: Report submitted by the students should be typed on both sides of the paper.

B. A student will support his/her achievement and verbal & communicative skill through presentation before the committee. (30 Marks)

C. Moral values & Ethics

Syllabus- A few topics from below mentioned books:

1. R.R.Gaur, R. Sangal and G.P. Bagaria, “ Bagaria, “ A foundation course in Human Values and Professional Ethics”, Pub: Excel Books, New Delhi-110028.
2. M. Govindrajan, S Natrajan & V.S. Senthil Kumar, “ Engineering Ethics (including Human Values)” Eastern Economy Edition, Prentics Hall of India Ltd.

A minor test/ Quiz will be conducted during the semester and It will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

A minor test/ Quiz will be conducted during the semester and it will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

The evaluation of this course will be made by the following Committee.

University Departments:

| | | |
|---|-------------------------------|----------|
| 1 | Chairperson of the Department | Chairman |
| 2 | Senior Most Faculty Counselor | Member |
| 3 | Vice- Chancellor’s Nominee | Member |

Affiliated Colleges:

| | | |
|---|---|----------|
| 1 | Director/Principal | Chairman |
| 2 | Head of the Department/Sr. Faculty | Member |
| 3 | External Examiner to be appointed by the University | Member |

Note: Remuneration will be paid to the external examiner only (at par with the other practical examinations).

B. TECH. SEMESTER – VII (BIOTECHNOLOGY) BT401B: BIOINFORMATICS

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Introduction: Internet, intranet and extranet, networking, protocols, genomic data, organization, representation, data base management systems.

Sequencing Data Bank: Introduction, collecting and storing sequence in laboratory, nucleic acid data bank – Gen Bank, EMBL, AIDS and RNA, protein data bank (PDB), cambridge structural database CSD, genome data bank, hybridoma data bank structure and others.

UNIT-II

Sequence Analysis: Analysis tools for sequence data banks, pair wise alignment: NEEDLEMAN and WUNSCH algorithms, Smith Waterman, multiple alignment – CLUSTAL-W, BLAST, FASTA, sequence patterns and motifs and profiles.

Predictions: Secondary and tertiary structure: algorithms Chao-Fasman algorithm, hidden Markov model, neural networking, protein classification, fold libraries, fold recognition (threading), homology detection, SRS-access to biological data banks.

UNIT-III

Phylogenetic Analysis– Basic concepts in systematics, taxonomy and phylogeny, phylogenetic trees- various types and their construction, tree building methods, distance methods, multiple alignment character based method, phylogenetic software.

Managing Scientific Data: Introduction, challenges faced in integration of biological information, SRS, Kleisli Query System TAMBIS, P/FDM mediator for a bioinformatics database, federation, discovery link and data management.

UNIT-IV

Genomics & Proteomics: Genome mapping, assembly and comparison, functional genomics: sequence based approaches & microarray based approaches, proteomics: technology of protein expression analysis & posttranslational modifications, protein sorting, protein-protein interaction.

TEXT / REFERENCE BOOKS:

- Developing Bioinformatics Computer Skill, ed. Gibes & Jombeck, Shroff Publication
- Bioinformatics, ed. David W. Mount

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT403B: DRUG AND VACCINE DEVELOPMENT**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT- I

Drug Development: Proteins as therapeutic agents, choice of expression systems and optimizing gene expression, delivery and targeting of therapeutic proteins, engineering human interferons and human growth hormones, regulatory aspects of therapeutic proteins.

Enzymes as Therapeutic Agents: Use of genetically engineered DNase I, phenyl ammonia lyase and alginate lyase for treatment of cystic fibrosis.

UNIT- II

Monoclonal Antibodies as Therapeutic Agents: Production of Monoclonal antibodies, human monoclonal antibodies - its scope and limitations, hybrid human-mouse antibodies, production of antibodies in *E.coli*, approaches for producing HIV therapeutic agents.

UNIT- III

Immune System in Health and Medicine: Immune response against viral & bacterial diseases, diseases caused by protozoan and parasitic worms (helminths), emerging infectious diseases, active and passive immunity, autoimmunity, rationale of immunization.

UNIT-IV

Vaccine Development: Designing vaccines, adjuvants, whole organism vaccines-attenuated viruses and bacteria, inactivation of pathogenic organisms by heat and chemical treatment, purified macromolecules as vaccines, bacterial polysaccharides, proteins and toxins as vaccines, recombinant vaccines, subunit, and vector vaccines, univalent, bivalent & multivalent vaccines, vaccine development against AIDS, commercial and regulatory aspects of vaccine production and its distribution.

TEXT/ REFERENCE BOOKS:

- Molecular Biotechnology: Principles Application of Recombinant DNA, ed. Bernard R Glick and Jack J. Pasternak, ASM press Washington DC.
- Basic Biotechnology, ed. Ratledge and Kristiansen, Cambridge University press.
- New generation vaccines, ed. woodsaw, GC & LeineHM, Marcel Dekker Inc., New York.
- Recombinant DNA vaccines: Rationale & Strategies, ed. Richard E.I, Marcel Dekker Inc., New York.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT405B: BIOSENSORS**

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: Scope and history of biosensors, concept and applications of biosensors.

Biosensors and human health: Biosensors for personal diabetic management, diseases diagnosis by using biosensors. Non-invasion biosensors in clinical analysis

UNIT - II

Surface plasmon resonance.

Biosensors based on evanescent waves.

UNIT – III

Development of biosensors: Biosensor based instruments to the bioprocess industry–their applications and development. Development and application of biosensors for environment samples, pollution and control.

UNIT – IV

Micro fabricated sensors and commercial development of the i Stat Point-of-care system.

Biochips as biosensors: Introduction to biochips and their applications in modern sciences.

TEXT /REFERENCE BOOKS:

- Commercial Biosensors, ed. Graham Ramsay, John Wiley Publishers

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VII (BIOTECHNOLOGY) BT407B: MICROBIAL BIOTECHNOLOGY

L T P Credits
3 1 - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Biocatalysis and Enzyme Biotechnology: Biomimetic catalysis, industrial biocatalysis, extremozymes, modular enzymes, Michaelis & menton equation & its deviation.

Isolation and Purification of Enzymes: Extraction of enzymes, preparation of crude enzymes, purification of enzymes, processing of enzymes, applications of enzymes in various sectors.

UNIT II

Protein and Enzyme Engineering: History, basic principles, methods and their applications.

Metabolic Engineering: Heterogonous gene expression, complementing, transferring and engineering of metabolic pathways, redirecting metabolite flow.

UNIT III

Single Cell Protein (SCP): Introduction, conventional protein sources, substrates, microorganisms used, SCP from CO₂, carbohydrates, hydrocarbons.

Molecular Breeding of Biosynthetic Pathways: Metabolic engineering for carotenoid, polyhydroxy-alkanoates and alkaloid biosynthesis, metabolic control analysis, metabolomics.

UNIT IV

Microbes and Microbial Genomics for Industry: Microbial transformations, transformation of steroids, sorbitol, sorbose and antibiotics, microbes in paper industry, biohydrometallurgy and biomineralization.

Microbial Genomics in Industry: Techniques used for analysis of microbial genomes and their use for designing vaccines and drugs.

TEXT / REFERENCE BOOKS:

- Biotechnology and Genomics, ed. P.K. Gupta, 2004, Rastogi Publications, Meerut, India.
- Biotechnological Innovations in Chemical Synthesis, ed. M.C.E Van Dam-mieras et al., 1997, Butterworth-Heinemann, Oxford, U.K.
- Biotechnology, ed. John E. Smith, Cambridge University Press.
- Methods for General and Molecular Bacteriology, ed. Gerhardt P, Murray RG, Wood WA & Kreig NR, 1994.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT409B: BIOINFORMATICS LAB**

L T P Credits
0 0 2 1

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

1. Retrieval of sequences from NCBI.
2. Retrieval of sequences from DDBJ.
3. Retrieval of structures from PDB.
4. DNA sequence analysis using BLAST.
5. To perform pairwise alignment using l-align & s-search.
6. To perform multiple alignment.
7. Protein visualization using RASMOL & JMOL.
8. Protein structure prediction by predict protein and fold recognition.
9. Molecular modeling and dynamics using oligonucleotides and protein with known crystal structure.
10. Drug designing using available data.

TEXT / REFERENCE BOOKS:

- Bioinformatics: A practical guide. By Baxeuarus and Ovelletie, John Wiley Publishers.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT401B (Bioinformatics).

**B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT411B: DRUG AND VACCINE DEVELOPMENT LAB**

L T P Credits
0 0 2 1

Class Work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3 Hrs.

List of Experiments/ Exercises:

Aptamer selection procedure

1. Study the target selection antigen
2. Study the SELEX systems/procedures
3. Selective exponential selection with Biotinylated primers
4. Examine the sequencing patterns.
5. Secondary structures of proteins.

Bacterial O-PS antigen purification and Peptide O-PS linkages

6. Cell mediated immunity
7. Functionalising adjuvants
8. Covalent linkage + purification (sephadex)
9. Check spectrophotometrically

Phage Displays and Evaluation

10. Phage display selections and their analysis.
11. Biopanning

TEXT / REFERENCE BOOKS:

- Molecular Cloning – A laboratory manual, ed. J. Sambrook and D. W Russell, 2001, Cold Spring Harbor laboratory Press, New York.
- Antibodies: A laboratory manual, ed. Harlow and David Lane, 1988, Cold Spring Harbor laboratory Press, U.S.A.
- DNA cloning: A Practical Approach, ed. Glover and Hames.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT403B (Drug and Vaccine Development).

B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT413B: PROJECT

L T P Credits
- - 4 4

Class Work Marks : 100 Marks
Total Marks : 100 Marks

The primary objective of this course is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. which commences in the VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

| | |
|-------------------------------|--------------------|
| Chairman of Department | : Chairperson |
| Project coordinator | : Member Secretary |
| Respective project supervisor | : Member |

The student will be required to submit two copies of his/ her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of, maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B.Tech. will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

B. TECH. SEMESTER – VII (BIOTECHNOLOGY)
BT415B: PROFESSIONAL TRAINING- II

| L | T | P | Credits |
|---|---|---|---------|
| - | - | 2 | 2 |

Class Work Marks : 50 Marks

Total Marks : 50 Marks

At the end of 6th semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional / Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.

The typed report should be in a prescribed format.

The report will be evaluated in the VII Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The student will interact with the committee through presentation to demonstrate his/her learning.

Teachers associated with evaluation work will be assigned 2 periods per week load.

MEI 623B ENTREPRENEURSHIP
B. TECH. SEMESTER – VII (BIOTECHNOLOGY) - OPEN ELECTIVE

| L | T | P | Credits |
|----------|----------|-----------|----------------|
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT-I

ENTREPRENEURIAL DEVELOPMENT PERSPECTIVE: Concepts of Entrepreneurship Development, Evolution of the concept of Entrepreneur, Entrepreneur Vs. Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager, Attributes and Characteristics of a successful Entrepreneur, Role of Entrepreneur in Indian economy and developing economies with reference to Self-Employment Development, Entrepreneurial Culture

UNIT II

CREATING ENTREPRENEURIAL VENTURE: Business Planning Process, Environmental Analysis - Search and Scanning, Identifying problems and opportunities, Defining Business Idea, Basic Government Procedures to be complied with.

UNIT III

ENTREPRENEURSHIP DEVELOPMENT AND GOVERNMENT: Role of Central Government and State Government in promoting Entrepreneurship - Introduction to various incentives, subsidies and grants - Export Oriented Units - Fiscal and Tax concessions available; Role of Central/State agencies in the Entrepreneurship Development - District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB).

UNIT IV

PROJECT MANAGEMENT AND CASE STUDIES

Technical, Financial, Marketing, Personnel and Management Feasibility, Estimating and Financing funds requirement - Schemes offered by various commercial banks and financial institutions like IDBI, ICICI, SIDBI, SFCs, Venture Capital Funding, Why do Entrepreneurs fail - The Four Entrepreneurial Pitfalls (Peter Drucker), Case studies of Successful Entrepreneurial Ventures, Failed Entrepreneurial Ventures and Turnaround Ventures.

Texts and References:

1. Entrepreneurship: New Venture Creation - David H. Holt.
2. Entrepreneurship - Hisrich Peters.
3. The Culture of Entrepreneurship - Brigitte Berger.
4. Project Management - K. Nagarajan.
5. Dynamics of Entrepreneurship Development - Vasant Desai.
6. Entrepreneurship Development - Dr. P.C.Shejwalkar.
7. Thought Leaders - Shrinivas Pandit.
8. Entrepreneurship, 3rd Ed. - Steven Brandt.
9. Business Gurus Speak - S.N.Char.
10. The Entrepreneurial Connection - Gurmit Narula.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

**BME 451B MEDICAL INSTRUMENTATION
B. TECH. SEMESTER– VII (BIOTECHNOLOGY) - OPEN ELECTIVE**

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT-I

PHYSIOLOGY AND TRANSDUCERS: Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell – Synapse – Cardio pulmonary system – Physiology of heart and lungs – Circulation and respiration – Transducers – Different types – Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers – Selection criteria.

UNIT-II

ELECTRO – PHYSIOLOGICAL AND NON-ELECTRICAL PARAMETER MEASUREMENTS: Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms. Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound – Respiratory rate – Gas volume – Flow rate of CO₂, O₂ in exhaust air - PH of blood, ESR, GSR measurements – Plethysmography.

UNIT-III

MEDICAL IMAGING AND PATIENT MONITORING SYSTEMS: X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety. Biological effects of X-rays and precautions.

UNIT-IV

ASSISTING AND THERAPEUTIC EQUIPMENTS: Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph Ventilators.

TEXT BOOKS

1. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. Medical Instrumentation, Application and Design – John G. Webster, John Wiley, 3rd Ed., 1998.

REFERENCE BOOKS

1. Principles of Applied Biomedical Instrumentation – L.A.Geoddes and L.E. Baker, John Wiley, 1975.
2. Hand-book of Biomedical Instrumentation – R.S. Khandpur, TMH, 2nd Ed., 2003.
3. Biomedical Telemetry – Mackay, Stuart R., John Wiley, 1

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

**ECE 305B CONSUMER ELECTRONICS
B. TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE**

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT I

MONOCHROME TV (INTRODUCTION): Elements of a TV System,Picture transmission,Sound transmission,Picture reception,Sound reception,Synchronization,Receiver control,Image continuity, Scanning Process, Aspect Ratio, Flicker, Composite Video Signal, Picture Elements,Kell factor, Vertical Resolution,Horizontal Resolution,Video bandwidth,Interlacing, 625 Line System,Bandwidths for TV Transmission,Vertical and horizontal synch detail,Vestigial Side Band transmission(Advantages and Disadvantages)

MONOCHROME TV (PICTURE AND CAMERA TUBES): Monochrome picture tube,beam reflection,Beam focussing,Screen Phosphor,Face plate,Picture tube characteristics,picture tube circuit controls,Monochrome Camera Tubes:Basic principle,Image Orthicon, Vidicon,Plumbicon

UNIT II

COLOUR TV ESSENTIALS: Compatibility , Colour perception,Three Colour theory,Luminance,Hue and Saturation, Dispersion and Recombination of light,Primary and secondary colours,luminance signal,Chrominance Signal, Colour picture tube,colour TV Camera,Colour TV display Tubes,colour Signal Transmission,Bandwidth for colour signal transmission,Colour TV controls. Cable TV,Block Diagram and principle of working of cable TV.

PLASMA AND LCD: Introduction,liquid crystals,types of LCD's,TN,STN,TFT,Power requirements,LCD working,Principle of operation of TN display,Construction of TN display,Behaviour of TN liquid crystals,Viewing angle,colour balance, colour TN display, limitatons, advantages, disadvantages, applications.

UNIT III

LED AND DMD : Introduction to LED Television , comparison with LCD and Plasma TV's, schematic of DMD, introduction to Digital MicroMirror device, Diagram of DMD, principle of working, emerging applications of DMD.

MICROWAVE OVENS AND AIR CONDITIONERS: Microwaves, Transit Time, Magnetron, Waveguides, Microwave Oven, Microwave Cooking. Air conditioning, Components of air conditioning systems, all water Air conditioning systems, all air air conditioning Systems, Split air conditioner.

UNIT IV

MICROPHONES: Introduction, characteristics of microphones, types of microphone: carbon, moving coil, wireless, crystal, introduction to tape recorder.

LOUDSPEAKER: Introduction to ideal and basic loudspeaker, loudspeaker construction types of loudspeaker: Dynamic and permanent magnet, woofers, tweeters, brief introduction to baffles, equalisers.

Text Books :

1. Consumer Electronics by S. P. Bali (Pearson Education)
2. Complete Satellite and Cable T.V by R.R Gulati (New Age International Publishers)

Reference Books:

1. Monochrome and Colour Television by R. R. Gulati

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

EE 451B ENERGY AUDIT

B.TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE

| L | T | P | Credits |
|---|---|----|---------|
| 4 | - | -- | 4 |

| | |
|--------------------------------|--------------------|
| Class Work | : 25 Marks |
| Examination | : 75 Marks |
| Total | : 100 Marks |
| Duration of Examination | : 3 Hours |

UNIT I

INTRODUCTION TO THE POWER DISTRIBUTION SYSTEM: Description of the power distribution system- voltage levels, Components of the distribution system- Substation, Transformer, feeders, distribution system planning, operation & maintenance objectives, activities involved in O&M, grid management, load scheduling & dispatch, load balancing, 66-33/11 KV substation equipment, 11/0.4 KV substation equipment, Distribution transformers- reasons for DT failures.

UNIT II

ENERGY ACCOUNTING & ENERGY AUDIT: Need for energy accounting, objectives & functions of energy accounting, Energy flow diagram in power distribution system, energy accounting procedure- Energy measurement, and problems in energy accounting & overcoming these problems in energy accounting, Definition, need and types of energy audit, energy audit instruments, procedure for conducting an energy audit.

UNIT III

AT&C LOSS REDUCTION & EFFICIENCY IMPROVEMENT: Concepts and principles of distribution losses- transmission & distribution losses, AT&C losses in power distribution network, factors contributing to high technical & commercial losses. Technical loss reduction- Short term measures for technical loss reduction, long term plans for technical loss reduction, Commercial loss reduction- reasons for commercial losses, measures for commercial loss reduction.

UNIT IV

DEMAND SIDE MANAGEMENT: An introduction, Why DSM?, Benefits of DSM, DSM in power systems: load management, DSM techniques and emerging trends, EC Act 2001, DSM on consumer side – the industrial sector, the agricultural sector, the domestic & commercial sectors, ESCO-a route for DSM.

TEXT BOOKS:

1. Handbook of Energy Engineering, The Fairmont Press, INC.-Albert Thumann& Paul Mehta.
2. Energy Management Supply & Conservation, Butterworth Heinemann, 2002-dr. Clive Beggs.

REFERENCE BOOKS:

1. Hand book on energy audit & environment management by ISBN 81-1993.0920 TERI

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

EEE457B ENERGY RESOURCES & TECHNOLOGY B.TECH. SEMESTER – VII (BIOTECHNOLOGY)– OPEN ELECTIVE

| L | T | P | Credits |
|---|---|----|---------|
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT-I

ENERGY SOURCES & AVAILABILITY: World energy situation. Indian energy scenario. Comparative study of thermal, hydro, nuclear and gas power plants. Impact of thermal, gas, hydro and nuclear power stations on environment, air and water pollution, green house effect (global warming), Plasma confinement - magnetic confinement and inertial confinement, geothermal, hydrogen energy, fuel cells, Alkaline fuel cells (AFC), Solid oxide fuel cell (SOFC), Molten carbonate fuel cells (MCFC), thermo-electric power, MHD power generation OTEC & tidal waves.

UNIT-II

SOLAR ENERGY: Solar constant, solar radiation geometry, local solar time, day length, solar radiation measurement, radiation on inclined surface, solar radiation data & solar charts. Flat plate collectors, liquid and air type. Theory of flat plate collectors, advanced collectors, optical design of concentrators, selective coatings, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Thermal storage. Conversion of heat into mechanical energy. Active and passive heating of buildings. Solar cells.

UNIT-III

WIND ENERGY: Wind as a Source of Energy, Characteristics of wind, wind data. Horizontal & Vertical axis wind Mills, Wind Energy: Wind energy potential measurement, general theories of wind machines, basic laws and concepts of aerodynamics, wind mill and wind electric generator. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes.

Applications of wind energy.

UNIT-IV

BIOMASS ENERGY: Introduction to biomass, biofuels & their heat content, biomass conversion technologies. Aerobic & anaerobic digester, Factors affecting biogas production, biogas plants - types & description. Utilisation of biogas - Gasifiers, direct thermal application of Gasifiers. Advantages & problems in development of Gasifiers, use in I.C. engines, Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production.

TEXT BOOKS:

1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.
3. Power Plant Engg: G.D. Rai

REFERENCE BOOKS:

1. Renewable Energy Resources: John Twidell and Tony Weir
2. Renewable Energy Resources Conventional & Non- Conventional: M.V.R Koteswara Rao
3. Science & Technology of Photovoltaics: Jayarama Reddy P.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

BT401B BIOINFORMATICS

B. TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE

| L | T | P | Credits |
|---|---|----|---------|
| 4 | - | -- | 4 |

| | | |
|-------------------------|---|-----------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT-I

INTRODUCTION: Internet, intranet and extranet, networking, protocols, genomic data, organization, representation, data base management systems.

SEQUENCING DATA BANK: Introduction, collecting and storing sequence in laboratory, nucleic acid data bank – Gen Bank, EMBL, AIDS and RNA, protein data bank (PDB), cambridge structural database CSD, genome data bank, hybridoma data bank structure and others.

UNIT-II

SEQUENCE ANALYSIS: Analysis tools for sequence data banks, pair wise alignment: NEEDLEMAN and WUNSCH algorithms, Smith Waterman, multiple alignment – CLUSTAL-W, BLAST, FASTA, sequence patterns and motifs and profiles.

PREDICTIONS: Secondary and tertiary structure: algorithms Chao-Fasman algorithm, hidden Markov model, neural networking, protein classification, fold libraries, fold recognition (threading), homology detection, SRS-access to biological data banks.

UNIT-III

PHYLOGENETIC ANALYSIS– Basic concepts in systematics, taxonomy and phylogeny, phylogenetic trees- various types and their construction, tree building methods, distance methods, multiple alignment character based method, phylogenetic software.

MANAGING SCIENTIFIC DATA: Introduction, challenges faced in integration of biological information, SRS, Kleisli Query System TAMBIS, P/FDM mediator for a bioinformatics database, federation, discovery link and data management.

UNIT-IV

GENOMICS & PROTEOMICS: Genome mapping, assembly and comparison, functional genomics: sequence based approaches & microarray based approaches, proteomics: technology of protein expression analysis & posttranslational modifications, protein sorting, protein-protein interaction.

TEXT / REFERENCE BOOKS:

- Developing Bioinformatics Computer Skill, ed. Gibes & Jombeck, Shroff Publication
- Bioinformatics, ed. David W. Mount

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

AE 417B MODERN VEHICLE TECHNOLOGY B.TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE

| | | | |
|---|---|----|---------|
| L | T | P | Credits |
| 4 | - | -- | 4 |

| | | |
|-------------|----|-----------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration | of | 3 Hours |
| Examination | | |

UNIT I

TRENDS IN POWER PLANTS: Hybrid vehicles – stratified charged / lean burn engines – Hydrogen engines – battery vehicles – Electric propulsion with cables – magnetic track vehicles.

UNIT II

SUSPENSION BRAKES AND SAFETY: Air suspension – Closed loop suspension – antiskid braking system, Retarders, Regenerative braking safety cage – air bags – crash resistance – passenger comfort

UNIT III

NOISE & POLLUTION: Reduction of noise – Internal & external pollution control through alternate fuels / power plants – Catalytic converters and filters for particulate emission.

UNIT IV

VEHICLE OPERATION AND CONTROL: Computer control for pollution and noise control and for fuel economy – Transducers and actuators – Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

VEHICLE AUTOMATED TRACKS: Preparation and maintenance of proper road network – National highway network with automated roads and vehicles – Satellite control of vehicle operation for safe and fast travel.

TEXT BOOKS

1. Heinz Heisler, “Advanced Vehicle Technology” - Arnold Publication.

REFERENCES

1. Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 1993.

2. Bosch Hand Book, 3rd Edition, SAE, 1993.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CE451B POLLUTION & CONTROL B.TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE

| L | T | P | Credits |
|----------|----------|-----------|----------------|
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT – I

WATER POLLUTION – Classification of water pollutants, water characteristics, effluent standards, primary treatment, secondary treatment – aerobic (activated sludge, aerated lagoons, trickling filter, roughing filter, rotating biological contactor) anaerobic (contact process, UASB).

UNIT – II

AIR POLLUTION: Classification of air pollutants, Particulates: Physical characteristics, mode of formation, setting properties, Control measures.

HYDROCARBONS: Nature; sources, control, Carbon Monoxide: Source, harmful effects on human health, control measures. Oxides of Sulphur and Nitrogen Sources, effects on human health and plants. Control measure.

UNIT – III

SOLID WASTE: Types, sources and properties of solid waste, methods of solid waste treatment and disposal

SOLID WASTE MANAGEMENT – Generation, Collection and techniques for ultimate disposal, Elementary discussion on resource and energy recovery.

UNIT – IV

Elementary treatment of nuclear pollution, metal pollution, noise pollution their effects & control.

Trace element: Mechanism of distribution, essential and non essential elements, trace of element in marine environment, its ecological effects and biological effects.

Suggested Books:

1. Environmental Engg.: by Howard s. Peavy & Others, MGH International.
2. Metacaf – EDDY – Waste-water engineering revised by George Teholonobus (TMH)
3. Environmental Chemistry by B.K. Sharma, Goel Publishing, Meerut.
4. Environmental Chemistry, A.K.DE, Wiley Eastern.
5. Air Pollution: H.C. Perking – Mc Graw Hill.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

**CSE 411B: MANAGEMENT INFORMATION SYSTEM
B.TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE**

| | | | |
|----------|----------|----------|----------------|
| L | T | P | Credits |
| 4 | - | -- | 4 |

| | | |
|--------------------------------|----------|------------------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT I

FOUNDATIONS:-

INFORMATION SYSTEM: Introduction to Information System and MIS, Decision support and decision making systems, systems approach, the systems view of business, Managing the digital firm, Electronic Commerce and Electronic business, DBMS, RDBMS, introduction to Telecommunication and Networks

I.T.INFRASTRUCTURE:- Managing Hardware Assets, Managing Software Assets, Managing Data Resources. Internet And New It Infrastructure .

UNIT II

CONCEPTUAL SYSTEM DESIGN: Define the problems, set systems objective, establish system constraints, determine information needs determine information sources, develop alternative conceptual design and select one document the system concept, and prepare the conceptual design report. Information Systems Security and Control, Ethical and Social Impact of Information Systems.

UNIT III

DETAILED SYSTEM DESIGN: Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade of criteria, define the sub systems, sketch the detailed operating sub systems and information flow, determine the degree of automation of each operation, inform and involve the organization again,

inputs outputs and processing, early system testing, software, hardware and tools propose an organization to operate the system, documentation of detailed design

UNIT IV

IMPLEMENTATION, EVALUATION AND MAINTENANCE OF THE MIS: Plan the implementation, acquire floor space and plan space layouts, organize for implementation, develop procedures for implementation, train the operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files test the system, cut-over, document the system, evaluate the MIS control and maintain the system. Pitfalls in MIS development, Redesigning the organization with Information systems, Managing Knowledge Work.

TEXT BOOKS:

1. Management Information System by W. S. Jawadekar, 2002, Tata McGraw Hill.
2. Management Information System by K.C. Laudon & J.P. Laudon 7th Edition 2003 Pearson Education Publishers Indian Reprint.
3. Information System for Modern Management (3rd edition)- Robert G. Murdick, Loel E. Ross & James R. Claggett. PHI

REFERENCE BOOKS:

1. Management Information System; O Brian; TMH
2. Management Information System by Davis Olson Mac Graw Hill
3. Management Information System by Stallings,(Maxwell Mc Millman Publishers)

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

IT413B CYBER SECURITY B.TECH. SEMESTER – VII (BIOTECHNOLOGY) – OPEN ELECTIVE

| L | T | P | Credits |
|---|---|----|---------|
| 4 | - | -- | 4 |

| | | |
|-------------------------|---|-----------|
| Class Work | : | 25 Marks |
| Examination | : | 75 Marks |
| Total | : | 100 Marks |
| Duration of Examination | : | 3 Hours |

UNIT I

INTRODUCTION TO CYBERCRIME: Cybercrime and Information Security, Classifications of Cybercrimes, The need for Cyberlaws, The Indian IT Act Challenges to Indian Law and Cybercrime Scenario in India, Weakness in Information Technology Act and its consequences, Digital Signatures and the Indian IT Act, Cybercrime and Punishment; Technology, Students and Cyberlaw; Survival tactics for the Netizens, Cyber-offenses: Cyberstalking, Cybercafe and Cybercrimes, Botnets, Attack Vector, Cloud Computing;

UNIT II

TOOLS AND METHODS USED IN CYBERCRIME: Proxy Servers and Anonymizers, Phishing and identity theft, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow; Cybercrime: Mobile and Wireless Devices: Trends in Mobility, Attacks on Wireless Networks, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones.

UNIT III

UNDERSTANDING COMPUTER FORENSICS: The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics,

Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Challenges in Computer Forensics, Forensics Auditing, Antiforensics.

UNIT IV

CYBERSECURITY: ORGANIZATIONAL IMPLICATIONS: Cost of Cybercrimes and IPR Issues, Web Threats for Organizations, Security and Privacy Implications from Cloud Computing, Social Media Marketing, Social Computing and the Associated Challenges for Organizations, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling, Forensics Best Practices, Media and Asset Protection, Importance of Endpoint Security in Organizations.

TEXT BOOKS:

- “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Nina Godbole, Sunit Belapur, Wiley India Publications, April, 2011

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT402B: DNA MICROARRAY TECHNOLOGY

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Introduction: Technology behind DNA microarray, microarray designs, methods of fabrication, hybridization, SAGE, parallel sequencing.

Image analysis: Basic data analysis, normalization, dye bias, expression indices, fold change, mixed cell population, visualization by reduction of dimensionality.

UNIT-II

Cluster analysis: Hierarchical clustering, K-means clustering, self-organizing maps, distance measures, time series analysis, gene normalization, function prediction, integrated analysis and system biology.

UNIT- III

Reverse engineering of regulatory network: Time series approach, steady state approach, limitation of network modeling, molecular classifiers- feature selection, validation schemes, performance evaluation, genotyping and resequencing chips.

UNIT-IV

Experimental design and interpretation of results: Factorial design, two channel array, hypothesis driven experiments, independent verification, interpretation of results, limitation of expression analysis.

Softwares for data analysis: Software issues and data formats, commercial software packages.

TEXT / REFERENCE BOOKS:

- Guide to Analysis of DNA (Microarray DNA), ed. Steen Knudsen, 2004, John Wiley, U.S.A.
- DNA Microarray, ed. Bowtell. D
- DNA Arrays: Technology and Experimental Strategies, ed. Grigorenko et al.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)
BT404B: STEM CELL TECHNOLOGY**

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

Introduction: Stem cells, properties of stem cells, difference between embryonic and adult stem cell, potential applications/ uses of stem cells

Cell Diversification in the early animal embryo: Early development of Xenopus, spatial segregation, inductive interactions, complex pattern of cell responses, cellular response to a signal, the role of an intracellular clock, early mammalian embryo development, control of mammalian embryonic stem cells on pathways of development.

UNIT- II

Renewal by Stem Cells: Epidermis, division of stem cells, epidermal stem cells, differentiation of epidermal cells and synthesis of keratins, epidermal stem cells as a subset of basal cells, regulation of basal cell proliferation, secretory cells in the epidermis and their population kinetics.

Genesis, modulation and regeneration of skeletal muscle: New skeletal muscle cells form by the fusion of myoblasts, muscle cells can vary their properties by changing the protein isoforms that they contain, some myoblasts persists as quiescent stem cells in the adult.

UNIT-III

The concept of the hemopoietic stem cell: Hemopoietic stem cell disorders, classification and manifestations, aplastic and myelodysplastic disorders, clinical applications of colony stems, complications of gene therapy, replacement therapy, marrow transplantation, immunological principles, preservation and clinical use of blood and blood components.

UNIT - IV

Fibroblast and their transformations: Connective tissue cell family, fibroblasts and their character in response to signals in the extracellular matrix, its influence on connective tissue cell differentiation, action of signaling molecules on regulation of cell production, remodeling of bone, osteoblasts secretion of bone matrix, erosion, cartilage development, bone structure stabilization by connective tissue framework and selective cohesion of cells.

TEXT / REFERENCE BOOKS:

- Development Biology, ed. Scott F, Gilbert
- Hematology, ed. William J. Williams, Earnest Beutler, Allan J.U and Marshall A.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT414B: SEMINAR

L T P Credits
- - 2 2

Class Work Marks : 50
Total Marks : 50

The objectives of the course remain:

- To learn how to carryout literature search
- To learn the art of technical report writing
- To learn the art of verbal communication with the help of modern presentation techniques

A student will select a topic in emerging areas of Biotechnology and will carry out the task under the observation of a teacher assigned by the department.

He/ She will give a seminar talk on the same before a committee constituted by the chairperson the department. The committee should comprise of three faculty members from different specializations. The teacher associated in the committee will be assigned 2 hours teaching load per week.

However, guiding students' seminar will not be considered towards teaching load.

The format of the cover page and the organization of the body of the seminar report for all the undergraduate programs will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)
BT415B: PROJECT

L T P Credits
- - 8 8

Class Work Marks : 75
Exam Marks : 125
Total Marks : 200

The project started in VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

| | |
|---------------------------|-------------------------------------|
| Chairperson of Department | : Chairperson |
| Project coordinator | : Member |
| External expert | : To be appointed by the University |

The student will be required to submit two copies of his/ her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of, maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B.Tech. will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)
GFBT402B: GENERAL FITNESS FOR THE PROFESSION

L T P Credits
- - - 4

Exam Marks : 100
Total Marks : 100

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

The evaluation will be made by the committee of examiners constituted as under:

1. Dean, Faculty of Engineering & Technology/ Director
/Principal of affiliated college : Chairperson
2. Chairperson of the department : Member
3. External expert : Appointed by the university

A. The student will present a written report before the committee with following in view:

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

| | | |
|-----|--|------------|
| I. | Academic Performance | ----- |
| II. | Extra Curricular Activities / Community Service, Hostel Activities | (12 Marks) |
| III | Technical Activities / Industrial, Educational tour | (12 Marks) |
| IV | Sports/games | (16Marks) |

Note: Report submitted by the students should be typed on both sides of the paper.

B. A student will support his/ her achievement and verbal & communicative skill through presentation before the examiners. (40 Marks)

C. Faculty Counselor Assignment (20 Marks)

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

1. Discipline throughout the year
2. Sincerity towards study
3. How quickly the student assimilates professional value system etc.
4. Moral values & Ethics: Syllabus- one lecture/ week on the topics of human values/ ethics is to be delivered.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) **BT 452B: BIOPHARMACEUTICAL TECHNOLOGY (ELECTIVE- I)**

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT I

Introduction: Development of Drug and pharmaceutical Industry – Therapeutic agents, their uses and economics; Regulatory aspects.

Drug Metabolism and Pharmacokinetics: Drug metabolism- physico chemical principles, radioactivity- pharmacokinetics- action of drugs on human bodies.

UNIT II

Important Unit Processes and Their Applications: Bulk drug Manufacture, types of reaction in bulk drug manufacture and processes, Special requirements for bulk drug manufacture.

UNIT III

Manufacturing Principles: Compressed tables, Wet granulation- dry granulation or slugging- direct compression tablet presses, coating of tablets, capsules, sustained action dosage, forms- parental solutions- oral liquids- injections- ointments- Topical Applications, Preservation, Analytical methods and test for various drugs and pharmaceuticals, Packing- Packing Techniques, Quality Management, GMP.

UNIT IV

Pharmaceutical Products and Their Control: Therapeutic categories such as vitamins, laxatives, analgesics, non-steroidal contraceptives, Antibiotics, biological, hormones.

TEXT/ REFERENCE BOOKS:

1. Leon Lachman et al- at Theory and Practice of Industrial Pharmacy, 3rd Edition, Lea and Febiger, 1986.
2. Remington's Pharmaceutical Sciences, Mark publishing Co.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)
BT454B: HUMAN GENOME (ELECTIVE-I)**

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT - I

INTRODUCTION: History and development of human genetics, organization of human genome. Genes and chromosome –structure, function and inheritance. Repetitive DNA in human genome-Alu and SINE repeats. Functional organization of centromeres and telomeres, telomerases and centrosomes.

UNIT – II

METHODS OF GENETIC STUDY: Methods for genetic study in man- pedigree analysis, chromosomal analysis, Biochemical analysis. (Somatic cell genetic technology, polyclonal and monoclonal antibodies), molecular genetic analysis. Tissue culture techniques, long term and short term cultures, lymphoblastoid cell lines

UNIT – III

HUMAN GENOME MAPPING: Human genome mapping- genetic physical mapping- restriction fragment length polymorphism, pulse field gel electrophoresis, yeast artificial chromosomes, expressed sequence tags, sequence tagged sites, micro satellites and single nucleotide polymorphisms.

UNIT – IV

GENETIC DISORDERS AND GENE THERAPY: Congenital abnormalities; clinical aspects of autosomal and sex chromosomal disorders; inborn errors of metabolism, haemoglobinopathies. Inherited human disorders- single gene diseases. Complex traits, Identification and isolation of disease genes-positional cloning, functional cloning, DNA and eDNA micro arrays. Yeast two-hybrid system. Statistical methods for genetic analysis of complex traits. Cancer genetics. Immunogenetics; prenatal diagnosis- chorionic villous sampling, amniocentesis. Pre-implantation diagnosis, Genetic Counseling, Gene Therapy-concept, vectors, gene targeting and tissue specific expression Ethics and human genetics. Introduction to pharmacogenomics and toxicogenomics.

TEXT/ REFERENCE BOOKS:

1. Human heredity, Principles and issues: Michael R Cummings. Brooks/ Cole publishing 6th Edition(2003).
2. Human Molecular Genetics Peter Sudbury Pearson (2002).
3. Human Molecular Genetics Tom Strachan and Andrew Read garland Science publishing 3rd edition.(2003).
4. Modern genetic Analysis Anthony J.E. Griffiths, William M. Gilbert, Richard C. Lewontin and Jaffery H. Miller. W.H. Freeman and Co. 2nd edition(2002).

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT456B: VIROLOGY (ELECTIVE- I)

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

INTRODUCTION: Virus and virion: General properties of viruses, nature of the virion. Nomenclature and Classification of viruses. Sub-viral particles-Viriods and prions.

VIRAL REPLICATION AND MULTIPLICATION: Growth and Quantification: the virus host. Quantification of virus, virus replication; genera features of viral replication; virus multiplication- attachment and penetration, productin of viral nucleic acid and protein.

UNIT – II

VIRAL DIVERSITY - VIRUSES OF PROKARYOTES: Overview of bacterial viruses, virulent bacteriophages & 14., temperate bacteriophage, bacteriophage lambda. RNA bacteriophages, Isolated single stranded DNA bacteriophages. Filamentous single stranded DNA- bacteriophage-T-7, Mu double stranded transposable DNA Bactriophage. Life Cycle of Bacteriophage and their use in genetic analysis.

UNIT – III

VIRAL DIVERSITY- VIRUSES OF EUKARYOTES: Plant viruses: Positive strand RNA. Viruses of animals- Poliovirus and Coronavirus, Negative strand RNA. Vruses of animals- Rabies & Influenza. Double stranded RNA Viruses-

Rcoviruses. Replication of double stranded DNA, Viruses of animals, double stranded DNA viruses Herpes virus, Pox virus and adenovirus. Viruses with reverse transcriptase- retroviruses and hepadnaviruses.

UNIT – IV

EXPERIMENTAL VIROLOGY: Cultivation of viruses in embryonated eggs. Principles of animal cell culture. Primary and secondary cultures. Suspension and monolayer cultures. Concept of cell lines and viral transformation. Serological methods in virology. Haemagglutination. Complement fixation and immunofluorescence methods, ELISA and RIA. Physical and chemical assays of viruses (Proteins, Nucleic acids, Radioactivity Tracers, Electron Microscopy) Infectivity Assay (Plaque method, end point method)- infectivity assay of plant viruses.

APPLICATION OF VIROLOGY: Viruses and transgenic plants and animals. Overview of tumor viruses. Viral vaccines; Conventional Vaccines, New generation Vaccines including DNA vaccines with examples. Interferons- Production and mode of action. Antiviral drugs.

TEXT/ REFERENCE BOOKS:

1. Brock: Biology of Microorganisms by Madigan and Martinko, 11th Ed. 2005, Prentice Hall- Pearson Publications, New Jersey, US
2. Microbiology Pelzar, M.J. Chan, F.C.S. and Kreig, N.R. Tata Mc Graw Hill, New Delhi
3. Introduction to modern virology, Dimmock, N.J. and primrose, S.B. 4th Ed. Blackwell Science Publications, Oxford.
4. Medical Virology, Morag, C & Tinbury, M.C. Churchill Livingstone, London.
5. Functionals of plant virology, Mathew, R.E. Academic Press, San Diego. US.
6. The genetics of bacteria and their viruses; William Hayes Blackwell Scientific Publishers: Oxford.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)

BT458B: BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS (ELECTIVE-I)

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Bioethics: Ethical issues related to biotechnology and biomedical research and their impact to living system, public education of the processes of biotechnology involved in generating new forms of life for informed decision making.

UNIT – II

Socioeconomic Impacts of Biotechnology: Beneficial applications and development of research focus to the need of the poor, identification of directions for yield effect in agriculture, bioremediation and environmental impacts of release of GMOs, social issues to biotechnology.

UNIT – III

Bio-safety: Bio-safety regulatin and national and international guidelines r-DNA guidelines. Experimental protocol approval, levels of containment, environmental aspects of biotech applications, Use of genetically modified organisms and their release in environment, special procedures for r-DNA based product production (GMP).

UNIT- IV

Intellectual Property Rights-I: Intellectual property rights, and Intellectual Property protection, patents and methods of application of patents, Trade secret, copy rights, trade mark, legal implications, farmers rights, plant breeder's rights.

Intellectual Property Rights-II: International and National conventions on Biotechnology and related areas, GATT, TRIPS, Biodiversity convention, etc.

TEXT/ REFERENCE BOOKS:

- Sasson A, Biotechnologies and Development, UNESCO Publication, 1988.
- Sasson A. Biotechnologies in developing countries present and future, UNESCO publisher, 1993.
- Ben Mephram, Bioethics: An introduction to Biosciences. Oxford University Press.
- Singh K. Intellectual Property Rights on Biotechnology, BCIL, New Delhi

IMPORTANT LINKS:

- <http://www.w3.org/IPR/>
- <http://www.wipo.int/portal/index.html.en>
- http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
- www.patentoffice.nic.in
- www.iprlawindia.org/ - 31k - Cached - Similar page

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT464B: BIOCATALYSTS & BIOTRANSFORMATIONS (ELECTIVE-II)

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

INTRODUCTION: General usage of biocatalyst, fermentation and applied biocatalysis.

BIOTRANSFORMATION REACTIONS: Types of bioconversion reactions, Procedure for biotransformation, use of cells and enzymes for biotransformation, Genetic manipulations of organism for biotransformation, applications of bioconversion.

UNIT – II

TRANSFORMATION OF STEROIDS AND STEROLS: Reaction types of microbial transformation from steroids, microbial breakdown of sterols side chain.

TRANSFORMATION OF NON-STEROIDAL COMPOUNDS: L- Ascorbic acid, dihydroxy acetone from glycerol, prostaglandins, hydantoinases, carboamylases, catalytic antibodies.

UNIT – III

TRANSFORMATION OF ANTIBODIES: Acylases and peptidases, reaction of penicillin and cephalosporin substrate, protection of amino groups

TRANSFORMATION OF PESTICIDES: Accumulation of pesticides, pesticides as carbon source, conjugate formation.

BIOTRANSFORMATION OF NITRILE GROUP: Nitrile hydratase and nitrilase, Biotechnology of Nitrile transformation, Regio and Stereo selective biotransformation of nitriles, commercial processes search for novel nitrile biotransforming activities, redesign of existing enzymes by protein engineering, metabolic engineering by multistep biotransformation, cyanide biotransformation

UNIT – IV

BIOTRANSFORMATION OF LIPASES: Commercial Lipases, properties and applications of lipases, lipid or surfactants coated lipases, inter esterification of fats and oils, enantioselective esterification by lipases, commercial applications (food ingredients and enantiomerically pure chemical and pharmaceutical intermediates)

ALKALOID BIOTRANSFORMATION: Propane alkaloid Biosynthesis, microbial metabolism of protein alkaloid, morphine alkaloid biosynthesis, transformation of morphine alkaloid by *Pseudomonas putida M10*, microbial transformation of heroin.

TEXT/ REFERENCE BOOKS:

1. Biotechnology by H.J. Rehm and Reed , Vol 8A, Willey- Veh, Weinheim 1999.
2. A textbook of industrial microbiology by W. Cruger and A. Cruger .. 2nd Edition, 2003.
3. Microbial Biotechnology by A.N. Glazer and H. Nikaido, W.H. Freeman and Company ,2nd edition, 1969.
4. Behaviour of Enzyme System by John M Reiner, Van Norstad Reinhold Company, 2nd Edition, 1969.
5. Enzymes- Biochemistry, Biotechnology and clinical chemistry By Trevor Palmer, East- West Press Pvt. Ltd. 2004
6. Methods of Enzymology by Sydney Pestka, Academic Press, Vol. 79, 1981.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT466B: PROTEIN ENGINEERING (ELECTIVE-II)

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT- I

Introduction: Conformation of proteins in general and enzymes in particular, chemical and physical characterization of proteins (properties of amino acids, peptides and proteins), effect of amino acids on structure of proteins.

UNIT- II

Structure of Proteins: Structural classification of proteins (primary, secondary, tertiary and quaternary structures), Ramachandran plots, super secondary structures and motifs.

UNIT-III

Determination of Protein Structures: Chemical (Edman degradation), physical (X-ray crystallography, NMR, MS-MALDI TOF) and in silico methods.

UNIT – IV

Protein Engineering: Protein database analysis, site- directed mutagenesis for specific protein function, methods to alter primary structure of proteins, examples of engineered proteins, applications of protein engineering and protein folding, protein design (principles and examples).

TEXT/ REFERENCE BOOKS:

- Moody PCE, and AJ Wilkinson, Protein Engineering, IRL press Oxford, 1990.
- Köhrer C and Raj Bhandary U.L., Protein Engineering (Nucleic Acids and Molecular Biology), Springer, 1 edition.
- Cleland J. L. and Craik C.S., Protein Engineering: Principles and Practice, Wiley-Liss, 1edition.
- Lehninger, Principles of Biochemistry 4th Ed. By David L. Nelson and Michael M. Cox, WH Freeman and Company.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

**B. TECH. SEMESTER – VIII (BIOTECHNOLOGY)
BT468B: UNIT OPERATIONS IN BIOTECHNOLOGY (ELECTIVE-II)**

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT – I

INTRODUCTION: Unit and dimensions, Unit system, SI units, conversion of units. Flow measurements: Orifice and venture meters, Pilot Tube, Rotameters and other types of meters, Transportation of fluids, Pipe fittings and valves, pumps, Fundamentals of fluidization

FLUID MECHANICS: Nature of fluids, viscosity, laminar flow, turbulent flow, steady flow, Prandtl boundary layer, velocity gradient, Hagen Poiseville equation, Bernoulli equation, Fluid friction, Types of fluid friction, friction from changes in velocity or direction, resistance of immersed bodies, friction in flow through packed beds.

UNIT – II

HEAT TRANSFER: Classification of heat flow processes, conduction, thermal conductivity, heat flow in fluids by conduction and convection. Counter current and parallel flow, Enthalpy balance in heat exchange equipment, Individual heat transfer coefficient, Overall coefficient, heating and cooling of fluids, Heat transfer equipment. Extended surfaces, natural convection, Boiling heat transfer, Heat transfer from condensing vapours, Unsteady state heat transfer, Radiation, Kirchoffs Law.

UNIT – III

MECHANICAL OPERATIONS: Principles of communications, Types of commutating equipment, Energy and power requirements, Crushers, Grinders, Mixers, Types of Mixing and power consumptions, Mechanical Separations, screening, Types of Screening, Filtration Process, Principal, Constant Pressure and Constant rate filtration, Settling classifiers, Flootation, centrifugal Separations.

UNIT – IV

MASS TRANSFER: Molecular diffusion in fluids, diffusivity, Mass Transfer Coefficient, Interface Mass Transfer, Gas Absorption, Counter Current multistage operations, Packed Tower, Vapour-Liquid equilibria, Distillation, Flash vapourisation, Differential distillation, continuous rectification, Bubble cap distillation column, Liquid-Liquid equilibria, Liquid extraction, Liquid Solid equilibria, Leaching, Humidification, Wet and dry bulb temperature, Psychometric chart, Dehumidification, Cooling Towers, Crystallization, Membrane separation Technology, Ion-Exchange, molecular sieves, reverse osmosis, Evaporation and Ultrafiltration.

TEXT/ REFERENCE BOOKS:

1. Unit operations of chemical engineering by Mc Cabe, Smith and Harriot, TMH, 5th Edition
2. Transport Processes and Unit Operations by Geankopolis. PHI, 3rd Edition
3. Chemical Engineering , Volume 1 and II : Butterworth Heinemann, Coulson and Richardson.
4. Mass Transfer Operations by Treybal, R. E.
5. Handbook of chemical Engg. By Perry , Chilton and Green : MGH
6. Heat Transfer by D. Q. Kern, MGH
7. Principles of Unit Operations by Foust, A. S.: Wenzel, L.A. et al, 2nd Edition, JWS

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

B. TECH. SEMESTER – VIII (BIOTECHNOLOGY) BT462B: BIOFERTILIZERS & BIOPESTICIDES (ELECTIVE-II)

L T P Credits
4 - - 4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

UNIT-I

Introduction: Soil fertility, sources of nitrogen, N₂- cycle, forms of soil nitrogen, amount of nitrogen fixed, factors affecting nitrogen fixation.

Nitrogen Fixation: Methods, Discharge of electricity, activity of symbionts, activity of free fixers, manufacture of synthetic nitrogen, Interactions of O₂ with N₂- fixation, supplies of electrons, energy requirement for N₂ – fixation, Mechanism of penetration and nodule formation in roots by Rhizobium, factors affecting nodule formation, function of the nodule. Measurement of N₂- fixation, assimilation of fixed nitrogen, diazotrophic microorganisms, genetics of free living and symbiotic diazotrophs, nitrogen fixation genes.

Nitrogenase: Nature and mode of action and mechanism of nitrogen fixation

The Nif genes: Nif⁺ and Nif⁻, Genetics of Nif in *Klebsiella pneumoniae*, structure and regulation of Nif genes K. pneumoniae, Rhizobium and Anabaena.

UNIT-II

Production of biofertilizer: Physiology and function of *Rhizobium*, *Azobacter*, *Azospirillum*, *Frankia* and *Mycorrhizae* types, functions and use in agriculture and forestry: Inoculum production and inoculation techniques for production of

biofertilizer, crop response to biofertilizer producing microorganisms, mass production of biofertilizer, quality control, agronomic importance.

UNIT-III

Blue Green Algae (BGA): Nitrogen transformations in a low land rice ecosystem, heteroysts – mode of nitrogen fixation in BGA, Isolation of BGA, Agroclimatic variations, algalization- mass cultivation, manipulation of BGA in rice field and effect of inoculation on the yield of rice *Azolla*, green manure, algae and soil reclamation, organic matter composting and phosphate solubilizing microorganisms.

UNIT- IV

INTEGRATED PEST MANAGEMENT: The concept and history of pest management; tools of pest management, ecological and socio-economic aspects, cost/ benefit and risk/ benefit ratios; cultural, biological, chemical, legal and other control tactics and their integration for pest management; sampling and measuring the economic balance of damage, economic injury level and economic threshold: analysis and modeling for pest management and case histories; decision making for need based pest management, incidence, movement and succession of crop pests as influenced by biotic and abiotic factors, key factor and time analysis in pest management; pest management in major crops; integration of IPM options in integrated farming systems and sustainable agriculture.

REFERENCES:

1. Gray Stacey, Robert H Burris and Harold J. Evans (1997); Biological nitrogen fixation. CBS, ND (India).
2. Rao, N.S.S. 1996. Biofertilizer in agriculture and forestry. Oxford and IBM Pvt. Ltd. India.
3. Sustainable agriculture. John Wiley & Sons. Chichester, UK
4. Dent, D. 1995, Integrated Pest Management, Chapman and Hall London.
5. Dhaliwal, G.S. and Arora R. 1998, Principles of Insect Pest Management. Kalyani Publishers. New Delhi 110002.
6. Metcalf, R.L. and L.H. Luckman (eds.) 1982. Introduction to Insect Pest Management. Ple-num Press, New York.
7. Vanderplank, J.E. 1963 Plant disease epidemic and control . Academic Press, New York.
8. Whitehead, A.G. 1997 Plant nematode control CAB international Vol. 4 UK

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.