FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL) MICROBIOLOGY
1\textsuperscript{ST} TO 6\textsuperscript{TH} SEMESTER

AND

M.Sc. (HONOUR SCHOOL) MICROBIOLOGY
1\textsuperscript{ST} TO 4\textsuperscript{TH} SEMESTER

EXAMINATIONS
2014-2015

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### OUTLINES OF TESTS, SYLLABI AND COURSES OF READING IN THE SUBJECT OF MICROBIOLOGY FOR B.Sc. (HONS. SCHOOL) (SEMESTER SYSTEM) (MAJOR/SUBSIDIARY) 1ST TO 6TH SEMESTER EXAMINATIONS 2014-2015

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course No.</th>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B.Sc (H.S.) 1st year (Major)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st semester</strong></td>
<td>BMI 1101</td>
<td>Introduction to General Microbiology &amp; Bacterial Systematics</td>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>BMI 1151</td>
<td>Practical</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td><strong>2nd semester</strong></td>
<td>BMI 1201</td>
<td>Introduction to Applied Microbiology &amp; Pathology</td>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>BMI 1251</td>
<td>Practical</td>
<td>2</td>
<td>50</td>
</tr>
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Subsidiary courses for B.Sc (HS) 1st year in Microbiology

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>Physics</td>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>Chemistry</td>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>Mathematics</td>
<td>8</td>
<td>200</td>
</tr>
</tbody>
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Total Credits = 48
Total Marks = 1200

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course No.</th>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
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<tbody>
<tr>
<td><strong>B.Sc (H.S.) 2nd year (Major)</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>3rd semester</strong></td>
<td>BMI 2301</td>
<td>Phycology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>BMI 2302</td>
<td>Parasitology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>BMI 2303</td>
<td>Environmental Microbiology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>BMI 2351</td>
<td>Practical (Combined)</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td><strong>4th semester</strong></td>
<td>BMI 2401</td>
<td>Mycology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>BMI 2402</td>
<td>Industrial Microbiology</td>
<td>3</td>
<td>75</td>
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<tr>
<td></td>
<td>BMI 2403</td>
<td>Soil Microbiology &amp; Bioremediation</td>
<td>3</td>
<td>75</td>
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<tr>
<td></td>
<td>BMI 2451</td>
<td>Practical (Combined)</td>
<td>3</td>
<td>75</td>
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Subsidiary courses for B.Sc (HS) 2nd year in Microbiology

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
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<tbody>
<tr>
<td>Biophysics</td>
<td>8</td>
<td>200</td>
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<tr>
<td>Biochemistry</td>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>Statistics</td>
<td>8</td>
<td>200</td>
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</table>

Total Credits = 48
Total Marks = 1200

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course No.</th>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B.Sc (H.S.) 2nd year (Subsidiary) for Biochemistry &amp; Biophysics students</strong></td>
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<tr>
<td><strong>3rd semester</strong></td>
<td>BMIS 2371</td>
<td>Introduction to General Microbiology</td>
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<td>BMIS 2372</td>
<td>Practical</td>
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<tr>
<td><strong>4th semester</strong></td>
<td>BMIS 2471</td>
<td>Introduction to Applied Microbiology</td>
<td>3</td>
<td>75</td>
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<td></td>
<td>BMIS 2472</td>
<td>Practical</td>
<td>1</td>
<td>25</td>
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Total credits = 8
Total Marks = 200
### B.Sc (H.S.) 3rd year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Code</th>
<th>Course</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>BMI 3501</td>
<td>Medical Bacteriology – I</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3502</td>
<td>Microbial &amp; Molecular Genetics</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3503</td>
<td>Food Microbiology</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3504</td>
<td>Immunochemistry</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3551</td>
<td>Practical (Combined)</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>6th</td>
<td>BMI 3601</td>
<td>Medical Bacteriology – II</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3602</td>
<td>Virology</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3603</td>
<td>Microbial Physiology &amp; Metabolism</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>BMI 3604</td>
<td>Immunopathology</td>
<td>4</td>
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<tr>
<td></td>
<td>BMI 3651</td>
<td>Practical (Combined)</td>
<td>4</td>
<td>100</td>
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</tbody>
</table>

Total credits = 40
Total Marks = 1000

**GRANT TOTAL**

- Total Credits = 136
- Total Marks = 3400

**IMPORTANT NOTE:**

The Paper of Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.A./B.Sc. 1st year (2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester, he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.
ENVIRONMENT AND ROAD SAFETY EDUCATION (SEMESTER – II)

UNIT I (ENVIRONMENT)

Note: The syllabus has 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topic from 2 to 11 and one each for the topics 1 and 12 to 15.

1. Environment Concept:
   Introduction, concept of biosphere—lithosphere, hydrosphere, atmosphere; Natural resources—their need and types; principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:
   Types of aquatic systems. Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. Lithosphere:
   Earth crust, Soil—a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems—soil, water, air, wildlife, forests.

7. Management of Solid Waste:
   Merits and demerits of different ways of solid waste management—open, dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. Indoor Environment:
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:
    Indian laws pertaining to Environmental protection : Environment (Protection) Act, 1986; General information about Laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity:
    What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution:
Pollution due to noise and microbes and their effects.

13. **Human Population and Environment**:

14. **Social Issues**:
   Environmental Ethics : Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues**:
   Environmental problems in rural and urban areas, Problem of Congress grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals**:
Depending on the available facility in the college, a visit to Vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

**Examination Pattern**:

A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or unattempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added/included in the final mark sheet.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

**Note**: **Examination Pattern**:

- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or unattempted questions).
- The paper shall have two units: **Unit I (Environment) and Unit II (Road Safety)**.
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination : 90 minutes.
- The paper setter is requested to set the questions strictly according to the syllabus.
Suggested Readings

2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

Websites:

(a) www.chandigarhpolice.nic.in

(b) www.punjabpolice.gov.in

(c) www.haryanapolice.gov.in

(d) www.hppolice.nic.in
Syllabus and Courses of Reading for B.Sc. (Hons. School) (courses where English is taught as a subsidiary subject) for the session 2014-2015.

FIRST SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e. prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
- I. The Judgement Seat of Vikramaditya, Sister Nivedita
- II Engine Trouble, R. K. Narayan
- III The Conjurer’s Revenge, Stephen Leacock

Drama:
- I The Rising of the Moon, Lady Gregory
- II Waterloo, Arthur Conan Doyle

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (not exceeding 200 words); public notices and advertisements relating to product promotion etc.,

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.

Practical work:-
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not
exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

**Note:** In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100).

**Testing Scheme:**
The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

**Section I** (It is text-based and corresponds to unit I in the syllabus)
Q1. It shall consist of *five* short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text *Varieties of Expression* and cover a wide range of issues, topics and problems. It shall consist of **12 marks**.

Q2. It shall consist of *two* long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text *Varieties of Expression*. This shall carry **10 marks**.

**Note:** The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an **Unseen Passage for Comprehension** (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of **12 marks**.

Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry **6 marks**.

**Section II** (Based upon Unit II)
Q5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry **8 marks**.

Q5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry **4 marks**.

Q6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of **8 marks**.

Q7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry **10 marks**.

Q8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:
(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.
(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:
SECOND SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

**Prose:**
I  J. C. Bose, Aldous Huxley
II  The Position of Women in Ancient India, Padmini Sen Gupta

**Drama:**
I  The Proposal, Anton Chekhov
II  Riders to the Sea, J. M. Synge
III  Lithuania, Rupert Brooke

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

**Communication:** It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

**Writing Skills:** This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (not exceeding 200 words); public notices and advertisements relating to product promotion etc.,

**Modern Forms of Communication:** Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.

**Practical work:-**
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.
Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100.

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Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text Varieties of Expression. This shall carry 10 marks.

Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.

Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry 6 marks.

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(b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry 4 marks.

Q6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks

Q7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.

Q8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:

(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.

(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:

Pattern of instructions for Paper Setter:

Question papers will have FOUR sections. Examiner will set a total of NINE questions comprising TWO questions from each PART and ONE compulsory question of short answer types covering the whole syllabus. Students will attempt FIVE questions in all including ONE question from each PART and the compulsory question. All Questions will carry equal marks, unless specified.

B.Sc (H.S.) 1st year in MICROBIOLOGY
FIRST SEMESTER

BMI 1101: INTRODUCTION TO GENERAL MICROBIOLOGY AND BACTERIAL SYSTEMATICS

Objective: Introduction to General Microbiology (BMI-1101)
To give an overview of various aspects of microbiology viz. history, microbial world, taxonomy nomenclature, growth kinetics, metabolism, microbial genetics, antimicrobial agents and microbial ecology.

PART – A

Microbiology: definition, history and development of Microbiology, scope and relevance of microbiology, composition of microbial world and its applications. Distinguishing features of major groups of microorganisms: bacteria, fungi, algae, protozoa, viruses.


Characteristics of microorganisms: Prokaryotic cell structure and function, size, shape, capsule and slime layer, spore, cell wall, cell membrane, outer membrane, ribosome, motility organelle, fimbriae, nuclear region and cellular differentiation.

Cultivation of microorganisms: nutrition, cultivation methods and environmental factors affecting microbial growth.


PART – B

Microbial growth and metabolism: Bacterial growth curve, cell division, genes in cell division, maintenance of cells in exponential phase, synchronous growth, continuous culture, fed batch culture and measurement of growth. Metabolic pathways of carbohydrate metabolism common (Embden Meyerhof pathway, direct oxidation pathway, pyruvate decarboxylation, TCA cycle) and unique to heterotrophic and phototrophic microorganisms (Entner- Doudoroff pathway, β Ketoadipate pathway), Calvin cycle, patterns of energy yielding metabolism in microorganisms (respiration and fermentation), generation of energy and its use in biosynthesis of carbohydrates, nucleic acids, proteins and regulation of metabolism: regulation of RNA synthesis and DNA synthesis and cell division.
PART – C

**Control of microorganisms:** control of microorganisms by physical and chemical agents, patterns of microbial death, factors affecting effectiveness of antimicrobial agents activity.

**Antimicrobial chemotherapy:** Development of chemotherapy, general characteristics of antimicrobial drugs, and mechanisms of action of antimicrobial agents. Origin of drug resistance and its transmission in microorganisms.

**Bacterial systematics:** classification systems, major characteristics used, nucleic acid, serology, chemical composition and phylogenetic mode of classification. Use of catabolic and anabolic keys. Numerical Taxonomy, cluster analysis and construction of taxonomy group based on dendrograms and similarity matrix. International codes, rules, recommendations, construction of names in bacterial nomenclature and its role in taxonomy. Methods for isolation of pure culture of microorganisms. Diagnostic procedures, keys and schemes

PART – D

**Microbial genetics:** General principles of bacterial genetics, DNA as genetic material, gene structure, mutations and their chemical basis. Detection and isolation of mutants and DNA repair mechanisms. Intercellular transfer and genetic recombination in bacteria (transformation, transduction and conjugation), bacterial plasmids, transposable elements, genome mapping. Recombinant DNA technology: historical perspectives, preparation of recombinant DNA, cloning vectors, expression of foreign genes in bacteria and application of genetic engineering.

**Microbial ecology:** Microbial flora of soil, factors affecting soil microflora, interactions among soil microorganisms, Biogeochemical role of soil microorganisms: Role of microorganisms in cycling process of carbon, sulphur, nitrogen and mining, lichens, normal flora of animals, germ free animals, rumen symbiosis, and microbial symbiosis with insects, algae and invertebrates.

**Water Microbiology:** Factors affecting microorganism in aquatic environment, water borne diseases; microbiological assay of water pollution, sewage treatment systems.

BOOKS FOR READING

3. Review of Medical microbiology by Jawetz, Melnick and Adelberg.Lange Medical publications 20th Edn..
SECOND SEMESTER

BMI 1201: INTRODUCTION TO APPLIED MICROBIOLOGY AND PATHOLOGY.

Objective: Introduction to Applied Microbiology and Pathology (BMI 1201)
The course provides basic knowledge of various aspects of applied microbiology including food & industrial microbiology, environmental microbiology, pathogenesis of microbial diseases.

PART – A
Host parasite relationship of infectious diseases: determinants of infectious diseases, attributes of pathogens and offending host (physical, chemical barriers and biological barriers), specific and non-specific immune defense mechanisms of host, autoimmune diseases and allergic reactions.
Introduction to pathogenic microbiology.
Epidemiology of infectious diseases, infectious disease cycle, transmission of infectious agent, surveillance, recognition, study and control of epidemics and nosocomial infections.
History, development, and its relevance in relation to study of homoeostasis, febrile reaction, intra and extra cellular environment of cells and factors affecting the constancy of environment, Degenerations: cloudy swelling, fatty acid degeneration, glycogen infiltration, hyaline degeneration and amyloidosis. Odema and its pathogenesis. Necrosis: Its pathogenesis and role of ischaemia in necrosis,

PART - B
Introduction to soil and agriculture microbiology: Agriculture and soil microbiology, pesticides, microbial insecticides, ruminants and microorganisms, introduction to infectious diseases of domestic animals and agricultural plants.
Introductory food and industrial Microbiology: Food spoilage, food borne diseases, assessing microbial contents of food, food preservation, food sanitation and microbiology of milk and dairy products.
Industrial microbiology, industrial fermentation of alcohol and alcoholic beverages antibiotic fermentation, vitamins and amino-acids, microbial bioconversions, enzyme production by microorganisms, food from microorganism.

PART- C
Microbial diseases of humans caused by Chlamydia, Rickettsiae, Gram positive and Gram negative organisms, Human mycotic and parasitic protozoan infections.
Viral diseases: Characteristics of causal agents and disease course of selected diseases such as influenza, measles, yellow fever, rabies, poliomyelitis, and AIDS.

PART – D
Inflammations: acute and chronic inflammatory reactions, pathogenesis, morphological varieties of inflammation.
Regeneration and repair, types of wounds healing and the mechanism involved. Factors affecting wounds healing allergic.
Thrombosis and embolism. Shock and hemorrhage
Disturbances of growth of cell: atrophy, hypertrophy, aplasia, hyperplasia.
Neoplasia: benign and malignant tumors, possible routes of spread, grading and staging, types of carcinogenesis, diagnosis, therapeutic approaches.
BOOKS FOR READING

2. Review of Medical microbiology by Jawetz, Melnick and Adelberg. Lange Medical Publications.
5. Current Medical Diagnosis and Treatment – M.A. Krupp & M.J. Chatton
10. Fundamental of Microbiology IE Alcamo, Publisher. An imprint of Addison Wesley Longman Inc.
Objective: Phycology (BMI-2301)
The objective of the course is to teach general, ecological, metabolic and economic aspects of algae so as to understand how the algae can be applied for various useful purposes.

PART – A

An introduction to algae: The position of algae in continuation of life; General classification; Algal cell structure and nutrition; Reproduction in algae.

Ecological aspects of algae: Soil algae, Fresh water algae, marine algae (seaweeds), aerial algae and algae as symbionts; Adaptation of algae to extreme temperatures; Nature of extracellular products formed by algae and their ecological effects.

PART-B


Phycovirus: Classification, structure and multiplication of phyco viruses (mainly Cyanophages), environmental impact of phycoviruses

PART – C

Nutrition and metabolism: Photosynthesis: The physical nature of light, pigments in systems of photosynthesis, the photosynthetic apparatus; path of electron in photosynthesis, factors affecting the rate of photosynthesis and carbon fixation. Respiration. Photorespiration.

Nitrogen – Fixation: Distribution of the capacity to fix nitrogen among algae. Site of nitrogen fixaion, heterocyst, ultrastructure of heterocyst, factors controlling heterocyst formation, nitrogenase and biochemistry of nitrogen fixation, physiology of nitrogen fixation in blue green algae.

PART-D

Genetics: Recombination, transformation and transduction. Molecular genetics of dinitrogen – fixation and nitrite and nitrate utilization. Carbon source mutants, pigment mutants, vitamin and amino acids mutants, flagella mutants, eyespot mutants, their isolation and characterization, cytoplasmic inheritance

Laboratory cultures: Growth characteristics, preparation of experimental material, methods of cultures.
BOOKS FOR READING

1. **Algal Culturing Techniques** by Robert A. Andersen (Editor), Elsevier Academic Press, 2005
2. **Algae: Anatomy, Biochemistry, and Biotechnology**, by Laura Barsanti (Author), Paolo Gualtieri (Author), CRC Press, 2006
3. **Algae**, by Linda E. Graham (Author), Lee W. Wilcox (Author), Cambridge University Press, 2004
6. **Seaweed Ecology and Physiology** by Christopher S. Lobban (Author), Paul J. Harrison (Author), Cambridge University Press, 2000
8. **Algae: An Introduction to Phycology**, by Christiaan van den Hoek (Author), David Mann (Author), H. M. Jahns (Author), Cambridge University Press, 1997

Journals:

1. Biotechnology Letters
2. Annual Reviews of Microbiology
3. Microbiology and Molecular Biology Reviews
4. International Journal of algal Research
5. Algologia
6. The Journal of Phycology
BMI 2302: PARASITOLOGY

Objective: Parasitology (BMI-2302)

To provide theoretical and practical information pertaining various parasitic diseases, and preventative measures.

PART – A

Protozology: Brief history of protozology, ecology and host parasite relationship (parasitism and symbiosis): Basis of host cell parasite interactions with special reference to autoimmune response and pathogenesis of protozoan diseases in general, zoonotic potentiality of protozoa.

PART – B

Morphology, life cycle, pathology, Symptomatology, laboratory diagnosis and treatment of following:

(a) Amoeba : Non pathogenic and pathogen amoebae
(b) Giardia (G. lamblia)
(c) Blood flagellates: Lishmania, Post kala-azar dermal leishmaniasis and Trypanosomes.
(d) Flagellates of gential tract: Trichonomonas (T. tenax, T. hominis T. vaginalis).
(e) Malaria parasite (Plasmodium, P. falciparum, P. malariae, P. ovale) general life cycle of malarial parasite in man and anopheles mosquito, sequelae of malaria.
(f) Toxoplasma gondi, life cycle, symptomatology. Transmission and lab. Diagnosis of toxoplasmosis.
(g) Cryptosporadium parvum

PART – C

Helminthology: General introduction of helminths and classification, medically important heminths, immunity in Taneia saginata, T. solium. Echinococcus granulosis,

Trematodes: Schistosoma haematobium, japonicum and mansoni.

Helminths : Ascaris lumbricoides, Ancylostome duodenale, Strongyloides stercoralis, Enterobius, Wuchereria bancrofti, Brugia malayi, Dracanculus medinensis.

PART – D

Medical entomology: - Role of arthropods in the spread and causation of parasitic disease. Classification and general characteristics of important insect vectors. Mode of transmission of various diseases.

BOOKS FOR READING

BMI 2303: ENVIRONMENTAL MICROBIOLOGY

Objective: Environmental Microbiology (BMI-2303)

The objective of the course is to teach the various microbial environments encountered in the area of soil water and air microbiology and how they affect the cycling of nutrients, various methods available for identification and enumeration of microbes in these environments.

PART – A

Petroleum Microbiology


PART - B

Microbial biodegradation of petroleum products in terrestrial, aquatic environment. Problems related to SO₄, reducing bacteria in petroleum industries and their metabolism, ecology and physiology. Treatment and disposal of petroleum refinery waste. Heavy crude and oilshale. Recovery of petroleum from oil bearing rocks.

PART – C

Microbiology of air
Organism of fermentation in the air, Exhaust gas purification, Methods of waste gas treatment, aerosols monitoring
Sewage & water treatment
Significance of microorganisms present in sewage & water
BOD mechanisms & kinetics, BOD in design and operation of biological treatment.
BOD as an aid in regulation of water quality

PART - D

Analysis of water. Quantitative and qualititative methods, coliform organisms in sewage, water-borne diseases.
Qualitative and quantitave standards of water.
Purification of water for industrial, municipal and domestic supply.
Recycling & treatment of domestic & industrial water.
BOOKS FOR READING
2. Environmental microbiology by A.H. Varnam and M. Evans Blackwill Publisher 2000
3. Microbial Biochemistry, Zagic, 1994
4. Comprehensive Biotechnology, Moo Young. 1995
5. Environmental Microbiology, Rose Vol. III-V, 1999

FOURTH SEMESTER

BMI 2401: MYCOLOGY

Objective: Mycology (BMI-2401)
The course provides insight into the classification and general characteristics of fungi, fundamental processes of fungi e.g. growth, reproduction and genetics, the industrial significance of fungi and their role in causing diseases along with diagnostic measures and treatment.

PART-A

Major taxonomic groups of fungi: Brief classification systems and distinguishing characteristics of Slime moulds & organisms distantly related to fungi, Oomycota, Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota & Deuteromycota.

Fungal structures: General structure of hypha, differentiation along the hypha, hypha as part of colony, mycelial modifications, general structure of yeasts, fungal walls, plasma membrane, septa, nuclei & associated structures, cytoplasmic components, Golgi, endoplasmic reticulum & vesicles, vacuoles, cytoskeleton.

Fungal growth and development: Apical growth, assembly of the wall at the apex, steady state model of wall growth, driving force for apical growth, spore germination, spore germination tropisms, hyphal tropisms, yeast cell cycles, cell cycle in mycelial fungi, colony branching & branch behaviour, kinetics of growth.

PART-B

Fungal nutrition: Mode of nutrition, fungal adaptations for nutrient capture (apical growth, enzyme secretion, defence of territory), nutrient requirements of fungi, carbon & energy sources.

Fungal metabolism: Energy production, energy from non-sugar substrates, coordination of metabolism, translocation & storage of compounds, chitin synthesis, Lysine synthesis, secondary metabolism.

Fungal reproduction: Vegetative reproduction- fragmentation, fission, budding, spawns, sclerotia, rhizomorphs; Asexual reproduction- endospores, conidia, oidia, chlamydospores, pycniospores, ascospores, basidiospores, uredospores & telutospores; Sexual reproduction- planogametic copulation, gametangial contact, gametangial copulation, spermatogamy, somatogamy; reduction of sex in fungi.
PART-C

**Fungal genetics:** Structure & organization of fungal genome, genetic variation in fungi- Non-sexual variation (heterokaryosis & parascuosity), Sexual variation (Tetrad analysis), applied molecular genetics of fungi.

**Fungal Interactions:** Mycorrhizal associations-ectomycorrhiza, endomycorrhiza & ectendotrophic mycorrhiza; Lichens- distribution, mycobiont, phycobiont, morphology & anatomy, growth, reproduction, types, economic significance.

PART-D

**Plant Mycology:** Fungal diseases of plants- characteristics of plant pathogenic fungi, classification of plant pathogenic fungi, symptoms caused by fungi on plants; diseases caused by fungal like organisms (Myxomycota, Plasmodiophoromycetes & Oomycetes), diseases caused by True fungi (Chytridiomycetes, Zygomyces, Ascomycetes, Deuteromycetes & Basidiomycetes); Post harvest diseases of plant products, caused by Ascomycetes & Deuteromycetes.

**Medical Mycology:** Superficial mycoses, systemic mycoses, fungal infections of skin, nail and hairs, opportunistic fungal infections, antifungal drugs.

**Mycotechnology:** Fungi in production of traditional fermented foods, single cell proteins, edible mushrooms and mushroom food poisoning, mushroom neutraceuticals, organic acids, vitamins, antibiotics, fungal antibiotics, mycoherbicides, fungal insecticides, mycorrhizal inoculants, mycotoxins.

**BOOKS FOR READING**

1. Introduction to Fungi By Alexopolus and Mims, CRC Press, 2005
2. Fungi: Biology and Applications, Edited by Kevin Kavanagh, John Wiley, 2005
5. Advances in Fungal Biotechnology for Industry, Agriculture, and Medicine Edited by Tkacz, Jan S.; Lange, Lene, Springer 2004
7. Fungal Associations Edited by B Hock, Springer Verlag, 2001
BMI 2402: INDUSTRIAL MICROBIOLOGY

Objective: Industrial Microbiology (BMI-2402)

To study the commercial exploitation of microorganisms for the production of valuable microbial products via fermentation processes. Another aspect is the role of microorganisms in detoxification of industrial wastes, degradation of petroleum in oil spills and production of biocontrol agents to be used as biofertilizers.

PART-A

Introduction to Industrial Microbiology: Fermentation, definition; Industrial microbes; Development of Industrial fermentation and fermentation Industry.

Strain improvement for various Industrial purposes: Isolation, conventional and genetic methods of strain improvement and preservation of industrially important microorganisms.

Types of Fermentation: Submerged, Surface and Solid-State fermentation; Range and Component parts of fermentation processes.

PART-B

Fermenter Configurations:

(1) Submerged fermenter systems: Stirred tank fermenter, Air lift fermenter, Fluidized Bed fermenter, Microcarrier bioreactor, Membrane bioreactor, Photobioreactor, Innovative and Special fermenters;

(2) Solid-State Fermenter Systems: Laboratory and Industrial Scale SSF Fermenter.

Design of fermenter: Design criteria-mechanical aspects and process aspects; Standard dimensions, Jackets & coils, Safety codes, Material of construction, baffles, Sparger, Nozzles & Manways, Piping & Valves, Steam locks, Welds & Joints, Surface treatment and Finish, Cleanability, sterility aspects, agitation system design-impeller design, drive location, seals, power requirements.

PART-C

Stages in Industrial Fermentation Process:

(1) Upstream Processing: design preparation, substrates, and sterilization of fermentation media; Optimization of fermentation media and inoculation.

(2) Fermentation process: Modes of operation- Batch fermentation, Continuous fermentation process, Fed Batch fermentation; Inoculum preservation, Growth of the inoculum, Fermenter preculture, Production fermenter-fermenter size, temperature, aeration, agitation and pressure; Process monitoring and control.
(3) **Down stream processing:** Removal of insolubles, product isolation, product purification, product polishing.

(4) **Scale Up of fermentation processes**

(5) **Asepsis in fermentation processes.**

**PART-D**

**Production of Industrial Food Grade Products:** Bakers Yeast, Single cell proteins, Amino acids, Vitamins, Enzymes, Beer, Wine, Acetic acid (Vinegar), Citric acid, Lactic acid.

**Production of Industrial Health Care Products:** Antibiotics & Vaccines.

**Production of industrial Biochemicals and Biofuels:** Ethanol, Acetone and Butanol.

**BOOKS FOR READING**

2. Industrial Microbiology-Prescott & Dunn, 2004
4. Industrial Applications of Microbiology- J. Riviere
5. Industrial Microbiology-Casida., 2007
6. Industrial biotransformation by Lieshe, Seelbach & Wandrey, Wiley VCH publications
9. Biotechnology of antibiotics By W. R. Strohl Edition: 2, illustrated Published by Informa Health Care, 1997

**BMI 2403: SOIL MICROBIOLOGY & BIOREMEDIATION**

**Objective: Soil Microbiology and Bioremediation (BMI-2403)**

The objective of the course is to teach the role of microbes and their products in various environmental processes and their interaction with pollutants. This will be helpful in the application of microbes in various processes e.g. nitrogen fixation and bioremediation.

**Part-A**

Introduction to types of soil microbes.

Role of microbes in biogeochemical cycles: Carbon cycle, Nitrogen cycle, Sulphur cycle.

Detrimental impacts of diverted biogeochemical cycles.

Factors affecting the movement of microorganisms in soil: Adsorption to soil particles, soil physical properties, plant roots, soil animals and human beings in relation to microbial moment in soil.
Part-B

Part-C
Nitrogen fixation: Biochemistry of \( N_2 \) fixation, properties of terrestrial nitrogen fixing organisms, free living diazotrophs. Symbiotic nitrogen fixation: Rhizobium-Legume association, Actinorhizal associations, contribution of symbiotic nitrogen fixation. Denitrification: Biochemical properties of denitrification, Microbiology of denitrification, quantification of \( N_2 \) losses from ecosystem via denitrification, environmental factors controlling the denitrification.

Part-D
Microbial interaction with metal pollutants: Sources of metal pollution, effects of metal pollution on microbes, metal corrosion, biotransformation and bioremoval of heavy metals from polluted environments. Beneficial effects of metal microbial interactions. Microbial bioremediation: What is bioremediation, biodegradation of major groups of environmental pollutants, mechanisms of metabolizing different classes of organic pollutants, prospects of microbial application to toxic waste treatment, recent trends in bioremediation

BOOKS FOR READING

2. Environmental microbiology by A.H. Varnam and M. Evans Blackwill Publisher 2000
4. Soil Microbiology by Martin Alexander, 1996
5. Soil Microbiology by Waksman, 1994
7. Microbial Communities, Insam, H, Rangger, A, 1997
SYLLABUS FOR B.SC. (HONS SCHOOL) SECOND YEAR (SUBSIDIARY COURSES FOR BIOCHEMISTRY AND BIOPHYSICS STUDENTS)
FOR THE EXAMINATIONS OF 2014-2015

Note: The pattern of Question paper set by the Examiner should be as below:

“The examiner should set nine questions in total including one question with sub-parts representing the entire syllabus that will be compulsory. Apart from the compulsory question, students have to attempt four other questions i.e. the students will be asked to attempt five questions at least one question from Part A, B, C and D including the compulsory question.

THIRD SEMESTER

BMIS 2371: INTRODUTCION TO GENERAL MICOBIOLOGY

Objective: Introduction to General Microbiology (BMIS-2371)
To provide an overview of various aspects of microbiology like growth, metabolism, reproduction, nutrition and beneficial and harmful roles of microorganisms in food and milk microbiology.

PART-A

Science of Microbiology: Definition, Scope- microbes & microbioloists, History of Microbiology-theory of spontaneous generation, the germ theory of disease, work towards controlling infections, emergence of special fields of microbiology- immunology, virology, chemotherapy, genetics & molecular biology; Sub-disciplines of microbiology; Prokaryotic and Eukaryotic microorganisms; The Scientific method; Classification systems.

Microscopy: Historical microscopy, Principles of Microscopy-metric units, properties of lights ( wavelength & resolution, light & objects), defect of lenses & their corrections, Light microscopy-the compound light microscope, dark-field microscopy, Nomarsky (differential interface contrast) microscopy, fluorescence microscopy, confocal microscopy & digital microscopy; Electron Microscopy-Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), Scanning tunneling microscopy (STM), Stains and principles of staining.

PART-B

Major Groups of Microorganisms: Bacteria- cell ultra-structure, nutrition, reproduction & function; Fungi- cell ultra-structure, nutrition, reproduction & function; Algae- cell ultra-structure, nutrition, reproduction & function; Viruses- origin & evolution, classification of animal, insect, bacterial & plant viruses, structure of viruses, quantification & replication, virus host interactions and Actinomycetes-classification, structure & important characteristics.

PART-C

**Microbial Nutrition & Biosynthesis:** preliminary discussion on the metabolism in heterotrophic & autotrophic organisms; transformation of energy by fermentation, respiration & anaerobic respiration.

**Culturing of Microorganisms:** Isolation methods of Microorganisms; Microbial media, genetic modification & preservation of industrial microorganisms.

**Control of Microorganisms:** Antimicrobial agents, such as growth factors analogs, antibiotics, germicides, disinfectants and antisepsics; Quantifications of antimicrobial action.

PART-D

**Food Microbiology:** Microbial spoilage of food; Food borne diseases; Assessing microbial contents of food; Food preservation methods; Food from microorganisms.

**Milk Microbiology:** Microorganisms commonly found in milk and milk products, Microbiology of milk and milk products; Preparation of starters and Microbiological aspects of dairy sanitation.

**BOOKS FOR READING**

3. *Microbiology* by Pelczar. MJ; Chan ECS and Kreig NR, Mcgraw Hill.Inc. 
   Bergey’s Manual of determinative Bacteriology 9\textsuperscript{th} Edn. Lippincott Williams, Wilkin Bacteriology, Vol. I.
6. *Industrial Microbiology* (4\textsuperscript{th} Edition) by Prescott & Dunn (Editor: Gerald Reed), CBS Publishers, Delhi.
7. *Microbiology : A Laboratory Manual* (7\textsuperscript{th} Edition) by James Cappuccino, Natalie Sherman, Publisher: Benjamin Cummings.
Objective: Introduction to Applied Microbiology (BMIS 2471)

The course provides basic knowledge of various aspects of applied microbiology including industrial microbiology, genetic engineering, environmental microbiology, host-parasite relationships and pathogenesis of microbial diseases.

PART –A

Host parasite relationships: Microbial factors, invasion and pathogen city, mechanisms of resistances. Host factors, Innate immune response, acquired immune response (types of antibodies, role of antibodies, T cells, B cells, natural killer cells)

PART - B

Introduction to pathogenic microbiology, chemotherapy and epidemiology, pathogenesis, diagnosis and treatment of infectious diseases caused by various micro-organisms like bacteria (Streptococci, Staphylococci, Corynebacterium, Mycobacterium, Clostridium, E. coli, Salmonella, Shigella, Haemophilus, Vibrio, Klebsiella, Bordetella, Meningococci Gonococci), Parasites (Giardia, Entamoeba, Plasmodium, Toxoplasma, Trypanosoma Leishmania) and Viruses (Entroviruses, Rhinoviruses, Rubella, Measles, Maps, Rabies, Influenza, Rota, Herpes, Small Pox, Hepatitis, Adenovirus, HIV).

PART – C

Microbiology of soil, physical characteristics, microbial flora, Biogeo chemical activities of microorganisms, transformation of nitrogen, Carbon and Sulfur. Aquatic Microbiology, micro-organisms in aquatic environment and techniques employed for their study. Microbiology of domestic water and waste water, bacteriological techniques, sewage treatment and disposal, municipal treatment processes.

Petroleum microbiology, formation, exploration, recovery and oil spills.

Air Microbiology, indoor and outdoor air, microbiological techniques for measurement of air contamination, control of airborne infections.

PART - D


BOOKS FOR READING

Objective: The course is designed to introduce the students a broad view of diseases caused by various groups of bacteria, the laboratory diagnosis and preventive measures. Accordingly, the students are given practical training for identification of Gram positive and Gram negative common pathogens encountered in clinical specimens.

**PART – A**

- History and development of medical microbiology.
- Biological properties of etiological agents of diseases, Pathogenic Mechanisms Specific Virulence Factors, Nature of damage to the tissues caused by infectious agents. Biologic Activities of microbial toxins.
- Epidemiology: Epidemiology and control of community infections.
- Study of normal flora of human body and its importance to host.

**PART – B**

- Study of morphological and physiological characteristics and pathogenesis of infections and diseases and clinical manifestations of following microorganisms.
  - *Staphylococcus*: aureus and S. epidermidis.
  - *Streptococcus pyogenes*, S. agalactiae, S. pneumoniae and S. mutans

**PART – C**

- Bacillus anthracis and Bacillus cereus
- *Clostridium*: Infections agents associated with tetanus botulinum, gas gangrene diseases and pseudomembranous colitis.
- Listeria: monocytogenes
- Corynebacterium: Corynebacterium diptheriae

**PART – D**

- *Mycobacterium tuberculosis* and *M. leprae* and other mycobacteria.
- *Neisseria meningitidis* and *N. gonorrhoeae*
- *Haemophilus influenzae* and *H. ducreyi*
- *Bordetella pertussis*, *B parapertusis* and *B. bronchiseptica*
- *Francisella tularensis*
- *Yersinia pestis*, *Y. enterocolitica* and *Y.pseudotuberculosis*
BOOKS FOR READING

2. Mackie and McCartney Practical Medical Microbiology Ed Collee JG, Fraser AG, Marmion BP and Simmons A. Churchill Livingstone publication
3. Textbook of Microbiology: Ananthanaryan and Panikar
5. Medical Microbiology by Greenwood D, Slack RCB and Peutherer. Churchill Livingstone publication
6. Medical Microbiology by Mims and others. Elsevier Mosby Spain
7. Medical Microbiology Samuel Baron Publisher. Addison Wesley Publishing Co.
8. Mandell, Douglas and Bennett’s; Principles and Practice of Infectious diseases: GL Mandell R.Dolin and JE Bennett;s, Publisher Churchill Livingstone. NY

BMI 3502: MICROBIAL AND MOLECULAR GENETICS

Objective: The objective of the course is to introduce the students to basic and applied aspects of microbial genetics. The students are given a thorough understanding of recombinant DNA technology and guidelines. This prepares them for further advances courses.

PART – A


PART- B

Vectors- plasmids, lambda phage structure, biology and derivatives as vectors, in vitro packaging, cosmids, phagemids, P1, PAC, BAC, YAC and M13 vectors, restriction enzymes, types, restriction and modification systems of bacteria, restriction and generalized mapping, RFLP

PART - C

Gene technology & implications: Gene cloning: genomic and cDNA library construction, subtractive cDNA library, PCR, RT-PCR, Real time PCR, ligation theory, transformation by CaCl₂, electroporation, biolistics; screening of cloned transformants – autoradiography, hybridization, non-radioactive methods; in vitro protein synthesis;
PART – D

Oligonucleotide mediated site directed mutagenesis. DNA sequencing- Sanger, Maxam-Gilbert, capillary, on chip, pyrosequencing. streptomycetes genetics; NIH guidelines on the genetic engineering experiments, fungal (yeast) genetic, protoplast fusion.

BOOKS FOR READING


BMI 3503: FOOD MICROBIOLOGY

Objective: This course has been designed with the objective of relating interactions of microorganisms and food in relation to food bioprocessing, food spoilage and food borne diseases.

PART – A

Microbiology of Milk and Milk products:
Composition of milk, sources of microorganisms in milk and their control. Number and type of microorganisms present in milk. Microbiological examination of milk and milk products.
Legal standards for milk and milk products, grading of milk and certified milk, microbiology of lactic cultures, dairy products manufactured with the aid of microorganisms, cheese, fermented milks,
PART – B

Food Chemistry

Moisture in foods, hydrogen bonding, bound water, determination of moisture in foods.


PART – C

Food microbiology

Contamination of foods from natural sources, Conventional and Rapid methods for microbiological examination of foods, Spoilage of different foods. Role of microorganisms in preserving foods. Fermented foods of Indian origin, Fermented soyabean products.

PART-D

Food preservation & Food poisoning:
Preservation methods: physical agents of preservation, chemical agents of preservation. Food poisoning: Intoxications and food infections, investigation of food borne disease outbreaks.

BOOKS FOR READING


BMI 3504: IMMUNO CHEMISTRY

Objective: The immunology section will introduce the student to immunologic concepts and their relationship to medicine. The cellular and molecular basis of the immune system and its function in host-parasite interactions are covered
PART – A


Cells of the immune system: Lymphoid cells, Mononuclear phagocytes, Granulocytic cells, Dendritic cells.

Organs of the immune system: Primary lymphoid organs, Secondary lymphoid organs, Mucosa associated lymphoid tissues.

Markers: Markers on T-Cells, B-Cells, Natural killer cells, macrophages and antigen presenting cells

PART-B

Structure of antibodies and antibody classes: Basic structure of antibodies as revealed by chemical and enzymatic methods. Antibody binding site. Domains and immunoglobulin folds. Five major classes of immunoglobulins and their biological activities. The B-Cell receptor and the immunoglobulin super family.

Organisation and Expression of Immunoglobulin genes: Germ line and somatic variation models to explain antibody diversity. Dreyer and Bennett two gene one-polypeptide model, Multi gene organization of immunoglobulin genes. Gene rearrangement in light and heavy chain and its mechanism. Generation of antibody diversity. Class switching among constant region genes.

PART – C

Molecular basis of immunogenicity and antigenicity Haptens, Mitogens, B cell epitope, T- cell epitopes. Affinity of antigen antibody interactions, antibody avidity and its biological significance, precipitation reactions, passive, bacterial and haemagglutination Radioimmunoassay, Enzyme linked immunororbent assay, immunofluorescent assay.


PART-D

Adjuvants, their chemical nature and mode of action. Complement and its components, functions of complement, complement activation by classical, Alternative and lectin pathway and its biological consequences, Regulation of complement system, diseases associated with complement deficiencies.

Cytokines & their properties, cytokine receptors, their families and subfamilies. Cytokine antagonists, diseases related to cytokines. General organization of Major Histocompatibility complex, Major classes of MHC antigen, Class I, Class II and Class III. MHC, disease susceptibility and immune responsiveness. Generation of monoclonal antibodies, hybridoma technology and various applications of monoclonal antibodies.
BOOKS FOR READING

3. Introduction to Medical Immunology by Gabriel Virella et.al. (1996)

SIXTH SEMESTER
BMI 3601: MEDICAL BACTERIOLOGY –II

Objective: The course is designed to introduce the students a broad view of diseases caused by various groups of bacteria, the laboratory diagnosis and preventive measures. Accordingly, the students are given practical training for identification of Gram positive and Gram negative common pathogens encountered in clinical specimens.

PART - A
Diseases caused by the following genera of family Enterobacteriaceae.

- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Shigella*: *Shigella dysenteriae*, *S. sonnei*, *S. flexneri* and *S. boydii*
- *Salmonella*: Causal agents of enteric fever, septicemia and enteritis.

PART – B

- *Proteae group*
- *Serratia marcescens*
- *Campylobactor jejuni* and *Helicobacter pylori*

Diseases caused by

- *Vibrio cholerae*
- *Pseudomonas group*
- *Bacterocides*: *B. fragilis* and *Fusobacterium sp*

PART – C

Spirochetes:
- Treponema:
- Borrellia:
- Leptospira:

Brucellae
Bartonella
PART-D

Legionella, 
Calymmatobacterium sp 
Mycoplasma and L. forms bacteria 
General description and biological properties of Rickettsiae and Chlamydiae. Epidemiology and pathogenesis of diseases caused by these organisms in humans.

BOOKS FOR READING
2. Mackie and McCartney Practical Medical Microbiology Ed Collee JG, Fraser AG, Marmion BP and Simmons A. Churchill Livingstone publication
3. Textbook of Microbiology: Ananthanaryan and Panikar
5. Medical Microbiology by Greenwood D, Slack RCB and Peutherer. Churchill Livingstone publication
6. Medical Microbiology by Mims and others. Elsevier Mosby Spain
7. Medical Microbiology Samuel Baron Publisher. Addison Wesley Publishing Co.
8. Mandell, Douglas and Bennett’s; Principles and Practice of Infectious diseases: GL Mandell R.Dolin and JE Bennett;s, Publisher Churchill Livingstone. NY
10. Review of Medical Microbiology-Jawetz et.al.

BMI : 3602: VIROLOGY

Objective: The objective of this course is to give an exhaustive account of viruses, their structure, classification and diseases associated with them to the B.Sc. (H.S.) final year students. This course will prepare them for further studies and research in virology.

PART – A


PART – B

Cultivation of viruses: Cultivation in animals, embroyonated eggs and cell culture. Detection of virus growth in cell culture.


Virus and cancer: Mechanism of viral oncogenesis and Oncogenic RNA and DNA Viruses.
PART – C

Virus host interactions:

Prevention and control: Immunoprophylaxis and chemoprophylaxis of virus deseases

PART-D

Detailed study of important groups of viruses causing diseases in man including the following groups:
Poxviruses, Herpesviruses, Picornaviruses, Orthomyxoviruses, Paramyxoviruses, Rhabdoviruses, Hepatitis viruses, AIDS viruses, Miscellaneous viruses.

BOOKS FOR READING


BMI 3603: MICROBIAL PHYSIOLOGY AND METABOLISM

Objective: The objective of the course is to teach the various aspects of microbial metabolism, growth kinetics and cell thermodynamics so as to understand the microbial physiology. This knowledge will be helpful to students for the research and industrial applications of microorganisms.

PART - A

Introduction to Microbial Physiology in the Post Genomics era (Metabolomics).

Microbial growth: Trophophase & Idiosphase, Primary & Secondary metabolites, Growth kinetics, Types of growth: Batch, Fed-batch, continuous & their industrial applications. Transport of nutrients in bacteria

Bacterial Cell Division, Cell Wall Synthesis, Fungal differentiation & Physiological specialization, Microbial nutrition & structural modifications,
PART - B

Regulation of metabolism: Concept of operons and regulons, enzyme induction, catabolite repression, End product inhibition and repression, attenuation, feed-back inhibition & repression, properties of allosteric enzymes and their role in controlling central metabolic pathways, covalent modification of enzymes.

Principles to study enzymes, different enzyme preparations and practical assay conditions, enzyme kinetics.

PART - C

Cell thermodynamics: Concept of thermodynamics of biological systems, modes of energy production, principles of electron transport & Chemiosmotic theory, photosynthesis, aerobic/anaerobic respiration, fermentation, modes of energy conservation

Ageing & death in microorganism, Stress response: Tolerance to extremes and starvation.

PART - D

Carbohydrate metabolism in bacteria & yeast: Glycolysis phosphogluconate pathway, hetero-lactic fermentation, Entner-Duodoroff pathway, Neuberg’s scheme of fermentation, mixed acid fermentation, Kreb’s cycle, Methyl glyoxal, gluconeogenesis, teichoic acid and lipopolysaccharide synthesis

Metabolism of nitrogen compounds, anaerobic amino acid catabolism, paired degradation of amino acid (Stickland reaction), aromatic amino acid synthesis.

BOOKS FOR READING

Objective: The objective of teaching of this course is the application of basic immunology /immunochemistry in various clinical manifestations/pathologies.

PART – A

Hypersensitivity reaction and Gell and Coomb classification. Type I hypersensitivity reaction components of IgE mediated hypersensitivity, intracellular events in mast cells degranulation, Pharmacologic agents mediating reaction, late phase reactions, localized and systemic anaphylaxis atopic and anaphylactic disorders, detection and control.

Type II Hypersensitivity: Mechanism of Type II hypersensitivity, Roles of different cells in causing Type II hypersensitivity reaction, Incompatible Blood Transfusion (immediate and delayed reactions) Hemolytic Disease of New borns, Drug Hypersensitivity. Diagnosis of Type II hypersensitivity reactions. Prevention/Treatment.

PART – B

Immune complex mediated type III hypersensitivity. Localized and generalized reactions, Arthus reaction and serum sickness, Diagnostic and therapeutic approaches.

Basis for cell mediated immune response. Type IV Hypersensitivity: Tuberculin and hypersensitivities to other agents, contact dermatitis, phases of DTH response, cytokines participating in DTH response, in vivo & in vitro diagnostic tests.

PART – C

Role of phagocytes in health and disease: Origin of phagocytic cells, Immune and non immune receptors present on macrophage membrane, Oxidative and non oxidative phagocytic functions, Secretary product of macrophages, Role of macrophages in regulating immune response, Functions of macrophages in vivo, Role of phagocytes in variety of human disorders,

Immunological tolerance; Basis of immunological tolerance, T cell tolerance to thymic and extra thymic antigens (clonal deletion and clonal anergy), Role of apoptosis, B cell tolerance (clonal abortion and clonal anergy), Factors affecting the induction and duration of tolerance, Failure of tolerance leading to auto immunity.

Physiological and pathological auto immune response. Autoimmune diseases: possible factors contributing to the diseases. Classification: organs specific autoimmune diseases (diseases mediated by direct cellular damage and by stimulating or blocking auto-antibodies) and systemic autoimmune diseases including auto immune thyroiditis, multiple sclerosis. Myasthenia gravis, systemic lupus erythematosus, rheumatoid arthritis. Their diagnosis as well as conventional and recent therapeutic approaches.

HIV / AIDS infection: history / spread, structure of HIV, pathogenesis, opportunistic infections, diagnosis and preventive / therapeutic approaches for AIDS.
PART – D

Classification of immunodeficiency diseases, primary deficiencies, immune deficiencies of myeloid lineage, phagocytic number, adherence, chemotactic and killing defects. Humoral deficiencies, Agammaglobulinemia, hypergammaglobulinemia, hypogammaglobulinemia, selective immune deficiencies, Ataxia telangiectasia.

Cell mediated immunodeficiencies, Di George syndrome. Combined immunodeficiencies, SCID and Wiscott Aldrich Syndrome, Experimental models of immunodeficiency, nude and SCID mouse.

Immunology of tumors, Malignant transformation of cells, tumor antigen, tumor specific and non specific antigens, humoral & cell mediated immune responses to tumor antigens, Immunological surveillance and evasion of immune response by tumors. Role of immunotherapy. Immunization, adoptive cellular therapy, passive therapy with monoclonal antibodies. Cytokines in tumor therapy


BOOKS FOR READING

2. Clinical Aspects of Immunology: Gell, Coomba and Lachman
6. Immunology by CV Rao, 2005

Apart from books, further reading should be done from Journal like:

1. Immunology
2. Infection and Immunity
3. Journal of Immunology
4. Internet sites for advanced immunology
### M.Sc (H.S.) 1st Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit</th>
<th>Marks</th>
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<tr>
<td>First semester</td>
<td>MMI 4101</td>
<td>Advances in Microbial Ecology</td>
<td>6</td>
<td>150</td>
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<tr>
<td></td>
<td>MMI 4102</td>
<td>Pathogenesis of Infectious diseases</td>
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<tr>
<td></td>
<td>MMI 4103</td>
<td>Newer approaches in diagnostic Microbiology</td>
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<td>MMI 4151</td>
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<td>Second semester</td>
<td>MMI 4201</td>
<td>Fermentation Technology</td>
<td>6</td>
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<td>MMI 4202</td>
<td>Advances in Molecular Biology &amp; Biotechnology</td>
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<td></td>
<td>MMI 4203</td>
<td>Advances in Immunoprophylaxis &amp; Immunotherapy of infections</td>
<td>6</td>
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<td>MMI 4251</td>
<td>*Combined Practical</td>
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Total Credits = 46
Total Marks = 1150

### M.Sc (H.S.) 2nd Year

<table>
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<th>Course Title</th>
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<td>MMI 5301</td>
<td>Fundamentals of Computer Programming and Applications</td>
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<td>80 (Theory) +20 (Practical) =100</td>
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<td>MMI 5302</td>
<td>Advanced Topics in Microbiology –I (Seminar)</td>
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<td>MMI 5303</td>
<td>Advanced Topics in Microbiology –II (Paper)</td>
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<td>MMI 5304</td>
<td>Project Training Report &amp; Presentation</td>
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<td>Fourth semester</td>
<td>MMI 5401</td>
<td>Thesis*</td>
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<td></td>
<td>MMI 5402</td>
<td>Viva Voce</td>
<td>4</td>
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</table>

* The research work for thesis will start from third semester

Total Credits = 34
Total Marks = 850
SYLLABI OF CORE COURSES OF READING

Pattern of instructions for Paper Setter:

Question papers will have FOUR sections. Examiner will set a total of NINE questions comprising TWO questions from each PART and ONE compulsory question of short answer types covering the whole syllabus. Students will attempt FIVE questions in all including ONE question from each PART and the compulsory question. All Questions will carry equal marks, unless specified.

M.Sc (H.S.) 1st Year in MICROBIOLOGY
FIRST SEMESTER

MMI 4101: ADVANCES IN MICROBIAL ECOLOGY

Objective: The syllabus has been designed to make students aware of the microbial interactions with environment including their natural habitat and adaptations, the fundamental processes of extreme thermophiles along with their stress resistance mechanism. Also, the course deals with the application of various molecular techniques to study microbial ecology and effect of various biotechnological processes on microbes.

PART-A

Microbial Ecology: Introduction, scope, historical overview, its relation with general ecology, microbial diversity- bacterial, archaeal & eucaryal diversity; fungal diversity; cyanobacterial diversity.

Natural Environment of Microorganisms: Habitat and its microbial inhabitants; Atmosphere-characteristics & stratification, atmosphere as habitat and medium for microbial dispersal, microorganisms in atmosphere; Hydro-Ecosphere- (1) fresh water habitats, composition & activity of fresh water microbial communities (2) Marine habitats-characteristics and stratification of the ocean, composition and activity of marine microbial communities; Litho-Ecosphere- microbiology of rocks & soils, deep subsurface microbiology.

Microbial Interactions: (1) Microbe-Microbe interactions- interaction within a single microbial population, positive & negative interactions, Interactions between diverse microbial populations-Neutralism, Commensalism, Mutualism, Synergism, Competition, amensalism, Parasitism & Predation ;(2) Microbe-Plant interactions- Interactions with plant roots : Rhizosphere, Mycorrhizae, Nitrogen-fixation in nodules, nitrogen fixing associations between rhizobia and legumes, non-leguminous nitrogen-fixing mutualistic relationships, interactions with aerial plant structures, microbial disease of plants :plant pathogens, bacterial, fungal & viral diseases of plants ; (3) Microbe-Animal interactions-Microbial contribution to animal nutrition, predation on microorganisms by animals, cultivation of microorganisms by animals food & food processing, commensal & mutualistic intestinal symbionts, digestion within rumen.
PART-B

Microbial Communities & Ecosystem: Structure & dynamics of microbial communities, diversity & Stability of microbial communities; population selection within communities: R & K Strategies; Succession within microbial communities; microbial communities in nature-microbes within Macro-communities, their structure & functions.

Microbiology of Extremophiles: Ecology of thermophiles, psychrophiles, halophiles, barophiles, osmophiles; effects of light, magnetic force, organic and inorganic compounds on microorganisms and defence strategies.

Microbial adaptations: Abiotic limitations to microbial growth-Liebig’s Law of the minimum, Shelford’s law of Tolerance, environmental determinants: temperature, radiation, pressure, salinity, water activity, movement, hydrogen ion concentration, redox potential, magnetic force, organic compounds, inorganic compounds.

PART – C

Quantitative Microbial Ecology: Modern and conventional methods used to study microorganisms, sampling procedures and devices, microbial enumeration, biomass determination, activity assessment.

Anaerobic Microbiology: Introduction to anaerobic techniques, measurement isolation and identification of methanogenic and other anaerobes.

Application of molecular techniques to microbial ecology: Nucleic acid extraction from soil and sediment, gene probe technology to study soil microbiology and biochemistry.

Molecular Approaches to Phylogeny: Allozyme genotyping, DNA markers, RFLP, RAPD, 16s rRNA technique, limitations of molecular microbial ecology.

PART-D

Microorganisms in Biological Control: Microbial control of insects, pests, weeds and other disease causing organisms.

Biodegradability testing and monitoring the bioremediation: Biodegradability and ecological side effect testing, Bioremediation efficacy testing, approaches to bioremediation, Bioremediation of various ecosystems.

An environmental assessment of biotechnological processes: Ecological consequences of the release of genetically engineered microorganism, risk assessment and methods used to study the effect of genetically engineered microorganism on environment. Regulation of biotechnology processes.

BOOKS FOR READING

2. Techniques in Microbial Ecology by Robert S. Burlage (Editor), Ronald Atlas (Editor), David Stahl (Editor), Gill Geesey (Editor), Gary Sayler (Editor), ASM Press, 1998
3. Freshwater Microbiology: Biodiversity and Dynamic Interactions of Microorganisms in the Aquatic Environment by David Sigee, 2004
12. Biological and Biotechnological Control of Insect Pests, By Jack E Rechcigl and Nancy A Rechcigl CRC Press ,1999

Journals

4. Multidisciplinary Journal of Microbial Ecology
5. Applied and Environmental Microbiology
6. Annual Reviews of Microbiology

MMI 4102: PATHOGENESIS OF INFECTIOUS DISEASES

Objectives: The course contents are designed to understand the disease process associated with various group of microorganisms collectively based on signs and symptomatology.

PART – A

• General principles of infectious diseases.

• Entry of microorganisms into the body: Role of host receptors and bacterial virulence traits. Organisms gaining entrance through skin, respiratory tract, intestinal tract, pharynx, urogenital tract, conjunctiva, interference by normal flora and exit of organisms from the body.

• Events occurring immediately after the entry of the microorganisms in host in relation to establishment of infections. Growth in epithelial cells spread of intracellular organisms & tissue tropism etc.
PART B

- The encounter of the microbe with the phagocytes and cells of RE system of the body. Neutrophil kinetics, phagocytosis by phagocytic cells, microbial defenses/strategies in relation to phagocytosis, consequences of functional defects of phagocytic cells on pathogenesis and evaluation of phagocytic functions.

- Immune responses to infections: Mechanisms of lymphocyte activation, role of lymphokines and related factors in induction of humoral and cell mediated immune responses.

PART – C

- The spread of microbes through the body: direct and indirect spread, microbial factor promoting spread, spread via lymphatic, blood and via other pathways.

- Microbial strategies in relation to immune responses: Immune tolerance immune suppression, molecular mimicry, induction of ineffective antibodies antibody mopping, antigenic variation, avoidance of immune responses and interference to immune response induction.

- Mechanisms of tissue inquiry in relation to bacterial infection: infection with no cell or tissue damages, direct damage by micro-organisms, microbial toxins, extra cellular enzymes, indirect damage via inflammation, immune responses.

PART D

- Recovery from infection: Role of specific (immunological) and non-specific factors (complement, interferon acute phase proteins, temperatures in recovery, tissue repairs and resistance to reinfection. Failure to eliminate microbes. Various aspects of latency with and without shedding of infectious agents.

- Susceptibility and resistance: Role of hosts and microbial genetic factors, hormonal and emotional stresses on host microbes’ interactions.

BOOKS FOR READING

4. Immunology by Tizard IR, Thomson, 4th Edn. 2004
5. Virulence mechanisms of bacterial pathogens edited by Brogdm KA, Roth JA, Stawton TB, Bolin CA, Minion FC, & Wannemuehler, ASM Press Washington DC
6. Clinical Immunology 2nd Edn. By Catherine Sheelan Publisher: Lippincot NY

Apart from above books, further reading should be done from Journals & reviews like

1. Journal of Medical Microbiology
2. Journal of Infectious diseases
3. Infection and Immunity
4. Visit on line internet sites for advancements in the field of pathogenesis of various Infectious diseases.
Objective: To provide information about latest techniques used for the diagnosis of various bacterial, viral, fungal and parasitic diseases.

PART – A

Enzyme Immunoassays:
Comparison of enzymes available for enzyme immuno assays. Conjugation of enzymes
Solid phases used in enzyme immuno assays. Homogeneous and heterogeneous enzyme
immuno assays. Enzyme immuno assays after immuno blotting. Enzyme immuno histochemical
techniques. Use of polyclonal or monoclonal antibodies in enzymes immuno assays.
Applications of enzyme immuno assays in diagnostic microbiology

PART - B

Molecular methods in clinical microbiology:
Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism
and plasmid finger printing in clinical microbiology

Laboratory tests in chemotherapy:
Susceptibility tests: Micro-dilution and macro-dilution broth procedures. Susceptibility tests:
Diffusion test procedures. Susceptibility tests: Tests for bactericidal activity. Automated
procedures for antimicrobial susceptibility tests.

PART – C

Automation in microbial diagnosis, rapid diagnostic approach including technical purification
and standardization of antigen and specific antibodies. Concepts and methods in idiotypes. Anti-
idiotypes and molecular mimicry and receptors. Epitope design and applications.
Immunodiagnostic tests. Immuno florescence. Radioimmunoassay.

PART - D

GLC, HPLC, Electronmicroscopy, flowcytometry and cell sorting.
Transgenic animals.
Methods and ethics of research.

BOOKS FOR READING

Objective: This course aims to provide fundamentals of fermentation technology and biochemical engineering for the production and recovery of various value-added products including the industrial chemicals, biofuels, metabolites for use in food industry and chemotherapeutic products.

PART – A
Production of industrial chemicals, biochemicals and chemotherapeutic products. Propionic acid, butyric acid, 2-3 butanediol, gluconic acid, itaconic acid, Biofuels: Biogas, Ethanol, butanol, hydrogen, biodiesel, microbial electricity, starch conversion processes; Microbial polysaccharides; Microbial insecticides; microbial flavours and fragrances, newer antibiotics, anti cancer agents, amino acids.

PART – B

PART - C
Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Distruption of microbial cells, centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products. Experimental model for design of fermentation systems, Anaerobic fermentations.

PART - D
Rate equations for enzyme kinetics, simple and complex reactions. Inhibition kinetics; effect of pH and temperature on rate of enzyme reactions. Mathematical derivation of growth kinetics, mathematical derivations of batch and continuous culture operations; single stage CSTR; mass transfer in aerobic fermentation; resistances encountered; overall mass transfer co-efficient (Ka); determination, factors depending on; scale up principle and different methods of scaling up. Metabolic engineering of antibiotic biosynthetic pathways.

BOOKS FOR READING
5. Biochemical Engineering by Aibe, Humphry & others.
Objectives: To apprise the students with advanced techniques and applications of Molecular Biology and recombinant DNA Technology. This course will help the students in further research in this area.

PART – A

Molecular genetics: signal transduction and expression of genes including environmentally regulated genes; molecular basis of pathogenesis; Regulation of gene expression in prokaryotes and eukaryotes, Promoters, enhancers, methylation, acetylation,

PART – B

Structural and functional genomics; Proteomics, Plasmid stability and incompatibility; codon preferences, transposones; transposition, gene rearrangement, homologous recombination.

PART – C

Molecular biological techniques: PFGE, DNA microarray, antisense RNA, RNAi and microRNA, protein engineering, phage display, DNA sequencing, Ribozymes, Stem cell technology . DNA foot printing and oligonucleotide mediated site directed mutagenesis; use of computer programs in data analysis and interpretation;

PART - D

Application of molecular biology in Biotechnology:

- Industry: e.g. protein engineering; enzyme and polysaccharide synthesis, activity and secretion, alcohol and antibiotic formation.
- Agriculture: e.g. N2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; qualitative improvement of live stock.
- Environments: e.g. chlorinated and non-chlorinated organ pollutant degradation; degradation of hydrocarbons and agricultural wastes, stress management, development of biodegradable polymers such as PHB.
- Forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing.
- Health: e.g. development of non-toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in E.coli, human genome project.

BOOKS FOR READING


Apart from above many other books, journal and reviews can be consulted such as:

1. Various volumes of methods in Enzymology
2. Annual Reviews of Molecular Biology, Biochemistry, Genetics, and Microbiology, Microbiological reviews, Trends in Biotechnology.

    Students are also advised to be online(various internet sites) for genomics/proteomics and other advancements in the field of Molecular Biology, Biotechnology.

**MMI 4203: ADVANCES IN IMMUNOPROPHYLAXIS AND IMMUNOTHERAPY OF INFECTIONS**

**Objectives:** To give insight into therapeutic and prophylactic measures of various human and animal diseases.

**PART – A**

Disease amenable to control by vaccination, rationale of immunization, controlled studies of vaccines, hazards of immunization, vaccination schedules.

Vaccines produced by conventional means to control major infectious disease: man and animals. Immune responses to vaccination.

**PART – B**

Bird flu vaccine: Yellow fever vaccine, Hib vaccine, Pneumococcal vaccine DNA vaccine, Edible Vaccine, Viral Vectored vaccine, Bacterial Vectored vaccine, Rabies Vaccine, Salmonella Vaccine, BCG Vaccine, Malarial Vaccine, Cholera Vaccine, DPT Vaccine, Hepatitis vaccine, Polio vaccine, MMR vaccine, Combinational Vaccine/Super vaccine, Anthrax vaccine.

**PART – C**

The development of biosynthesized vaccines. Infectious recombinant vectored virus vaccines. Modern approaches to live virus vaccines, live bacterial vaccines and their application against tumor antigens immunomodifiers in vaccines.

AIDS : HIV testing: product development strategies, approaches to HIV, vaccine design.

Idiotype vaccines and immunotoxins
PART – D
Plant expression systems for the production of vaccines.
Recombinant DNA vaccines.
Adjuvants & their future development.
Contraceptive vaccine development: future prospects.
Commercial & regulatory aspects of vaccines production and distribution.

BOOKS FOR READING
MMI 5301: FUNDAMENTALS OF COMPUTER PROGRAMMING & APPLICATIONS

Objective: Fundamentals of Computer Programming and Applications (MMI 5301)

The course provided basic introduction to computers, word processing tools, computing languages and computer programming operations.

PART - A

Introduction to computers:

Block Diagram of a computer; Description of each block in detail; concept of input-output devices; Types of input-output devices; Concept of Memory: Types of Memory; Concept of Central processing Unit (CPU), Control Unit (CU), and Arithmetic Logic Unit (ALU).

Flowcharts and Algorithms: Algorithms-their use; Flowcharts; various slide boxes and symbols; examples.

Introduction to word processing spread sheets and slide presentation packages.

Introduction to Bioinformatics.

PART – B

Introduction to C Language: C character set; Constants, variables, key words; Types of C Constants; Rules for constructing Integer Constants; Rules for constructing Real Constants; Rules for constructing Character Constants; Types of C variables; Rules for constructing variable Names: C keywords; C instruction classification; Type declaration instruction; Arithmetic; instruction; Integer and float conversion; Type conversion in assignments; Hierarchy operation; Basic C programe.

If Statement: The if statement; its syntax; Multiple statements within if, if-else statement; its syntax; Nested if else statement; its syntax; forms of If; Programs related to if, if-else statement.

Decision Control Structure; Conditional operator

    Use of Logical operators; Conditional operators; its syntax; Nested conditional operator;

    Programs related to conditional operator

PART – C

While, D-While Loop: The while Loop; its syntax; Tips and traps More operators; Nesting of while loops; do-while statement; its syntax; Nesting of do-while loops; Difference between while and do-while; programs with the use of while, do-while loops.

For Loop: The for loop; its syntax; Nesting of for loops; Tips and traps: difference between while, do-while and for loops; Programs with the use of for loops.
The Case Control Structure; Case-switch statement; Decision using switch statement; syntax; break statement; syntax; Programs with the use of case-switch, break statement.

**PART – D**

Functions: What is a function; Why use functions; Passing values between functions; Scope Rule of functions; Advanced Features of functions; Function declaration and prototypes; Call by value and call by reference. Programs with the use of functions.

Arrays: Array Definition and Syntax; Program related to arrays; array declaration; Accessing elements of array; entering data into an array; Reading data from an array; array initialization; array elements in memory. Two Dimensional Array. Programs with the use of Arrays.

Structures & Unions, their use:- Introduction to file handling. Reading and writing text as well as binary files.

**BOOKS FOR READING**

4. A simplified Text-cum-workbook on Application programming in C by R.S. Salaria, Khanna Booka Publishing Co. (P) Ltd.
7. Let Us C: Yashavant Kanetkar

**MMI 5302: ADVANCED TOPICS IN MICROBIOLOGY-I**

The students will be assigned various advanced topics in Microbiology and will be asked to deliver seminars on these.

**MMI 5303: ADVANCED TOPICS IN MICROBIOLOGY-II**

The students will be examined through a written test covering various advanced topics on which the students delivered seminars as part of MMI 5302

**MMI 5304: PROJECT TRAINING REPORT & PRESENTATION**

The students will be sent on 4-6 weeks summer training in various research institutes/industries for on the spot training and will be asked to submit a project report after the training which will be evaluated after making a presentation on the same.
FOURTH SEMESTER

**MMI 5401: THESIS**

The students will submit a thesis after undertaking a research which will start during the IIIrd semester under the supervision of faculty members.

**MMI 5402: VIVA VOCE**

The students will be evaluated for their research work on the basis of an oral examination by an external examiner.

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