COURSE OUTLINE

B.Sc. (HONS.) MICROBIOLOGY

HIMACHAL PRADESH UNIVERSITY

SHIMLA
Effective from session 2009-10

AL PRADESH UNIVERSITY
ER-HILL, SHIMLA-171005

B.Sc. (HONS.) MICROBIOLOGY PROGRAMME

GENERAL INSTRUCTIONS/GUIDELINES FOR EXECUTION OF CURRICULUM

1.   The B.Sc. (Hons) Microbiology programme will be of three years duration.

2.   There will be twenty Four courses for B.Sc. (Hons.) Microbiology programme. In the first year, second and third year there will be nine, eight and seven courses respectively. Each course will consist of a theory and a practical paper except course No. I (English), VIII (Hindi-I), IX (Environmental Studies), X (Hindi-II) and course No. XXIV (Introduction to Intellectual Property Rights & Entrepreneurship) which will have only theory paper.

3.   (a) The theory paper will be of 50 marks, practical paper of 30 marks and internal assessment of 20 marks. Except for Courses I (English) and XXIV (Introduction to Intellectual Property Rights & Entrepreneurship) in which theory will be of 80 marks and internal assessment will be of 20 marks and IX (Environmental Studies) which will be of 100 marks each. Hindi-I and Hindi-II will be of 50 marks each in which 40 marks will be of theory and 10 marks of internal assessment. The pass percentage and Divisions shall be as for other B.Sc. pass courses.
     (b) The split of the 20 marks of internal assessment (except Hindi) will be: attendance 05 marks; Assignment (one) 02 marks; Presentation 03 marks; Class test (two, half hour each) 05 marks and Final house test 05 marks. For Course Hindi, the internal assessment test will be of 10 marks (Attendance 05 marks and Final house test 05 marks). The award of marks for attendance will be as follows: i) upto 75% lectures including condonation of lectures as per ordinances: zero mark, ii) without condonation of lectures upto 75% : 1 mark; iii) 76-80% lectures : 2 marks, iv) 81-85% lectures : 3 marks; v) 86-90% lectures : 4 marks; vi) 91% and above lectures : 5 marks.

4.   The remedial course is to acquaint the biology students to basic methods, equations and expressions in mathematics and physics. These courses will be offered in first year. There will be examination in this course and pass marks in this course will be the same as for other courses.

5.   (a) The admission to B.Sc. (Hons.) Microbiology programme of Himachal Pradesh University will be as per guidelines of Himachal Pradesh University, Shimla from time to time.
     (b) The candidate should have passed 10+2 (class XII) Examination or its equivalent from a recognized Board/University with any of the three subjects out of Physics, Chemistry and Biology (or Biotechnology/ Microbiology/ Biochemistry) with 50% or equivalent grade (for SC/ST candidates marks of eligibility will be 45% or equivalent grade).
     (c) In case of candidates who are studying in University/Board/College/Schools in any of the foreign countries the eligibility/Qualifying marks will be the same as recognized/equivalent to 10+2 by the University or the association of the Indian University with 50% marks of equivalent grade (for SC/ST candidates, eligibility will be 45% marks or equivalent grade).
     (d) The candidate who has appeared in the qualifying examination but whose result has so far not been declared can also apply but his/her eligibility for the entrance test will be purely provisional subject to the condition that he/she has to produced a passing certificate scoring at least the minimum percentage of marks as prescribed for the qualifying examination on the day and the specified time of counseling.

more than 22 years of age as on 01st July of the year of
s recorded in the Secondary Education Board/ University
sidered as authentic.

6.   Admission will be based on the merit of the entrance test to be conducted by HP University or any other mode as to be decided by the University from time to time.

7.   The tuition fee and other monthly/annual charges will be as per University rules.

COURSES OF STUDY
FOR
B.Sc. (HONS.) MICROBIOLOGY

The syllabi, courses of study and credits in basic papers for B.Sc. (Hons.) Microbiology is given below and these papers will include: English, Fundamentals of Chemistry, Basic & Applied Physics, Fundamentals of Statistics and Computer, Hindi-I, Hindi-II and Environmental Studies. In addition, there will be

- Elementary Mathematics (for +2 medical)
- Year-wise marks distribution for B.Sc. (Hons.) Microbiology Course will be:

  First year   850
  Second year   750
  Third year   700
  Grand Total= 2300

OUTLINES OF COURSES FOR B.Sc. (HONS.) MICROBIOLOGY 1st YEAR

Course No.	Title of Course	Theory				Practicals
		Periods per week	Marks		Total periods of week	Marks
			Theory	Internal Assessment		
I*	English (common with B.Sc. pass course)	3	80	20	-	-
II (b)*	Elementary Mathematics	3	50	20	4	30
III*	Fundamentals of Chemistry	3	50	20	4	30
IV*	Fundamentals of Statistics and Computer	3	50	20	4	30
V*	Basic & Applied Physics	3	50	20	4	30
VI*	Introductory Microbiology	3	50	20	4	30
VII	Introduction to Applied Microbiology & Pathology	3	50	20	4	30
VIII*	Hindi-I (common with B.Sc. pass course)	2	40	10	-	-
IX*	Environmental Studies (common with B.Sc. pass course)	3	100	-	-	-
Total Marks in 1st Year			**520**	**150**		**180**

Total = 520+150+180 = 850

*Common courses with B.Sc. (Hons.) Biotechnology and B.Sc. (Hons.) Biochemistry.

OUTLINE OF COURSES FOR B.Sc. (HONS.) MICROBIOLOGY 2ND YEAR

Course No.	Title of Course	Theory				Practicals
		Periods per week	Marks		Total periods of week	Marks
			Theory	Internal Assessment		
X*	Hindi-II (common with B.Sc. pass course)	3	40	10	-	-
XI	Microbial Metabolism	3	50	20	4	30
XII	Virology	3	50	20	4	30
XIII*	Concepts in Immunology	3	50	20	4	30
XIV**	Fundamental Genetics & Molecular Biology	3	50	20	4	30
XV**	Introduction to Industrial Microbiology	3	50	20	4	30
XVI*	Instrumental Methods of Analysis	3	50	20	4	30
XVII	Phycology and Mycology	3	50	20	4	30
Total Marks in 2nd Year			**390**	**150**		**210**

Total Marks 390+150+210 = 750

**these courses are common with B.Sc (Hons) Biotechnology

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MICROBIOLOGY 3RD YEAR

		Theory			Practicals	
		Periods per week	Marks		Total periods of week	Marks
			Theory	Internal Assessment		
XVIII*	Basics of Recombinant DNA Technology	3	50	20	4	30
XIX	Systemic Bacteriology - I	3	50	20	4	30
XX	Systemic Bacteriology - II	3	50	20	4	30
XXI*	Introduction to Intellectual Property Rights & Entrepreneurship	1	80	20	-	-
XXII	Parasitology	3	50	20	4	30
XXIII	Environmental Microbiology	3	50	20	4	30
XXIV	Applied Medical Microbiology	3	50	20	4	30
Total Marks in 3rd Year			**380**	**140**		**180**

Total Marks 380+140+180= 700

Grand Total Marks for B.Sc. (Hons.) Microbiology Degree 850+750+700=2300

SYLLABUS OF B.Sc. (HONS.)
Microbiology(1ˢᵗ YEAR)

COURSE: I
ENGLISH
(Common with B.Sc. pass course)

Maximum Marks: 80

Instruction to Examiner:
- As per instructions for English paper in other B.Sc. Courses of H. P. University

A. Text Book
The Threshold
Poems
1. John Milton   On His Blindness
2. William Wordsworth   The World is too much with us
3. William Blake   The Echoing Green
4. Emily Dickson   A Bird came Down The Walk
5. Robert frost   Stopping by Woods on a Snowy Evening
6. Nissim Ezekiel   Night of the Scorpion
7. Sarojini Naidu   Palanquin Bearers
Essays
1. Nehru   Work in the Sun and the Light
2. Stephen Leacock   My Financial Career
3. C.V. Raman   The Elixir of Life
4. C. Beavers   Streamlining
5. L. A. Hill   Principles of Good Writing
Stories
1. O Henry   The gift of the Magi
2. Isaac Bashevis Singer The Fatalist
3. Guy de Mauppasant   Duel
4. R. K. Narayan   Nitya
5. Prem Chand   The Child

B. Grammar, translation and Composition
Phrase, clause, sentence;
Number, gender;
Noun, pronoun, adjective, adverb;
Preposition, conjunction, articles, modals;
Punctuation and capital letters;
Voice narration;
Synonyms and antonyms;
One word substitution;
Translation from Hindi to English;
Comprehension (unseen passage);
Personal letter & application;
Telegram, notice and invitation;

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unds of English, pronunciation.

C. Viva –Voce

    a. Testing of speaking/reading/comprehension ability of the students. The candidates may be given to read some sentences/a short passage in order to test their proficiency.

    b. Testing the student's ability to consult a dictionary for locating a word, its meaning, pronunciation, parts of speech, use of appropriate preposition, etc.

    c. Testing of students listening ability by asking them to write some words.

    d. At least 8 to 10 minutes may devoted to each student in conducting the viva-voce examination (Viva-voce may be conducted before the conduct of final written examination)

D. Internal assessment:

It shall be based on the classroom performance, class tests, assignment and response of the students during the academic session.

Recommended Books:

1. **The Threshhold-**MacMillan
2. **Advanced Learner's Dictionary-**Oxford University Press
3. **Longmann's Dictionary of Contemporary English**
4. **Intermediate English Grammar (with key)-Raymond Murphy**
5. **Suplimentary Excercises-**Raymond Murphy, Hashemi
6. **Living English Structure-**W. Stannard Allen
7. **English Vocabulary in Use-**Michael McCarthy and Palicity O'Deil

COURSE: II (b)
NTARY MATHEMATICS

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

UNIT 1

Real Numbers

Different kinds of numbers, Integer, rational and Irrational, Surds and their Properties, Fractional Indices.

Set, relation and function

Set, Product sets, Relations, Functions (Polynomials, Trignometric, Exponential), Graphical representation of Functions

Limit

Sequences, limits of sequences, Series, limits of functions

UNIT II

Elementary mathematical logic.

Elementary Trigonometry, Addition Subtraction, A-B, C-D Formulas.

Concept of A.P, G.P., Natural numbers, Elementary Computing Binary System

Binomial Theorem

Expanding $(x+y)n$, Binomial Coefficients, Binomial Theorem

UNIT III

Matrices and vectors

Matrix Algebra, Determinants, Applications vector in space,

Calculus

Differentiation: Calculating gradients of chords first and higher order derivatives. Applications Increasing and Decreasing Functions, maximum and Minimum Points, Derivatives as rates of change

Integration: Finding a Function from its derivative, Definite Integral, Indefinite Integral, Calculating Areas, Volumes for bounded regions

Differential Equations: forming differential equations, First Order differential equation, growth equation, Applications.

UNIT IV

Complex Numbers

Extending the number system, Operations with complex numbers

Linear Programming

Elementary Statistics

Representation of Data: Discrete Data, Continuous data, Histogram, Polygons, Frequency Curves

The Mean, Variability of data-The Standard Deviation

Median, Quantiles, Percentile

Skewness

1. Mathematics for Biosciences -**Arya J.C and Lardner, R.W**
2. Advanced Engineering Mathematics-**Erwin Kreyszig**

List of Practical:

Maximum Marks: 30

1. Sets
2. Product set, relation
3. Concept of A.P.G.P, Natural Number
4. Binomial Theorem and Coefficient
5. Matrix and Vectors
6. Mean, Median, Quartiles, Percentile

COURSE: III
ENTALS OF CHEMISTRY

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q. No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit- I

Periodic properties

Position of elements in the periodic table, effective nuclear charge and its calculations, atomic and ionic radii, ionization energy, electron affinity and electro negativity definition, methods of determination trends in periodic table and applications in predicting and explaining the chemical behavior.

Chemistry of Noble gases

Chemical properties of noble gases, chemistry of xenon, structure and bonding in xenon compounds, clathrates, types and stability.

Coordination compounds

Introduction, Werner's coordination theory, naming of coordination compounds. Stereochemistry, Geometrical isomerism and optical isomerism in compounds having coordination number 4 and 6.
Bonding in metal complexes

Unit II

Chemical bonding

Covalent bond

Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridisation and shapes of inorganic molecules and ions- BeF_2, $SnCl_2$, XeF_4, BF_3, NH_3, H_2O, ClF_3, ICl_2, PF_6, SF_6 and IF7.

Molecular orbital theory, Homonuclear (elements and ions of Ist and 2nd row) and heteronuclear (BO, CN, CO^+, NO, CO, CN^-), multicentre bonding in electron deficient molecules (BORANES).

Weak interactions

Hydrogen bonding & Vander walls forces

Some fundamental aspects of organic chemistry, inductive effect, electromeric effect, resonance, hyperconjugation, types of reagents electrophile and nucleophiles, types of organic reactions. Reaction intermediates- carbocations, carbanions, free radicals, carbenes (with examples).

Nomenclature and classification of Alkyl halide: Methods of formation, Chemical reactions, Mechanisms and stereochemistry of nucleophillic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy diagram. Methods of preparation of aryl halides. The Elimination-Addition mechanism (benzyne mechanism) and nucleophillic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and Aryl halides.

Alcohols and Phenols

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, Fries rearrangement. Mechanism of Kolbe's reaction, ...nism, Electrophilic substitution reactions of phenol.

Unit III

Aldehydes and Ketones

Reactions with mechanism: oxidation, reduction, reductive amination, nucleophillic addition reaction, ketoenol tautomerism, aldol condensation, Cannizaro's reaction, The Wittig's reaction, Perkin's reaction.

Carboxylic Acids and derivatives

Structure of Carboxylic acids and derivatives. Acidity of carboxylic acids, Effect of substituents on acidic strength. Chemical properties of carboxylic acids. HVZ reaction with mechanism. Relative Stability and reactivity of acid chloride, esters, anhydrides, amides. Mechanism of esterification.

Introduction quantum mechanics: Failure of classical mechanics, advent of quantum theory, Schrodinger wave equation (SWE), physical interpretation of wave function, Quantization, solution of SWE for (i) particle in one dimensional box (ii) rigid bodies (iii) Harmonics Oscillators (iv) Tunnelling and its applications in biological system.

Physical properties and molecular structure: Optical activity, polarization, orientation of dipoles in an electric field, dipole moment, magnetic properties.

Unit IV

Solutions: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient, Dilute solution, Osmotic pressure, its law and measurements. Elevation of boiling point and depression of freezing point.

Chemical Kinetics: Scope, Rate of reaction, influencing factors such as concentration, temperature, pressure, solvent *etc.* theories of chemical kinetics, Arrhenius Equation, Concept of Activation energy.

Molecular Velocities: Root mean, average and most probable velocities, qualitative discussion of Maxwell's distribution of molecular velocities, collision number, mean free path.

Recommended books:

1. Organic Chemistry -**I.L.Finar**
2. Organic Chemistry-**Morrison and Boyd**
3. Inorganic Chemistry-**J.D.Lee**
4. Inorganic Chemistry-**Puri, Sharma & Kalia**

Maximum Marks: 30

1. Inorganic qualitative analysis

Four ions including interferring ions.

2. Volumetric Analysis

- Iodimetry

- Redox titrations using cericsulphate, potassium dichromate and potassium permanganate

- Comlexometric titrations using EDTA of Ca^{++}, Mg^{++} and Zn^{++}

COURSE: IV
COMPUTER FUNDAMENTAL

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit I

Stastical methods
An introduction, types of data, collection, classification and tabulation of the Primary data, Secondary data, Discrete data and continuous data, diagrammatic and graphical representation of grouped data, frequency distribution {univariate and bivariate}, cumulative frequency distribution and their graphical representation, histogram frequency polygon and ogives.

Concept of Central Tendency or location and their measures, partition values: quantiles, deciles and percentiles, dispersion and their measures, relative dispersion.

Moments (Single and double variables) and their relationships, Karl Pearsonøs, Beta & Gamma coefficients, Charlierøs checks and Sheppardøs correction for moments for grouped data (without derivation), skew ness & kurtosis and their measures.

Unit II

Mathematical expectation (single and bivariate), expectation of sum of random variables, Variance and Covariance, moment generating and cumulate generating function.

Binomial distribution, Poisson distribution as a limiting form of binomial distribution and properties of these distributions, moments, moment generation function, cumulate generating function, Geometric distribution and exponential distribution and properties of these distributions.

Normal Distribution
Correlation and regression analysis
Hypothesis testing
Markov Models
Cluster Analysis
- Nearest neighbour search
- Search using stem numbers
- Search using text signature

Probability.

Statistical Packages.

Unit III

Computer Fundamental
Computers: General introduction to computers, organization to computers, digital and analogue computers, computers algorithms.

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...s: milestones in hardware and software- batch ...

...ots, stored programs, functional units and their interrelation: communication with computer.

Unit IV

Data storage devices primary storage: storage addressed and capacity, type of Memory: Secondary Storage Devices: Magnetic tape- data representation and R/W: Magnetic Disks, fixed and removable, data representation and R/W: Floppy and Hard Disks, Optical Disks CD-Rom, Mass Storage Devices.

Input/ Output Devices: Key-tape/ diskette devices, light pen Mouse, , joystick, Source data automation.

Printed outputs: serial, line, page, printers, Plotters, voice response units.

Recommended books:

1. Biostatics -**P.N. Arora & P.K. Malhotra**
2. Introduction to Biostastics- **Sokal & Rohif**
3. Statistical Methods in Bioinformatics: An introduction-**W.Evans.Grant**
4. Computers Today-**S.K.Basandra**
5. Computer fundamentals-**P. K. Sinha**

List of Practical:

Maximum Marks: 30

1. Presentation of date by frequency tables, diagrams and graphs
2. Calculation of measures of central tendancies
3. Calculation of measures of dispersion
4. Calculation of measures of skewness and kurtosis
5. Fitting of binomial distribution.
6. Fitting of Poisson distribution.
7. Probability
8. Bivariate frequency table.
9. Basics of Computer
10. Basic Commands-File Creation, Copying, moving and deleting in Linux & Windows.

COURSE:V
S AND APPLIED PHYSICS

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit I
Mechanics

Cartesian and spherical polar co-ordinate systems, area, volume, velocity and acceleration in these systems. Solid angle, centre of mass, equivalent one body problem, central forces, equation of motion under central force. Elastic collision and C.M system, velocities, angles and energies, rigid bodies motion, rotational motion, principal moments and axes, Euler's equations, Michelson-Morley experiment and its result. Variation of mass-energy equivalence, test mass in an inelastic collision, relativistic momentum and energy.

Unit II
Vibration waves

Simple harmonic motion, energy of a SHO, transverse vibrations of a mass on a string, composition of two perpendiculuar SHM. Decay of free vibrations due to damping. Differential equation for a forced mechanical and electrical, oscillators, transient and steady state behaviours. Displacement and velocity variation with driving force frequency, variation of phase with frequency, resonance, power supplied to an oscillator and its variation with frequency.

Unit III
Electricity and magnetism

Basic ideas of vector calculus, gradient, divergence, curl and their physical significance, Laplacian in rectangular, cylindrical and spherical coordinates. Coulums law for point charges and continuous distribution of charges, electric field due to dipole, line charge and sheet of charge. Eletric flux, Gauss's law and its applications.

Work and potential difference, as line integral of field, electric potential due to a point charge, a group of point charges, dipole and quadrupole moments, long uniformly charge wires, charge discs. Stroke's theorem and its application in electrostatic fields.

Current and current density, equation of continuity, deviation of ohm's law ($J=oE$). Permeability and susceptibility and their inter relationships. orbital motion of electrons and diamagnetism, electron spin and paramagnetism, ferromagnetism, domain theory of ferromagnetism. hysterisys loss, magnetization curve, ferrites.

Unit IV

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...aw and its application to long straight wires, circular ...gence and curl of B. Faraday's law of EM induction, ...ctance and Recipricity theorm,L for solenoid, coupling of electrical circuits.analysis of LCR series and parallel resonance circuits, Q factor, power consumed, power sector.

Recommended books:

1. Mechanics- **H.S. Hans & S.P. Puri**
2. Physics of vibrations & waves-**H.J. Pain**
3. Fundamental of Electricity and magnetism-**A.F. Lipp**
4. Electricity and Magnetism, Berkeley Physics Course Vol. II -**E.M. Purcell**
5. A laboratory manual of Physics for undergraduate classes- **D.P Khandelwal**
6. B.Sc. Practical Physics- **C.L. Arora**

List of Practical:

Maximum Marks: 30

1. To find the moment of inertia of a fly wheel.
2. To study the dependence of MOI on distribution of mass by noting the time periods of oscillation using objects of various geometrical shapes of but of same mass.
3. To measure/obtain logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
4. To find the resistance by Carry Foster method after calibrating the bridge wire.
5. To find internal resistance of a cell by using potentiometer.
6. Capacitance by flashing and quenching of a neon lamp.
7. To determine the capacitance of a capacitor by discharging it through a voltmeter.
8. To Study the use of CRO by lissajous figures.
9. To trace B-H curve for different materials using CRO and find magnetic parameters from these.
10. To use a multimeter to measure DC voltage, DC current, AC voltage, Resistance, audible continuity test and diode test.

COURSE: VI

INTRODUCTORY MICROBIOLOGY

Maximum marks-50

Instructions for Examiner:
- Set nine questions in all Q. No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit I
History of Microbiology: A.Leeuwenhoek, L.Pasteur, R.Koch, J.Lister, J.Tyndall, etc.

Biogenesis vs Abiogenesis, Koch's Postulates, Discovery of antibiotics.

Principle of Microscopy: Bright field, Dark field, Phase contrast, Fluorescent, Electron Microscopy.

Unit II
Microbial classification: Bacteria, Fungi and Algae.

Morphology of bacteria, Viruses and fungi with major emphasis on bacterial structure specially cell wall. Gram positive and Gram negative bacteria. Microbial spores, Sporulation/germination process.

Unit III
Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rates, monoauxic, diauxic and synchronous growth, chemostat.

Microbes in extreme environment like high temperature and high/ low pH values

Physical and chemical agents to kill microbes, sterilization and pasteurization processes

Unit IV
Normal micro flora in humans/animals.

Types of microbial pathogens and disease caused by them. Microbial interactions like symbiosis and antibiosis etc. Host defense mechanism against pathogens.

Nitrogen fixing microbes in agriculture.

Microbial metabolism, unique pathways, photosynthesis, fermentation and its products, production of heterologous proteins in microbes.

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Recommended books:

1. Microbiology- **Davis, B.D Dulbecco, R., Eiser, H.N. and Ginsberg, H.S.**
2. Microbiology: an introduction- **Tortora, G.J., Funke, B.R. and Case, C.L.**
3. General Microbiology- **Stanier, R.Y.**
4. Microbiology- **Pelczar, M.T.**
5. General microbiology- **Schlegel, H.G.**
6. Industrial Microbiology- **Prescot and Dunn**
7. Microbiology: fundamentals and Applications- **Purohit, S.S.**
8. Microbes and Man- **Postgate, J.**
9. Microbiology: Laboratory manual- **Cappuccino, J.G and Sherman, N.**

List of Practical:

Maximum Marks: 30

1. Aseptic techniques
2. Cleaning of glass wares, Preparation of media, Cotton plugging and sterilization
3. Personal hygiene-microbes from hands, Tooth-scums and other body parts.
4. Isolation of microorganisms from air, water and soil samples
5. Dilution and pour plating techniques.
6. Enumeration of microorganisms total vs viable counts.
7. Identification of isolated bacteria
8. Gram staining, other staining methods, metabolic characterisation (e.g ImVIC) Tests
9. Growth curve of microorganisms.
10. Antibiotics sensitivity of microbes. Use of antibiotic discs.
11. Testing of water quality
12. Test for antibodies against given Bacteria
13. One step growth of bacteriophage.
14. Culture from body fluids (stool, Urine, blood).

Alcoholic and mixed acid fermentation

COURSE: VII

IED MICROBIOLOGY AND PATHOLOGY

Maximum Marks-50

Instructions for Examiner:
- Set nine questions in all Q. No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

UNIT-I

Host parasite relationship of infectious diseases (General physical,chemical barriers and biological barriers).Specific and non-spesific immune defence mechanisims,of host .

Introduction to pathogenic microbiololgy; Epidemiology of infectious diseases, infectious disease cycle, transmission of infectious agents , no of epidemics nosocomial infections, salient features of prevention ,survillence and control of epidemics.

UNIT-II

Viral diseases such as influenza , measles, yellow fever, rabies , poliomyelitis and AIDS. Microbial disease of humans caused by chalamydiae , rickettsiae, Gram positive and Gram negative organisms, human mycotic and paracitic infections.

UNIT-III

Introductory food and industrial microbiology: Food spoilage, food borne disease, assessing microbial contents of food. food preservation, food sanitation and microbiology of milk and dairy products.

Introduction to Soil and Agriculture Microbiology:
Agriculture and soil microbiology, pesticides, microbial insecticides, ruminants and microorganisms,
Industrial microbiology, industrial fermentation of alcohol and alcoholic beverages, antibiotic fermentation, vitamins and amino-acids, microbial bioconversions, enzymes production by microorganisms.

UNIT-IV

Introduction to general pathology history, development and relevance of study in relation to human. Study of homeostasis, febrile reaction, intra and extra cellular environment of cells and factors affecting the constancy of environment, degenerations, cloudy swelling, fatty degeneration glycogen infiltration, hyaline degeneration, amyloidosis.
Necrosis: Its pathogenesis and role of ischaemia in necrosis, inflammations, various type of acute and chronic inflammatory reactions pathogenesis. Types of wounds, ulcers, their pathogenesis and process of repair. Healing by primary and secondary infection. Factor affecting wounds healing allergic inflammation and its role in diseases. Haemorrhage, shock, isochaemia, odema, thrombosis and embolism.

Disturbances of growth of cells, aplasia, neoplasia, hyperplasia, study of neoplastic cell, pathogenesis of benign and malignant tumors. Process of aging at cellular level.

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1. Microbiology by pelczar *et al*

2. Pathology by Anderson. vol. I & II.

3. Text book of pathology by William Boyd.

List of practicals: **Max Marks: 30**

1.Isolation of microorganisms from air,water,soil sample.
2 Baterial examination of milk.
3 To determine the quality of milk by dye reduction test.
4 Estimation of haemoglobin.
5 Estimation of E.S.R and P.C.V. Value.
6 Negative staining
7 Acid- fast staining.
8 To demonstrate bacterial motility.

COURSE: VIII
HINDI-I
(Common with B.Sc. pass course)

Maximum Marks: 40

सामान्य हिन्दी — पत्र-एक

समय : 3 घंटे   पूर्णांक : 50

हिन्दी को उच्च शिक्षा की माध्यम भाषा बनाने के लिए आवश्यक है कि
मानविकी, समाज विज्ञान, विज्ञान, वाणिज्य आदि सभी संकायों के विद्यार्थी
हिन्दी भाषा का अध्ययन करें। यह परीक्षा 50 अंकों की होगी और इसे उत्तीर्ण
करना आवश्यक होगा। श्रेणी – निर्धारण में ये अंक जोड़े जाएंगे। प्रथम/पत्र एक
स्नातक प्रथम वर्ष परीक्षा और द्वितीय पत्र स्नातक द्वितीय वर्ष हेतु निर्धारित है।
सामान्य हिन्दी स्नातक, बी.ए. उत्तीर्ण (पास) पाठ्यक्रम के विद्यार्थियों के
लिए भी निर्धारित है।

पाठ्यक्रम विषय

संक्षेपण, पल्लवन, पत्राचार, अनुवाद, मुहावरे-लोकोक्तियाँ, शब्द-शुद्धि, वाक्य-
शुद्धि, शब्द-ज्ञान-पर्याय, विलोम, अनेकार्थी, अनेक शब्दों के लिए एक शब्द,
कंप्यूटर में हिन्दी का अनुप्रयोग ; प्रारम्भिक परिचय, हिन्दी में संक्षिप्तीकरण, हिन्दी
में पदनाम।

पाठ्य पुस्तक

डॉ. कृष्ण कुमार गोस्वामी, **अनुप्रयोगिक हिन्दी**, अरुणोदय प्रकाशन, दिल्ली।

अंक विभाजन तथा व्याप्तक के लिए निर्देश

संक्षेपण, पल्लवन	7 अंक
पत्राचार	7 अंक
अनुवाद	6 अंक
मुहावरी-लोकोक्तियाँ	10 अंक
शब्द-शुद्धि, वाक्य-शुद्धि, शब्द ज्ञान-पर्याय, विलोम, अनेकार्थी, समश्रुत, अनेक शब्दों के लिए एक शब्द	10 अंक
कंप्यूटर में हिन्दी का अनुप्रयोग	5 अंक
हिन्दी में संक्षिप्तीकरण, हिन्दी में पदनाम	5 अंक

आवश्यक निर्देश

उपर्युक्त अंक विभाजन के अनुसार इस ज्ञान पत्र में निर्धारित पाठ्य पुस्तक में से
पर्याप्त विकल्पों के आधार पर प्रश्न पूछे जाएंगे।

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ENVIRONMENTAL STUDIES
(...ion with B.Sc. pass course)

Maximum Marks: 100

Instruction for Examiner

- Answer of five questions only expected
- There will be two questions from each section and students have to answer one question from each section. Each question will be of 20 marks.
- In addition to above there will be one compulsory question of 20 marks. This will be based on entire syllabus. This question will have 10 parts of 2 marks each.

Unit-I
1. Environment óits definition, objective and importance
2. Scope of environmental education-multi disciplinary approach a fusion of subjects of science, art and humanities.
3. Environment education in historical context
4. Environment education through various subjects
5. Natural resources: Exploitation and development
6. Bio-diversity and conservation

Unit-II
1. Eco-system, community and biotic regions
2. Increasing population its education & environmental results
3. Air, water, sound, noise pollution and control
4. Forest conservation and social forestry
5. Audio-video techniques & conservation of wild life
6. Soil erosion and its conservation
7. Energy and environment

Unit-III
1. Environmental education planning and its implementation
2. Environmental awareness
3. Environment in educational institutions and in the service training
4. Environmental problem: Solution method & project method
5. Environment club, laboratory, library and publication
6. Environmental learning aids (with audio-video material)
7. Game and environment
8. Field trip and environment

Unit-IV
1. Population growth & environmental degradation
2. Bad effects of insecticides on life
3. Polluted residence one more step towards downfall
4. Man & environment: Global view of environment
5. World history of environment conservation
6. Environment protection & improvement at National level
7. International treaty, conference and environmental act
8. Environmental destruction: Future vision and healthy environment for future

Recommended book:
Environmental Study-**S K Dhawan, S K Sharma and M L Sharma**

) MICROBIOLOGY 2ⁿᵈ YEAR
COURSE: X
HINDI-II
(Common with B.Sc. pass course)

Maximum Marks: 40

सामान्य हिन्दी — पत्र-दो

समय : 3 घंटे   पूर्णांक : 80

हिन्दी को उच्च शिक्षा को माध्यम भाषा बनाने के लिए आवश्यक है कि पाठविषयों, समाज विज्ञान, विज्ञान, वाणिज्य आदि सभी संकायों के विद्यार्थी हिन्दी भाषा का अध्ययन करें। यह परीक्षा 80 अंकों की होगी और इसे प्राप्तांक द्वारा आवश्यक होगा, हिन्दी - विषयांक में दो अंक जोड़े जायेंगे। प्रथम पत्र एक स्नातक प्रथम वर्ष परीक्षा और द्वितीय पत्र स्नातक द्वितीय वर्ष हेतु निर्धारित है। सामान्य हिन्दी स्नातक श्रेणी स्तर (पास) पाठ्यक्रम के विद्यार्थियों के लिए भी निर्धारित है।

राष्ट्रीय विषय :   खण्ड-क

निम्नलिखित लेखकों/विद्वानों के एक-एक निबन्ध का अध्ययन किया जाएगा ;

महात्मा गाँधी – आत्मिक दर्शन; विनोबा भावे – प्रार्थनाली को रचना; आचार्य

शीर्ष-समष्टि और व्यक्ति; भगवतशरण उपाध्याय – भारतीय संस्कृति की कहानी;

रघुवीरशरण दुबे – परम्परा : कुछ विचार, कुछ प्रश्न।

पाठ्य पुस्तक

डॉ. रमानोहरलाल शर्मा (सं.), युग चेतना, स्वर्ण जयन्ती, समृद्धिनगर पाठशाला, दिल्ली।

खण्ड-ख

हिन्दी भाषा और उसके विविध रूप-कार्यालयी भाषा, मीडिया की भाषा, विज्ञ एवं तकनीक की भाषा, महाँयी भाषा।

खण्ड-ग

अनुवाद व्यवहार – अंग्रेजी से हिन्दी में अनुवाद

खण्ड-ख तथा ग के लिए पाठ्य पुस्तक

डॉ. रामस्वरूप, भाषा के विविध रूप और अनुवाद, विद्यानिधि, हरियाणा, दिल्ली।

अंक विभाजन तथा प्रायोगिक के लिए निर्देश

दो व्याख्याएँ खण्ड-ख से   2 × 7 = 14 अंक

एक आलोचनात्मक प्रश्न (सा, संरूप, समस्या) खण्ड-ख   1 × 8 = 8 अंक

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एक पत्रम खाण्ड–अ से

$1 \times 8 = 8$ अंक

$1 \times 5 = 5$ अंक

खाण्ड (ग)

$1 \times 10 = 8$ अंक

$10 \times \frac{1}{2} = 5$ अंक

आवश्यक निर्देश

1. खण्ड "क" के अन्तर्गत निर्धारित पाठ्य पुस्तक के विभिन्न निबन्धों में से चार व्याख्याएँ पूछी जाएंगी जिनमें से दो को व्याख्यात्मक करना होगा।

2. निर्धारित निबन्धों पर दो आलोचनात्मक प्रश्न सार/उद्देश्य एवं समस्या पर पूछे जाएंगे जिनमें से एक का उत्तर देना होगा।

3. निर्धारित पाठ्य पुस्तक "युग मनीषा" में से सात लघुउत्तरी प्रश्न पूछे जाएंगे जिनमें से पाँच के उत्तर देने होंगे।

4. खण्ड "ख" में से दो प्रश्न पूछे जाएंगे जिनमें से एक का उत्तर देना होगा।

5. खण्ड "ग" में से अंग्रेजी से हिन्दी-अनुवाद के लिए पाठ्य पुस्तक से दो अनुच्छेद पूछे जाएंगे जिनमें से एक का अनुवाद करना होगा।

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COURSE: XI
OBIAL METABOLISM

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I

Introduction, scope of microbial physiology studies, organization of prokaryotic and eukaryotic cells, organelles of the microbial cells and their functions. Brief account of archaebacteria.

Microbial nutrition, classification of microorganisms on the basis of their nutrition requirements. Uptake of nutrients

Unit-II

Detailed study of Carbohydrates catabolism with special emphasis of bacteria and yeasts. Glycolysis, Phosphogluconate Pathway, Heterolactic Fermentation, Enter-Doudord Pathway, Neuberg's Schemes of Glucose fermentation, Mixed Acid Fermentation, Butyric Acid and solvents producing fermentations. Methyl Glyoxal metabolism. Krebs Cycle, Glyoxylate cycle, Electron Transport, Chemiosomotic theory.

Metabolism of Nitrogen Compounds, anaerobic amino acids catabolism, paired degradation of amino acids (Stickland reaction).

Unit-III

Microbial Growth: Trophophase and Idophase, Primary and secondary metabolites, growth kinetics.
Types of growth: Batch, Fed-Batch, and Continuous and their industrial applications. Transport of compounds in microbes.

Unit-IV

Sugar and Polysaccharide Synthesis, Cell Wall and Teichoic acid, Lipopolysaacharides biosynthesis. Anaplerotic sequences, bacterial photosynthesis, synthesis of lipids, essential amino acid synthesis.

Regulation of bacterial metabolism: enzyme induction, catabolite repression, feed-back inhibition and repression, properties of allosteric enzymes.

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ehninger, A.L. Nelson, D.L. and Cox, M.M.
2. Biochemistry of Industrial Micro-organisms ó **Eds., C. Rainbow, A. H. Rose and A.C.Press, New York**.
3. Chemical Microbiology ó **A. H. Rose**
4. Bacterial Metabolism - **G. Gottschalk,** Springer Verlag.
5. Principles of Fermentation Technology - **Whittaker**
6. Biochemistry- **Stryer, L**
7. The Microbial World-**Stanier, R.Y. et al. Prentice Hall (India) Pvt. Ltd.**
8. Microbial Physiology-**Moat, A.G. & Foster, J.W. John Wiley & Sons.**

List of Practical:

Maximum Marks: 30

1. Preparation of liquid and solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods.
3. Isolation of pure; cultures from soil and water
4. Growth: Growth curve
5. Measurement of bacterial population by turbidometry and serial dilution methods.
6. Direct microscopes counting of bacteria.
7. Motility by hanging drop techniques.
8. Microscopic examination of bacterial, yeast and molds and study of organisms by Gram stain, Acid fast stain and staining for spores.
9. Assay of antibiotics and demonstration of antibiotic resistance.
10. Protein estimation by Lowryøs / Bradfordøs method.
11. Estimation of carbohydrates in given solution by Anthrone Method.

COURSE : XII
VIROLOGY

Maximum Marks: 50

Instructions for Examiner:
Set nine questions in all, Q1 (Objective type) is compulsory.
Set two questions from each unit and one is to attempted.
Divide the questions into 3-4 short answer questions.

UNIT I

Introduction ó Viruses as distinct living organisms. The origin of virology, classification and nomenclature of viruses , isolation, purification and titration of viruses.

Particles ó Structure of viruses- capsid symmetry and architecture , envelop viruses, complex viruses, virus receptors, interaction with the host cell ,attachment and penetration. The Baltimore classification.

UNIT II

Bacteriophages and its classification, Multiplication and Reproduction.
Lysogency-with special reference to lambda and PI phages.

UNIT III

Pathogenesis- Mechanism of cellular injury ,viruses and immuno deficiency óHIV and AIDS, cellular viruses and cancer.

Prevention and Therapy of viruses infections.
Novel infectious agents : Emergent viruses , Satellites and viroids prions.

UNIT IV

Pathogenesis and immune mechanism of viral infections .Transmission of viruses and epidemiology of viruses infections, prevention and control measures of viral infections
Detailed study of important groups of viruses causing diseases in man including in following groups:
Picornaviruses , papovaviruses,herpes viruses ,poxviruses, reoviruses, paramyxoviruses, Paramyxoviruses,rhabdoviruses,leukemiaviruses,Hepatitis virus, orthomyxo viruses, Dengue, Yellow fever and Japanese encephalitis virus.

acteriology , virology and immunology Vol 1-4.
2 Borrow Textbook of Microbiology:Freeman
3 Text Book of Microbiology :Ananthanarayan and Panikar
4 Introduction to modern Virology : NJ Dimmock
5 Principles of Molecular Virology. Alan J Conn Academic Press

List of practicals: **Maximum Marks: 30**

1.Electron Microscopy
2 Collection of samples for viral studies.
3 Isolation of Bacteriophage from sewage.
4 Isolation of high titre of Bateiorphage.
5 Enumeration of Bacteriophage in a sample by Pl aque forming unit.
6 Seroligical test for viral studies(Hepatitis antigens.H.I.V.).
7 Tissue culture methods.
8 Egg inoculation techniques.

COURSE: XIII
CONCEPTS IN IMMUNOLOGY

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I

Introduction: Types of immunity-innate and adaptive; features of immune response-memory. Specificity and recognition of self and non-self; terminology and approaches to the study of immune system; immunity to viruses bacteria; fungi and tumours; vaccines.

Unit-II

Cells and organs of the immune system.

Lymphoid cells, heterogeneity of lymphoid cells, T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic

Unit-III

Humoral Immunity

Antigen-antibody interactions; affinity and avidity; high and low affinity antibodies, immuno-globulins, classes and structure, molecular mechanism of generation of antibody diversity, complement fixing antibodies and complement cascade.

Cell Mediated Immunity

T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of T-cell antigen receptors.

Unit-IV

Immunodiagnostic Procedures.

Various types of immunodiffusion and immunoelectrphoretic procedures, Immunblot, ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and Haemagglutination inhibition.

stoff, J. and Male, D.K.
2. Immunology- **Kuby, J.**
3. Principles of Cellular and Molecular Immunology- **Austyn, J.M. and Wood, K.J.**
4. Fundamental Immunology- **Paul, W.E.**
5. Monoclonal Antibodies Principles and Application- **Britch, J.R. and Lennox, E.S.**
6. Medical Immunology- **Strites, D.P.Terr, A.I. & Oparslow T.G.**
7. Clinical Immunology and Serology: A laboratory perspective- **Steverns, C.D.**
8. Cell Biology: A Laboratory Handbook- **Celies, J.E.**

List of Practical:

Maximum Marks: 30

1. Differential leucocytes count
2. Total leucocytes
3. Total RBC count
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Double immunodiffusion test using specific antibody and antigen.
7. Latex agglutionation test.
8. Isolation of mononuclear cells from peripheral blood and viability test by dye exclusion methods.
9. Direct and Indirect ELISA.

COURSE: XIV
ENETICS & MOLECULAR BIOLOGY

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I

Nature of genetic material, nucleic acids, DNA replication

Organization of Chromosomes: Genome size and complexity, the supercoiling of DNA, the structure of prokaryotic and eukaryotic chromosome, Polytene chromosomes, euchromatin and heterochromatin, satellite DNA, centromere and telomere structure.

Unit-II

Gene organization and expression in prokaryotes and eukaryotes.

Introduction to Genes and Proteins, Genome Sequences, ORFs, Genes, Introns, Exons, Splice Variants, DNA/RNA, Secondary structure, Triplet Coding, Protein sequences, Protein Structure, Secondary, Tertiary and Quaternary structures.

Unit-III

Mendelian Laws of inheritance, gene interactions.

Extrachromosomal inheritance, mitochondrial and chloroplast genetic systems: sex linked inheritance.

Gene linkage and chromosome mapping: Linkage and recombination of genes in chromosomes, crossing over and its molecular mechanism, gene mapping by three point test crosses, mapping by tetrad analysis, somatic cell hybridization for gene linkage studies, recombination within genes.

Unit-IV

Mutation: Spontaneous versus induced mutations, types of mutations, the molecular basis of mutations, mechanisms of DNA repair, mutations, frequency, correlation between mutagenicity and carcinogenicity, mutagenic agents, chemical and radiation.

Population Genetics: Hardy-Weinberg equilibrium, gene and genotypic frequencies, introduction of eugenics.
Basic microbial genetics: Conjugation, transduction, transformation, isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemical pathway, one geneó one enzyme hypothesis.

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.R. Crown, J.E., and Freifelder, D.

2. Genetics- **Hartl, D.L.**
3. Genetics: Analysis and Principles- **Brooker, R.J.**
4. The Science of Genetics- **Antherly A.G. Girton, J.R.**
5. Microbial Genetics- **Freifelder, D.**
6. Genetics: Analysis of Genes and Genomes- **Hartl, D.L. Jones, E.W.**

List of Practical:

Maximum Marks: 30

1. Demonstration of Law of segregation and Independent assortment (use of coloured beads, capsules etc.) Numericals for segregation and independent assortment. Use of Chi2 for prediction of phenotype/genotype frequencies of parents from progeny and vice-versa, Epistasis.
2. Segregation demonstration in preserved material (Maize)
3. Detection of Blood groups (A B O & Rh factors)
4. Inheritance of other human characteristics, ability to test PTC, Thiourea
5. Calculation of variance in respect of pod length and number of seeds/pod
6. Calculation of gene frequencies and random mating (coloured beads, capsules)
7. Paternity disputes (blood groups)
8. Dermatographics: Palm print taking and finger tip patterns.
9. Preparation and study of mitosis slides from buccal mucosa and onion root tips by squash method.
10. Preparation and study of meiosis slides from meristem tissue by squash method.
11. Demonstration of sex chromatin from buccal smear using thionin stain.

COURSE: XV

INTRODUCTION TO INDUSTRIAL MICROBIOLOGY

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I

Introduction: Basic concept of agriculture as industry: industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Differences between microbial industrial processes and chemical industrial processes.

Unit-II

Improvement of industrial microbes:

Improvement programme of industrial microbes, mutational programme of penicillin producing microorganisms, selection pressure in maintaining the hyper producing microbes, revertant back of higher yielding microbes into lower production, media formulation and process optimization of industrial and agro industrial microbes.

Unit-III

Industrial and agro-industrial microbes:

Microbes involved in antibiotics, pharmaceutical drugs, enzymes production, solvent production, surfactants, vermiculture, composting, herbicides and biopesticides production, biotransformation, nitrogen fixation, organic acids production, vitamins, aminoacids, single cell protein, biofertilizers, alcohols, wine, beers, mycotoxins.

Microbial processes in Agro biotechnology:

Introduction, plant microbe interactions, BT gene in BT cotton, *Rhizobium*, *Azospirillum*, *Azobacter*, *Anabena* in nitrogen fixation, *Agrobacterium*, *Spirulina* production, soil treatment with microbes, Mycorrhizal fungi, microbial pesticides, mycoherbicides.

Unit-IV

Microbial process in industrial biotechnology:

Introduction, primary and secondary metabolites production, production of vitamins, B_{12}, alcohols, wine beer, cheese, bread, citric acid, penicillins, glutamic acid, cellulases, proteases in leather industries Biochips.

1. Plant Biotechnology In Agriculture- **K. Lindsey and M.G.K. Jones**
2. Biotechnology : A Text Book of Industrial Microbiology-**T.D. Brock**
3. Industrial Microbiology-**L.E. Casida**
4. Industrial Microbiology-**Prescott & Dunn**
5. Biotechnology-A Hand Book of Industrial Microbiology-**W. Crueger and A. Crueger**
6. Microbial Biotechnology-**A. N. Glazer and H. Nikaids.**

List of Practical:

Maximum Marks: 30

1. Autoclaving
2. Microbial cells counting by serial dilution techniques.
3. Microbial cell counting by pore plate techniques.
4. Measurement of bacterial size
5. Screening of cellulase producing microorganism from wood degrading soil.
6. Antibiotic sensitivity of the above microorganism
7. Minimum inhibitory concentration of antibiotics for the above microorganism.
8. Additive and synergistic effect of two drugs on the above microorganisms.
9. Plating the milk samples for microbial contamination.
10. MBRT Test for determination of milk quality.

COURSE: XVI

INSTRUMENTAL METHODS OF ANALYSIS

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q. No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit I

Centrifugation: Principle, types, application

Electrophoresis: Principle, types, application

PCR techniques and DNA isolation

Unit II

Spectrophotometry (UV & Visible) and spectroflourimetry, Atomic absorption spectrophotometry

Infrared and Raman spectroscopy, ORD and circular dichroism, Nuclear magnetic Resonance and Electron Spin Resonance spectroscopy, Magnetic Resonance Imaging.

Concepts of microscopy-sections

Unit III

Crystallography and X-Ray diffraction, Electron diffraction, Neutron diffraction.

Unit IV

Radioisotope techniques: radiotracers GM Counter, Proportional and Scintillation counters, autoradiography, Mass spectrometry-GCMS and LCMS.

Recommended Books:

1. Principles and Techniques of Practical Biochemistry- **Keith Wilson & John Walker (Eds.)**
2. Spectroscopy of Biological Molecules: Modern Trends- **P. Carmona, R. Navarro, A. Hernanz (Eds.)**
3. Molecular Fluorescence: Principles and Application- **Bernard Valeur**
4. Protein NMR for the Millennium (Biological Magnetic Resonance)- **N. Rama Krishna, Lawrence J. Berliner (Eds.)**

Maximum Marks: 30

1. Verification of Beer ó Lambert Law by Biuret Method.
2. To perform salting out for partial purification of protein(s) in a given mixture.
3. Preparation of serum by centrifugation.
4. To separate a mixture of amino acids by Ascending Paper Chromatography.
5. To separate a mixture of amino acids by Thin Layer Chromatography.
6. Agarose Gel electrophoresis of DNA.
7. SDS-PAGE of proteins.
8. Polymerase Chain reaction.
9. Sandwich ELISA.
10. To check the purity of DNA by UV Spectrophotometry

COURSE : XVII
...LOGY AND MYCOLOGY

Maximum Marks: 50

Instructions for Examiner:
Set nine questions in all, Q1 (Objective type) is compulsory.
Set two questions from each unit and one is to attempted.
Divide the questions into 3-4 short answer questions.

UNIT I

An introduction to algae :
   a) The position of algae in continuation of life
   b) General classification
   c) Comparative morphology and reproduction
   d)
Phycoviruses: Structure and multiplication of phyco Viruses(Mainly Cyanophages)
Physiological Aspects of Ecology : Fresh water algae ,soil algae, marine algae (seaweeds), aerial algae and algae as symbionts.

Nitrogen Fixation : Site of nitrogen fixation , heterocyst, ultrastructure of heteorocyst, heteorocyst in nitrogen fixation in Cyanobacteria, nitrogenase and biochemistry of nitrogen.

Nitrogen assimilation , amino acids and proteins , inorganic phosphorous uptake and metabolism. Sulphur , halogen , major cations and inorganic micronutrients.

UNIT II

Photosynthesis , The physical nature of light , pigments in systems of photo synthesis, the photosynthesis apparatus path electron in photosynthesis , factors affecting the rate of photosynthesis and carbon fixation . Respiration .Photorespiration fermentation , substrate assimilation and heterotrophy.

Algae as bio fertilizer, algae as food including single cell protein. Source of agar agar , alginate ,diatomic and iodine etc .Antibiotics from algae ,Role of algae in indicating pollution (water pollution)Algal photosynthesis in sewerage treatment.

UNIT III

General characteristics of molds, types of reproduction , spore types
Ecophysiology : Lichens, their associations and applications syngamy horones, synthetic fungicides , fungal toxins , absorption of nutrients , transport mechanism , chemical and physical environment for growth . Fungal attack mechanisms.

Mycotechnology: Fungi in the production of antibiotics , organic acids , vitamins and single cell protein , alcohols, oriental food fermentation and solid substrate fermentations . mushrooms and cultivation of mushrooms.

Fungal genetics and Mycoviruses : General information about genetics of fungi , various mycoviruses , their nature and multiplication.

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UNIT IV

of skin , nail and hair , subcutaneous mycoses systemic mycoses, opportunistic fungal infections, Mushroom food poisoning. Plant Pathology: Fungi in relation to plant diseases.

Recommended Books:

1 The Fungi by Ain Sworth vol 2, 3, 4 (1997)
2 introduction to Fungi by Webster (1992)
3 The Biology of Fungi , In gold (1994)
4 Phycotoxin & Mycotoxin Steyn Vleggaar (1994)
5 Human Mycoses óBen eke Rippan and Rogers (1995)
6 The Fungi Vol 1 and Vol 2 (1993)
7 Ectomycorrihizal Fungi Caiey J.W.C 1999
8 The Mycota Esserk

List of practicals:

Maximum Marks: 30

1.Identification of Pathogenic and non Pathogenic Fungi.
2 Preparation of media for isolating Fungi.
3.To find Heterocyst frequency.
4.Quantification of total Chlorophyll by cold exatraction method.
5 Quantification of total Chlorophyll by warm exatraction method.
6.Quantification of carotenoids in given algal sample using organic solvents.
7 To examine the amylolytic activity of Fungi.
8.To prepare media for isolating non symbiotic-nitrogen fixing bacteria ammonifying bacteria,nitrifying bacteria..

B.Sc. (HONS) MICROBIOLOGY 3RD YEAR

COURSE : XVIII
BASICS OF RECOMBINANT DNA TECHNOLOGY

Maximum Marks: 50

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I
Introduction, Historical Enzymes Restriction enzymes, Ligases, DNA polymerase, kinases, Reverse transcriptase, Endonucleases, Phosphatase.

Unit-II
Vectors: Plasmid, Cosmids, Lambda, Vectors (Intentional and Replacement vectors),M-13, Phagemids

Unit-III
Radioactive and non-radioactive DNA and RNA labelling techniques: Nick translation, random priming, Sequencing

Unit-IV
Southern and Northern blotting, hybridization

Introduction to site directed mutagenesis

PCR and its Applications

Transformation of *E.coli* Yeast, animal and plant cells, Genomic cloning, cDNA cloning and colony hybridization.

Application of rDNA technology to medicine, agriculture and environment.

Recommended Books:

1. Molecular cloning: A Laboratory Manual- **J.Sambrook, E.F. Fritsch and T.Maniatis**
2. Principles of Gene Manipulation: An introduction to Genetic Engineering- **R.W. Old and S.B. Primrose**
3. Gene Probes I.A. Practical Approach- **B.D.Hames and S.J.Higginis**
4. Recombinant Gene Expression Protocols- **Tuan Rockey S**
5. PCR Cloning Protocols- **White Bruce A**

List of Practical:

Maximum Marks: 30

1. DNA isolation from plants
2. DNA isolation from E.coli
3. Spectrophotometer analysis of DNA
4. Agarose gel electrophoresis of DNA
5. Plasmid DNA isolation
6. Restriction digestion of DNA
7. Southern Blotting
8. Making competent cells
9. Transformation of competent cells.

COURSES : XIX
SYSTEMIC BACTERIOLOGY-I

Maximum Marks: 50

Instructions for Examiner:
-set nine questions in all Q. No. (objective type) is compulsory.
-set 2 questions from each unit and one is to be attempted.
Divide the questions into 3-4 short answer questions.

UNIT-I
History and development of medical microbiology. Biological properties of etiological agents. Mechanisms of bacterial pathogencity. Nature of damage to the tissue caused by infectious agents and the defenses of host.
Epideomology and control of community infections. Salient features of laboratory diagnosis of common bacterial infections.

UNIT-II
Normal microflora of human body; skin, respiratory system, genitourinary tract, sources of infection, mode of spread.

UNIT-II
A detailed account of clinical manifestations, morphological, physiological characteristics, and gross and histopathological changes in tissues caused by the following disease causing organisms:
Staphylococcus aureus and *S. epidermis, Streptococcus pyogenes, s, agalactiae and s. pneumoniae, Bacillus anthracis, Clostridium sp.* Associated with *tetanus, botulinum* and gas gangrene diseases*, Listeria monocytogenes, Corynebacterium diptheriae.*

UNIT-IV
A detailed account of clinical manifestations, morphological, physiological characteristics, and gross and histopathological changes in tissues caused by the following disease causing organisms:
Mycobacterium tuberculosis and M. leprae, Neisseria meningititis and N. gonorrhoeae, Haemophilus influenzae and H.ducreyi, Bordetella pertusis, B. parapertusis, Francisella tularensis, Yersinia pestis and Y. enterocolitica.

Recommended Books:
1. Topley and Wilsonøprinciples of Bacteriology, virology and immunology Vol.-1-IV
2. Text Book of microbiology- Ananthanaryan and panikar.
3. Medical microbiology- Greenwood, Stack and Penthre.
4. Medical microbiology- Mims *et al*.

List of practicals: **Max Marks: 30**

Making of a smear for gram staining, demonstration of motility by various method, preparation of routine culture media, inoculation of culture media and sterilization methods .To study the biochemical test used for the identification of bacteria

OURSES : XX

SYSTEMATIC BACTERIOLOGY-II

Maximum Marks : 50

Instructions for Examiner:
-set nine questions in all Q. No. 1(objective type) is compulsory.
-set 2 questions from each unit and one is to be attempted.
Divide the questions into 3-4 short answer questions.

UNIT-I

Diseases caused by the type *species* family *enterobacteriacea*e. *Escherichia coli*, *Klebsiella pneumoniae*,*Shigella dysentriae , S. sonnei, S .flexneri and S. boydii.*
Salmonella typhi and S. paratyphi, Proteus sp, Campylobactor jejuni, Helicobacter pylori, Serratia marcescens, Vibrio cholerae , Pseudomonas aeruginosa, Bacteriodes

UNIT-II

Spirochaetes (Treponema , Borrela, Leptospira)
Brucellae, Bartonella , Legionella,
Calymmatobacterium sp
Mycoplasma and L. form bacteria

UNIT-III

General description and biological properties of Rickettsiae and Chlamydiae. Epidemiology and pathogenesis of diseases caused by these organisms in human.

UNIT-IV

Management and quality control of Medical microbiology laboratory.
a) specimen collection from patients, clinics and hospitals.
b) specimen collection for epidemiological.
c) Training of medical microbiology to handle epidemics.

Recommended Books:
1. Topley and Wilsonøprinciples of Bacteriology, virology and immunology Vol.-1-IV
2. Text Book of microbiology- Ananthanaryan and panikar.
3. Medical microbiology- Greenwood, Stack and Penthre.
4. Medical microbiology- Mims *et al*.

List of practicals: **Max Marks: 30**

1. Type of specimen, collection techniques and processing of sample.
2. Identification of bacteria.
3. To study the biochemical test used for the identification of bacteria
4. To identify the unknown organism from the given culture.
5. To isolate and identify organism from skin, throat, nasal swab

COURSE: XXI
INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS &
ENTREPRENEURSHIP

Maximum Marks: 80

Instructions for Examiner:
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.

Unit-I

Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions.

Unit-II

Intellectual/Industrial property and its legal protection in research, design and development.

Unit-III

Patenting in Biotechnology, economic, ethical and depository considerations.

Patentable subject matter and legal aspects of transfer of Biotechnology in India. Writing a patent specification.

Information sources in Patent Literature search.

Unit-IV

Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

Recommended Books:

1. Agriculture and Intellectual Property Rights: Economic, Institutional and Implementation Issue in Biotechnology-**V Santaniello, R E Evenson, d Zilberman, G A Carlson**

COURSE: XXII
PARASITOLOGY

Maximum Marks: 50

Instructions for Examiner:
Set nine questions in all, Q1 (Objective type) is compulsory.
Set two questions from each unit and one is to attempted.
Divide the questions into 3-4 short answer questions.

UNIT I

Protozoology : Brief history of protozoology , 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.

UNIT II

Amoeba :Non pathogenic and pathogen amoeba . Morphology and life cycle of amoeba pathology .Symptomatology Laboratory Diagnosis of

a) Giardia (G.Limblia)
b) Flagellates of genital tract Trichomonas(T. tenax,T.hominis,T.vaginalis)
c) Malaria parasite (Plasmodium vivax ,P.malariae,P.ovale,) Genaral life cycle of Malarial parasite in man and anopheles mosquito , sequal of malaria ,Toxoplasma gondi , life cycle , Symptomatology, Transmission and Lab diagnosis of Toxoplasmosis.

UNIT III

Helminthology: Genaral introduction of helminthes and classification , medically important hemimths . Immunity in Taenia saginata , T.solium
Echinococcus granulosis, Trematodes,Schistosomes (S. haematobium,S.mansoni, S.Japonicum) Nematodes. Ascaris lumbriicoides, Ancylostome duodenale,
Strongyloides stercoralis, Enterrobius, wuchereria bancrofti, Brugia Malayi, Dracunculus medinesis.

UNIT IV

Medical entomology: Role of arthrophods in the spread and causation of parasite diseases .Classification and general characteristics of important insects vectors. Mode of transmission of various diseases.

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1 Parasitology(K.D Chatterjee)
2 Medical Parasitology (Gillespie and Hawkey)
3 Modern Parasitology (F.E.G Cox)
4 Essential of Parasitology(Schimidt).

List of practicals:

Max marks: 30

1To perform microscopic examination of cyst like *E.histolytica,E.coli.Giardia.*
  Intestinalis in the given stool sample.
2 To observe the given stool sample &identify helmenthic ova.
3 To perform microscopic examination for the given urine sample .
4 To perform microscopic examination for the given stool sample .
5 Examination of stool sample using concentration technique for ova.
6 Examination of blood film for Malaria,Filaria,Leishman

COURSE : XXIII
ENVIRONMENTAL MICROBIOLOGY

Maximum Marks: 50

Instructions for Examiner:
Set nine questions in all, Q1 (Objective type) is compulsory.
Set two questions from each unit and one is to attempted.
Divide the questions into 3-4 short answer questions.

Unit-I

Introduction to types of soil microbes, role of microbes in C,S&N Cycle. Factors affecting movement of microorganisms in soil.
Isolation and characterization of microbial products of soil. Application of Molecular Techniques to soil biochemistry & microbiology; Predicting the products of biodegradations.
Interaction between soil minerals and microorganisms.
Bioremediation: Microbiology of bioremediation and soil properties, controlling bioremediation.
Microbial degradation of phenolics, herbicides and pesticides. structure of lignocellulosics humus and their microbial degradation.

Unit-II

Petroleum Microbiology

Effect of hydrocarbon on microorganisms. Evidence regarding biogenesis of petroleum. Bacterial products as indicators of petroleum biodegradation. Methanogens, their physiology, ecology, global carbon cycling and biodegradation of toxic chemicals. Microbial biodegradation petroleum products in terrestrial, aquatic environment.

Problems related to SO_4 reducing bacteria in petroleum industries and their metabolism, ecology & physiology. Treatment and disposal of petroleum refinery waste, Recovery of petroleum from oil bearing rocks.

Unit-III

Microbiology of air

Structure of atmosphere microbial distribution, Organism of fermentation in the air, Exhaust gas purification, Methods of waste gas treatment.

Unit-IV

Sewage & water treatment

Significance of microorganisms present in sewage & water, BOD mechanism & kinetics, BOD in design and operation of biological treatment, BOD as an aid in regulation of water quality.

Analysis of water, Quantitative and Qualitative methods, coliform organisms in sewage, water borne diseases. Purification of water for industrial, municipal & domestic supply, Recycling & treatment of domestic and industrial water.

Recommended Books:
1. Environmental Microbiology, Rose, Vol. I, II, III, 1995.

Alexander, 1996.

y Paul, Meclaren Vol. I, 1995.

n, H., Rangger, A., 1997

5. Environmental and Microbial Relationships, Wicklow D. T & Soders from B.E., 1997.
6. Methods in Soil Biology, Schinner, F., 1996
7. Microbial Biochemistry, Zagic, 1994.
8. Comprehensive Biotechnology, Moo Young, 1995.
9. Environmental Microbiology, Rose Vol. III ó V, 1999.

List of practicals: **MAX MARKS: 30**

1 To estimate the percentage of the organic matter in the given sample.

2 To estimate sulphur content in the soil sample

3 To estimate the nitrate, nitrite concentration in the soil sample.

4 To estimate inorganic phosphorous in soil sample.

5 To isolate antibiotic producing organism,from the given soil sample.

6 To prepare selective media and there by isolate bacteria,fungi,and actinomycetes from soil sample.

7 Estimation of fat content in milk by Gerber test.

8 Determination of reducing,non-reducing sugar and total sugar in food sample.

9 Estimation of moisture content in food sample.

10 To determine potability of water(Presumptive,Coliform test).

11 Determination of total solid in milk by lactometer.

COURSE: XXIV
MEDICAL MICROBIOLOGY

Maximum Marks: 50

Instructions for Examiner:
Set nine questions in all, Q1 (Objective type) is compulsory.
Set two questions from each unit and one is to attempted.
Divide the questions into 3-4 short answer questions.

UNIT-I

1. Preparation of container and swabs for collections of specimens for microbial examination.
2. Portal regulation and transport of specimen.
3. Flowchart of lab diagnostic procedures.
4. Documentation of specimen in laboratory.

UNIT-II

1. Infection syndrome and diagnostic procedure.
2. Strategy of antimicrobial therapy.
3. Prophylactic mass immunization.
4. Nosocosmial infection and sterility testing of I.V. fluids and processing of various samples for various hospital infections.

UNIT-III

1. Preservation of pure culture: Periodic subculture methods, cold storage, freezing, deep freezing, lyophilization methods.
2. Blood culture, cell tissue and organ culture.
3. Total and viable counts of bacteria.
4. Epidemiology markers of microorganisms: Serotyping and Bacteriophage.

UNIT-IV

1. Diagnosis , treatment and control of common infections and infestations.
2. Specific serological methods of diagnosis .
3. Test of sensitivity to anti microbial agents and their preparation.
4. Specific culture and drug sensitivity methods.

Recommended Books:

1. Topley and Wilsonøprinciples of Bacteriology, virology and immunology Vol.-1-IV
2. Text Book of microbiology- Ananthanaryan and Panikar.
3. Medical microbiology- Greenwood, Stack and Penthre.
4. Medical microbiology- Mims *et al*.

MAX MARKS: 30

1. Antibiotic sentivity(one organism).
2. Collection and processing of specimens like blood, urine, stool, pus etc. and isolating the causative organism (any one material).
3. Dectection of antibody levels of sera taken from patients suspected to be   suffering from a bacterial infection(one sample).
4. Antigenic characterization of an unknown organism (one sample).
5. Animal inoculation.
6. Antibiotic sensitivity (one organism).