

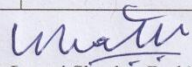
# B.Sc. in Microbiology Syllabus



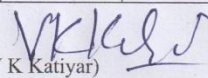
University of Patanjali, Haridwar

## B.Sc. Microbiology Structure (NEP)

Semester	Core-Major	Minor	Interdisciplinary	AEC	Skill Enhancement Course	Value added course	Total Credit
I	General Microbiology (Credit-6)	Cell Biology (Credit-4) Chemical Science (Credit-4)		English (Credit-2)	Environmental Science (Credit-3)	Foundation of Yoga (Credit-3)	22
II	Biochemistry (Credit-6)	Bacteriology and Virology (Credit-4)	Microbial Biotechnology (Credit-4)	Computer Application (Credit-2)	Management of Human Microbial Diseases (Credit-3)	Project (Credit-3)	22
III	Microbial physiology & Metabolism (Credit-6)	Microbes in Sustainable Agriculture and Development (Credit-4) Biostatistics (Credit -2)	Organic Chemistry (Credit-4)	Technical Writing & Personality Development (Credit-4)	Yagna Chikitsa (Credit-2)		22
IV	Industrial Microbiology (Credit 6) Drug Discovery (Credit 4)	Microbial Genetics and Molecular Biology (Credit-4)	Bio fertilizers & Bio pesticides (Credit 4)	Vedic Sciences (Credit-2)	Microbial Diagnosis in Health Clinics (Credit-2)		22
V	Food and Dairy Microbiology (Credit 4) Medical Microbiology (Credit 4)	Neurobiology (Credit-4) Microbial Enzymology & Metabolism (Credit-3)	Endocrinology (Credit 3)		Internship & Case Studies (IPD/OPD) / Project Work (Credit-4)		22
VI	Bioprocess Technology (Credit 4) Recombinant DNA Tech (Credit 4)	Microbiological methods and Analytical Techniques (Credit 4)	Bioinformatics / Bioinstrumentation (Credit-4)	Microbial Entrepreneurship (Credit-2)	Microbial Quality Control in Food and Pharmaceutical Industries (Credit-4)		22

  
(Dr Laxmi Shankar Rath)  
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Dean (A & R)  
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**1<sup>st</sup> Year**

**University of Patanjali, Haridwar**  
**Syllabus of B.Sc. Microbiology under NEP**

**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: General Microbiology**

**SUBJECT CODE: - BSMBMJ-101**

**SEMESTER – I**

**Course Objectives:**

- 1. Thorough knowledge and understanding of concepts of microbiology.**
- 2. Learning and practicing professional skills in handling microbes.**
- 3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.**

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>5</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>5</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical:50</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit-1 [ 15 Hours]**

**Historical development of microbiology** -Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microscopy- working principle, construction and operation of simple and compound microscopes.

**Unit -2 [20 Hours]**

**Microbiological Techniques**- Staining: Nature of stains, principles, mechanism, methods and types of staining- Simple, Differential-Gram staining, Acid fast staining, staining of capsule, cell wall, endospore, inclusion bodies.

**Control of microbes**- Sterilization: Principles, types and techniques, Physical and chemical methods, disinfection, antiseptic, tyndallisation, pasteurization: Physical- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter.

**Culture media** – Types, Cultivation of aerobic and anaerobic bacteria. Pure culture techniques and Cultural characteristics.

**Preservation of microorganisms:** Methods of preservation of microorganisms; slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation.

### **Unit-3 [25 Hours]**

**Scope of Microbiology** -Whittaker's five- kingdom concept of living organism- (General characteristics of those five groups), characteristics and importance of yeast, moulds (Penicillium, Aspergillus), protozoa, Giardia, Plasmodium, plant diseases (brown spot of rice, stem rot of jute, black stem rust of wheat, apple scab, grey blight of tea, bacterial blight of rice, citrus canker). i) Characteristics of pathogenic fungi ii) Plant pathogenic toxin and their classification iii) Disease expression in a plant, gene for gene concept iv) Control of plant disease – physical, chemical, cultural and biological control, IPM

### **Practical: BSMBMJ-101-P: General Microbiology Credit: 1**

1. Microbiological laboratory standards and safety protocols
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, Vortex, Magnetic stirrer).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
7. Demonstration of bacterial motility by hanging drop method.
8. Simple staining & Negative staining
9. Differential staining - Gram staining
10. Acid fast staining
11. Structural staining - Flagella and Capsule
12. Bacterial endospore staining
13. Staining of fungi by Lacto phenol cotton blue.
14. Preparation of Physiological saline and Serial dilution
15. Method of obtaining pure cultures of Microorganism

### **Text Books / References**

1. General Microbiology 1st Edition, 2020 , Linda Bruslind, Oregon State University
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.

7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr, Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge
14. Tortora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

#### Course Outcomes:

1. Students will learn about the different fields in microbiology.
2. Students will gain knowledge about the different types of microorganisms and their significance.
3. Students will study different techniques used in microbiology.

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: CELL BIOLOGY (THEORY)**

**SUBJECT CODE: - BSMBMN-102**

**SEMESTER – I TOTAL HOURS: 60 CREDITS: 4**

Course Objectives:

The cell biology course objectives are

1. Helping learners to describe cytological, biochemical, physiological aspect of cell.
2. Relate normal cellular structures to their functions.
3. Apply modern cellular techniques to solve aspects of scientific problems.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>		<b>Practical:50</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit-1**

Basics of Cell Biology (structure & function) – Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; (10 Hours)

**Unit-2**

Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and micro bodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells. (10 Hours)

**Unit-3**

Biogenesis of Cellular organelles – Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and Golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components. (10 Hours)

**Unit-4**

Structure and function of Prokaryotic cell & its components - The Slime and the cell wall of bacteria containing peptidoglycan and related molecules; the outer membrane of Gram

negative bacteria, the cytoplasmic membrane. Water and ion transport, mesosomes, flagella, Pilus, fimbriae, ribosomes, carboxysomes, sulphur granules, glycogen, polyphosphate bodies, fat bodies, gas vesicles; endospores, exospores, cysts. Mycelia of fungi and Actinomycetes, Cytoskeleton filament, heterocysts and akinets of Cyanobacteria, Gliding and motility. (10Hours)

### **Unit-5**

Membrane structure & transport – Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport.(10 Hours)

### **Unit-6**

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.(10 Hours)

Reference books:-

1. Alberts B, Bray D, Johnson A et al. (1997) Essential Cell Biology. London: Garland Publishing.
2. Darwin C (1859) On the Origin of Species. London: Murray.
3. Graur D & Li W-H (1999) Fundamentals of Molecular Evolution, 2nd edn. Sunderland, MA: Sinauer Associates.
4. Madigan MT, Martinko JM & Parker J (2000) Brock's Biology of Microorganisms, 9th edn. Englewood Cliffs, NJ: Prentice Hall.
5. Margulis L & Schwartz KV (1998) Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth, 3rd edn. New York: Freeman.
6. Watson JD, Hopkins NH, Roberts JW et al. (1987) Molecular Biology of the Gene, 4th edn. Menlo Park, CA: Benjamin-Cummings.



## **BSMBMN-102-P Practical work**

1. To study about the working principle ,parts and uses of a compound microscope
2. To study the different meiotic stages through permanent stained slides.
3. To study the different meiosis stages through permanent stained slides.
4. To prepare a stained temporary mount of onion peel.
5. To study and demonstration the process of mitosis through the preparation of the mount of an onion root tip.
6. To prepare a temporary mount of human cheek epithelial cells.
7. To study by demonstrating the osmosis process by potato osmometer.
8. To prepare a temporary mount of a leaf peel in order to show the stomata of a leaf
9. To study the process of plasmolysis in epidermal cells of tradescantia leaf
10. To study and comment upon different organelles of a typical cell using specimens/photographs
11. To cut a transverse section of a given monocot stem and make a temporary stained mount to study its structure
12. To cut a transverse section of a given dicot root and make a temporary stained mount to study its structure.
13. To cut a transverse section of a monocot root of Maize and make a temporary stained mount to study its structure
14. To cut a transverse section of a given dicot stem and make a temporary stained mount to study its structure

### References books

1. Celis JE (ed) (1998) Cell Biology: A Laboratory Handbook, 2nd edn. San Diego: Academic Press.
2. Lacey AJ (ed) (1999) Light Microscopy in Biology: A Practical Approach, 2nd edn. Oxford: Oxford University Press.
3. Paddock SW (ed) (1999) Methods in Molecular Biology, vol 122: Confocal Microscopy Methods and Protocols. Totowa, NJ: Humana Press.
4. Watt IM (1997) The Principles and Practice of Electron Microscopy, 2nd edn, Cambridge:

### Course Outcome:

1. The present course has been devised to familiarize students with the structural and functional aspects of cell, the basic unit of life, and its different organelles. Knowing the components of cells and how they work is fundamental to all biological sciences.
2. Students will understand structure and function of different cell organelles.
3. Students will be able to understand the cyclic events of cell division and types of cell division and understand cell signalling and processes of cell death and cellular aging.

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Chemical Science**

**SUBJECT CODE: - BSMBMN-103**

**SEMESTER – I TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemical Bonding, Chemistry of Bio inorganic molecules like Haemoglobin, Chlorophyll, and Vitamin B12.
2. To understand the Bio-Chemical relationship and properties of elements.
3. To enable the students to understand and apply the concepts of Concentration of Solutions, Colloidal behaviour, Coagulation, pH in Bio-system, Food industry and in Medicine.
4. To enable the students to understand and apply the concepts of Rate of Reaction, Role of Enzyme Catalyst, Electro-Chemical behaviour of body fluids, causes of corrosion in metals.
5. To enable the students to understand and apply the concepts of energy transfer through thermodynamics processes. Application in photosynthesis and global warming.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

<b>Contents</b>
<b>Unit-1: Hours 20</b>
Atomic Structure: Filling of electrons in orbitals. Chemical Bonding and Molecular Structure: Covalent bonding: VSEPR, VBT, hybridisation and MOT for homonuclear and heteronuclear (CO and HF) diatomic molecules. Ionic and Metallic bonding. Fajan's rule. Coordination bonding. Coordination structure of hemoglobin, chlorophyll, vitamin B12.
<b>Unit -2: Hours 10</b>
Modern Periodic Table: Modern Periodic law, Classification of elements in periodic table, Periodicity, electronegativity, electron affinity, ionisation potential, atomic radii, ionic radii.
<b>Unit-3: Hours 10</b>
Solution: Definition, types and strengths. Indicators: definition, types and uses. Colloidal state: Definition, classification and applications in food and medicine. Acids and Bases: Arrhenius, Bronsted and Lowry theories and Lewis concept. Buffer solution and pH scale. Basic idea of Determination of strength of unknown sample by titration method.
<b>Unit-4: Hours 10</b>
Chemical Kinetics: Order and molecularity of reaction, factors influencing on rate of chemical reaction. Catalysis: definition, classification and characteristics. Enzyme catalysed reactions. Electrochemistry: work done and potential energy, galvanic cell and electrode potential. Corrosion: definition, cause and types of corrosion, metallic corrosion and their prevention.
<b>Unit-5: Hours 10</b>
Chemical Thermodynamics: First law of thermodynamics: Work (w), heat (q), changes in internal energy ( $\Delta E$ ) and enthalpy ( $\Delta H$ ). Concept of calorie and joule. Isothermal and adiabatic conditions for reversible and irreversible processes. Concept of standard state and standard enthalpies of formation (Kirchhoff's equation). Second law of thermodynamics, concept of entropy, Gibbs free energy and Helmholtz free energy. Criteria of spontaneity.

### Reference Books:

1. J.D.Lee: A New Concise Inorganic Chemistry, E.L.B.S.
2. P.W. Atkins: Physical Chemistry, Oxford University Press
3. F. A. Cotton, G Wilkinson, PL. Gaus: Basic Inorganic Chemistry. Wiley
4. YR Sharma: Elementary organic spectroscopy, Banwell
5. Physical Chemistry, RL Madan, G D Tuli: S Chand

### BSBSMN-103-P: Chemical Science (Practical)

1. Introduction to calibration of analytical equipments and apparatus.
2. Determination of strength of given acid using titrimetric method with known Basic solution.
3. Determination of hydroxyl ions (alkalinity) in water sample.
4. Determination of calcium ion from aqueous solution by complexometric method.
5. Determination of pH of a solution using pH meter
6. Determination of surface tension of given liquid.
7. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture
8. Estimation of Fe (II) ions by titrating it with  $K_2Cr_2O_7$  using internal indicator
9. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer
10. Determination of concentration of Iron using Spectrophotometric method.

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**COURSE DETAILS**

**SUBJECT TITLE: English**

**SUBJECT CODE: - BSMBAE-104**

**SEMESTER – I TOTAL HOURS: 30 CREDITS: 2**

Course Objectives:

1. To be able to speak English fluently and accurately.
2. To think in English and then speak.
3. To be able to compose freely and independently in speech and writing.
4. To be able to read books with understanding.

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>2</b>	-	-
<b>Hrs/Week</b>		<b>2</b>	-	-
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	-	-	

**Unit-1** Introduction Theory of Communication, Types and modes of Communication [5 Hours]

**Unit-2** Language of Communication: Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication [5 Hours]

**Unit-3** Speaking Skills: Monologue Dialogue Group Discussion Effective Communication/ Mis- Communication Interview Public Speech [5 Hours]

**Unit-4** Reading and Understanding Close Reading Comprehension Summary Paraphrasing Analysis and Interpretation Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts [10 Hours]

**Unit-5**

Writing Skills Documenting Report Writing Making notes Letter writing [5 Hours]

Recommended Readings:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.

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**COURSE DETAILS**

**SUBJECT TITLE: ENVIRONMENTAL SCIENCE**

**SUBJECT CODE: - BSMBSE-105**

**SEMESTER – I TOTAL HOURS: 30 CREDITS: 3**

**Course Objective:**

- Investigate the complexities of the natural environment and our relationship with it.
- Explore the problems we face in understanding our natural environment and in living sustainability.
- Develop scientific, interpretive and creative thinking skills.

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	-	-
<b>Hrs/Week</b>		<b>3</b>	-	-
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>			<b>Practical:00</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	-	-	

**Unit -1 Introduction to Environmental studies & Ecosystems 10 classes**

Multidisciplinary nature of environmental studies, Environmental Education aim and objectives, Scope and importance, Need for public awareness. Concept, Structure and function of an ecosystem, Energy flow in an ecosystem: food chains, food webs and ecological pyramids. Examples of various ecosystems such as: Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

**Unit-2 Natural Resources: Renewable & Non- renewable resources 15 classes**

Classification, Land as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification. Forests & forest resources: Use and over-exploitation, deforestation. Impacts of deforestation, mining, dam building on environment and forests. Resettlement and rehabilitation of project affected persons; problems and concerns with examples. Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state). Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems with examples. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs.

### **Unit -3 Biodiversity & Conservation 10 classes**

Levels of biological diversity: genetic, species and ecosystem diversity. Bio geographic zones of India. Ecosystem and biodiversity services. Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation.

### **Unit-4 Environmental Pollution 15 classes**

Environmental pollution and its types. Causes, effects and control measures of :a) Air pollution b) Water pollution – freshwater and marine c) Soil pollution d) Noise pollution e) Thermal pollution, Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste, Global Warming, Climate Change

### **Unit-5 Environmental Policies & Practices 10 classes**

Wasteland reclamation. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Biological Diversity act 2002

### **Books Recommended**

1. Environmental Science: Toward A Sustainable Future by Dorothy F. Bourse and Richard T. Wright → Social Learning in Environmental Management: Towards a Sustainable Future by Meg Keen, Valerie A. Brown, Rob Dyball
2. Principles of Environmental Science by William P. Cunningham and Mary Ann Cunningham
3. Visualizing Environmental Science by Linda R. Berg, Mary Catherine Hager and David M. Hassenzahl → Environmental Studies From Crisis to Cure by R. Rajagopalan
4. Environmental Science: Systems and Solutions by Michael L. McKinney, Robert M. Schoch, Logan Yonavjack and Grant A. Mincy
5. Environmental Science: A Global Concern by William P. Cunningham and Mary Ann Cunningham → Fundamental Concepts in Environmental Studies by Dr. D.D Mishra
6. Neeraj Publication BEVAE-181 ENVIRONMENTAL STUDIES → Dinesh Environment Science (English Medium) (AECC) (B.A/B.Sc./B.Com/B.B.A/B.C.A./B.Voc. 1st year
7. Neeraj Publications BEVAE-181 ENVIRONMENTAL STUDIES → CSAT Environmental Ecology Biodiversity & Climate Change

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**COURSE DETAILS**

**SUBJECT TITLE: FOUNDATIONS OF YOGA**

**SUBJECT CODE: - BSMBVA-106**

**SEMESTER – I TOTAL HOURS: 30 CREDITS: 3**

Course Objectives: The Course entitled ‘Foundation of Yoga’ has the following objectives:

- Students of the UG course will have an understanding about origin, history and development of Yoga.
- They will have an idea about the insights of different Yoga streams. • Introduction about Yoga according to various Yogic texts, eminent Yogis.
- Quote references of each practice as per traditional texts.

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>2</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>2</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical:50</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>		<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>		<b>37</b>	<b>13</b>

**UNIT-1: General Introduction To Yoga** Brief about origin of Yoga: Psychological aspects of Yoga, History and Development of Yoga: prior to the Vedic period, Vedic period, Medieval period, modern era; Etymology and Definitions of Yoga, Aims and Objectives of Yoga, Misconceptions about Yoga; Importance of Yoga. (10 Hours)

**UNIT-2: Different Streams Of Yoga Jnana** Yoga: Meaning of Jnana and Jnana-Yoga, Sadhana-chatushtaya, Means of Jñāna, Bhakti Yoga: Meaning of Bhakti and Bhakti-Yoga, Stages of Bhakti, Types of Bhakti, Means of BhaktiYoga; Karma Yoga: Meaning of Karma and Karma-Yoga, Concept of Nishkama Karma, Means of Karma Yoga; Inter-relationship between Bhakti Yoga, Karma-Yoga and Jnana Yoga. (8 Hours)

**UNIT - 3: Brief About Yoga In Texts** Brief of Yoga in Vedas and Yoga in Principal Upanishads, Yogic perspective: Bhagavad Gita, Yoga Vasishtha, Narada Bhakti Sutras. Yogic perspective: Puranas with emphasis to Bhagavat Purana; Emphasis to Vedantic approach of Shankaracharya, Ramanujacharya, Madhvacharya and Vallabhacharya. (7 Hours)

**UNIT-4: Introduction To Eminent Yogis** Introduction to eminent Yogis and their style of Yoga: Hiranyagarbha, Vyasa, Kapilmuni, Bhrtihari, Adishankaracharya, Maharshi

Dayanand, Swami Vivekanand, Maharshi Arvind, Swami Kuvalyanand, Swami Shivanand, Yogrishi Swami Ramdev. (5 Hours)

### **TEXT BOOKS**

1. Yogrishi Swami Ramdev Ji : Yog ke moolbhut Sidhhant, Divya Prakashan, Haridwar.
2. Acharya Balkrishna: Grihasth Yog Sadhak k Gun, Divya Prakashan, Haridwar, 2017.
3. Singh S P & Yogi Mukesh: Foundations of Yoga, Standered Publication, New Delhi, 2010.
4. Yogendra Purushartha (Sw. Divyananda Saraswati): Vedo me Yog Vidya, Yogic Sodhsansthan, 1985. 5. Yogrishi Swami Ramdev Ji: Ek Yogi Ek Yodhha, Divya Prakashan, Haridwar, 2015.
6. Sri Vishwanath Mukharji: Bharat ke Mahan Yogi, Vishvavidyalaya Prakashan, 2012.

### **REFERENCE**

1. Acharya Balkrishna: Yog Vishwakosh, Divya Prakashan, 2014.
2. Agarwal M M: Six systems of Indian Philosophy, Chowkhambha Vidya Bhawan, varanai, 2010.
3. Swami Bhuteshananda: Nararad Bhakti Sutra, Advaita Ashrama Publication-Dept. Kolkata, II



**Course Name:** YOGA PRACTICAL **Course Code:** BSMBVA-106-P **Total Credit:** 1  
**Teaching Hours:** 30 Hrs

On completion of this course, students shall be able to

- Understand the principle and practice of various asanas
- Understand the principle and practice of Suryanamaskar.
- Demonstrate each Asana and explain its procedure.
- Quote references of each practice as per traditional texts

### **UNIT-1:**

Yogasana (Supine Lying Postures) and (Prone Line Postures) [10 HRS.]

Navasana, Pavanamuktasana, Utthana-padasana, Padavrittasana, Chakrikasana, Chakkichalana, Ardha Halasana, Halasana, Setubandhasana, Sarvangasana, Matsyasana, Chakrasana, Shavasana. Makarasana, Markatasana, Bhujangasana, Sarpasana, Shalabhasana, Dhanurasana, Purnadhanurasana.

### **UNIT- 2:**

Surya Namaskara and Bhojan Mantra, Pratah Evam Ratri Mantra [10 HRS.]

Understanding, recitation and memorization. Satkarma and breathing practices

#### **TEXT BOOKS**

1. Acharya Balkrishna: Dainik Yogabhyasakram, Divyayog Prakashan, Haridwar, 2015.
2. Yogrishi Swami Randev Ji: Dand-baithak, 2015.
3. Swami Dharendra Bhrahmachari: Yogasana Vijnana, Dharendra Yoga Publications, New Delhi.
4. Swami Kuvalyananda : Asana Kaivalyadhama, Lonavla

#### **BOOKS FOR REFERENCES**

1. Tulsi Naina: A Complete Guide for structural Body Work, Divya Prakashan, Haridwar, 2015.
2. Basavaraddi, I.V. & others: Yogasana: A Comprehensive description about Yogasana, MDNIY, New Delhi, 2011.
3. Iyengar, B.K.S.: Light on Yoga, Harper Collins Publishers.
4. Swami Satyananda Saraswati: Asana, Pranayama, Bandha, Mudra Bihar School of Yoga, Munger.
5. Tiwari, O.P.: Asana Why and How? Kaivalyadhama, Lonavla.

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: BIOCHEMISTRY (THEORY)**

**SUBJECT CODE: - BSMBMJ-201**

**SEMESTER – II**

**TOTAL HOURS: 60 CREDITS: 6 (Theory 4 and Practical 2 Credits)**

**Course Objectives:**

1. To give students a solid foundation in biology and chemistry.
2. To develop analytical and critical-thinking skills that allows independent exploration of biological phenomena through the scientific method.
3. To introduce students to modern methods of biochemical experimentation within the disciplines of biology and chemistry.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>5</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>5</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical:50</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit - 1: [15 hrs.]**

Introduction to Biochemistry; chief intracellular components; Introduction to chemical receptors/co-receptors, cell to cell communication, channels & transportation; Definition and classification of Vitamins and their Clinical importance; Basics of Molecular mechanism of O<sub>2</sub> transport and storage; Fundamentals of Bio-Energetics: Biological Oxidation, General Concept of oxidation, features of cellular Oxidation-respiratory chain oxidative phosphorylation, Structure and analysis of water.

**Unit – 2: [15 hrs]**

Carbohydrates: Definition, classification with examples and general functions; Concept of isomerism, types & mode of action; Introduction to metabolism, Integration of metabolism and catabolism. Unit-3: [15 hrs] lipids and proteins L

### **Unit-3: [15 hrs]**

lipids and proteins Lipids: definition, classifications and general functions; Introduction to essential fatty acids, cholesterol, Blood lipids, brief review of lipoproteins and fatty liver; Proteins: definition, classification and Biomedical Importance, Plasma Proteins and functions; Definition, classification and nomenclature of Enzymes, basic introduction to Enzymology and regulation of Enzymatic activity. Structure of DNA, RNA, nucleic acid metabolism and diseases associated with it.

### **Unit- 4: [15 hrs]**

Functional Bio-chemistry Introduction to hormones, molecular basis of hormonal action; Introduction to common metabolic disorders; Basic techniques for estimation of different Biochemical markers i.e., diffusion, Osmosis, Electrophoresis,

#### **SUGGESTED READING**

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company,
6. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill
7. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons,

### **BSMBMJ-201-P Biochemistry (Practical) Credits 2**

1. Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
2. Qualitative/Quantitative tests for carbohydrates, reducing sugars, and non-reducing sugars
3. Qualitative/Quantitative tests for lipids and proteins
4. Study of protein secondary and tertiary structures with the help of models

#### **SUGGESTED READING**

1. Introductory Practical Biochemistry, S.K. Sawhney, Narosa Publishing

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: BACTERIOLOGY AND VIROLOGY (THEORY)**

**SUBJECT CODE: - BSMBMN-202**

**SEMESTER – II**

**TOTAL HOURS: 60 CREDITS: 4 (Theory 3 and Practical 1 Credits)**

Course Objective:

1. Fundamental concepts of viruses, their origin, mode of replication, isolation, cultivation, characterization of viruses.
2. Students will be able to understand the basis of immunology, antigens and antibodies structure and diversity
3. Gain critical thinking skills in the area of virology and immunology related to human health
4. Develop analytical thinking skills to analyze the problems related to viral and immunological diseases in human health.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>		<b>Practical:50</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit 1 Cell organization No. of Hours: 10**

Cell size, shape and arrangements, capsule, flagella and pili, Composition and detailed structure of gram- positive and gram- negative cell wall and archaeal cell wall, Structure, chemical composition and functions of bacterial and archaeal cell membranes, Ribosomes, inclusions, nucleoid, plasmids, structure, formation and stages of sporulation.

**Unit 2 Bacterial growth and control No. of Hours: 8**

Culture media: Components of media, Synthetic or defined media, Complex media, enriched media, selective media, differential media, enrichment culture media. Pure culture isolation: Streaking, serial dilution and plating methods, cultivation, maintenance and stocking of pure cultures, cultivation of anaerobic bacteria. Growth: Binary fission, phases of growth.

**Unit 3 Bacterial Systematics and Taxonomy No. of Hours: 12**

Taxonomy, nomenclature, systematics, types of classifications. Morphology, ecological significance and economic importance of the following groups: Archaea: methanogens, thermophiles and halophiles. Eubacteria: Gram negative and Gram positive. Gram negative:

Non-proteobacteria– Deinococcus, Chlamydia, Spirochetes. Alpha proteobacteria- Rickettsia, Rhizobium, Agrobacterium. Gamma proteobacteria–Escherichia, Shigella, Pseudomonas. Gram positive: Low G+C: Mycoplasma, Bacillus, Clostridium, Staphylococcus High G+C Streptomyces, Frankia.

#### **Unit 4 Introduction to Viruses No. of Hours: 8**

Properties of viruses; general nature and important features. Sub viral particles; viroids, prions and their importance. Isolation and cultivation of viruses.

#### **Unit 5 Structure and multiplication of viruses No. of Hours: 12**

Morphological characters: Capsid symmetry and different shapes of viruses with examples. Viral multiplication in the Cell: Lytic and lysogenic cycle. Description of important viruses: salient features of the viruses infecting different hosts - Bacteriophages (T4 & Lambda); Plant (TMV & Cauliflower Mosaic Virus), Human (HIV & Hepatitis viruses).

#### **Unit 6 Role of Viruses in Disease and its prevention No. of Hours: 10**

Viruses as pathogens: Role of viruses in causing diseases. Prevention and control of viruses: Viral vaccines, interferon and antiviral compounds.

#### **PRACTICAL TOTAL HOURS: 30 CREDITS: 2 CODE: BSMBMN-202-P**

1. Preparation of different media: Nutrient agar, Nutrient broth.
2. To perform simple staining of the bacterial smear
3. To perform Gram's staining.
4. To perform spore staining.
5. Isolation of pure cultures of bacteria by streaking method.
6. Enumeration of colony forming units (CFU) count by spread plate method/pour plate.
7. Study the morphological structures of viruses (DNA and RNA) and their important characters using electron micrographs.
8. Study of the methods of isolation and propagation of plant viruses.
9. Study of cytopathic effects of viruses using photographs.

#### **SUGGESTED READING**

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W.M.T. Brown Publishers.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP (2014). Brock Biology of Microorganisms. 14th edition. Pearson Education, Inc.

3. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition. McMillan.
4. Carter J and Saunders V(2007). Virology; principles and Applications. John Wiley and Sons.
5. Flint SJ, Enquist, LW, Krug, RM, Racaniello, VR Skalka, AM (2004) Principles of Virology, Molecular Biology, Pathogenesis and Control.2nd edition.ASM Press.
6. Shors Teri (2013) Understanding Viruses 2nd edition Jones and Bartlett Learning Burlington USA. 7. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
8. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
9. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
10. Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology. 6th edition, Blackwell Publishing Ltd.
11. Cann AJ (2012) Principles of Molecular Virology, Academic Press Oxford UK

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: MICROBIAL BIOTECHNOLOGY (THEORY)**

**SUBJECT CODE: - BSMBID-203**

**SEMESTER – II**

**TOTAL HOURS: 60 CREDITS: 4 (Theory 3 and Practical 1 Credits)**

Course Objective:

1. Course objective for microbial biotechnology include learning about the classification of microorganisms, their structure, and their role in disease.
2. Students also learn about the techniques used to study microorganisms, and how to apply these techniques to solve real-world problems

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical:50</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>		<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>		<b>37</b>	<b>13</b>

**Unit 1 Microbial Biotechnology and its Applications      No. of Hours: 10**

Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast.

**Unit 2 Therapeutic and Industrial Biotechnology      No. of Hours: 10**

Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics Microbial biosensors.

**Unit 3 Applications of Microbes in Biotransformation      No. of Hours: 8**

Microbial based transformation of steroids and sterols. Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.

**Unit 4 Microbial Products and their Recovery    No. of Hours: 10**

Microbial product purification: filtration, ion exchange & affinity chromatography techniques  
Immobilization methods and their application: Whole cell immobilization.

**Unit 5 Microbes for Bio-energy and Environment            No. of Hours: 12**

Bio-ethanol and bio-diesel production: commercial production from lignocelluloses waste and algal biomass, Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents.

**Unit 6 RNAi    No. of Hours: 6**

RNAi and its applications in silencing genes, drug resistance, therapeutics and host pathogen interactions.

**Unit 6 Intellectual Property Rights            No. of Hours: 4**

Patents, Copyrights, Trademarks.

**MICROBIAL BIOTECHNOLOGY (PRACTICAL) BSMBID-203-P**

1. Study yeast cell immobilization in calcium alginate gels.
2. Study enzyme immobilization by calcium alginate method.
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium).
4. Isolation of xylanase or lipase producing bacteria.
5. Study of algal Single Cell Proteins. 6. Hydrolysis of Starch/Polysaccharide/Lignocellulosic residue.
7. Biotransformation of steroid and its detection by a suitable method (TLC).
8. Demonstration of production of a recombinant product.

**SUGGESTED READING**

1. Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, Cambridge University Press.
2. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition, ASM Press.
3. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12, 195–201.
4. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.



5. Gupta PK (2009) Elements of Biotechnology 2nd edition, Rastogi Publications.
6. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, Cambridge University Press.
7. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,
8. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2nd edition., Elsevier Science.
9. Crueger W, Crueger A (1990) Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauer associates, Inc.

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**SUBJECT TITLE: COMPUTER APPLICATION**

**SUBJECT CODE: - BSMBAE-204**

**SEMESTER – II, TOTAL HOURS: 30 CREDITS: 2 (THEORY 1 and PRACTICAL 1)**

**Course Objectives:**

1. To understand the basic concept of Computer Programming.
2. To understand various aspects of Biology and Computer Programming techniques.

<b>Total Number of Hrs. : 30</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>	<b>1</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>	<b>1</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>			
<b>Total marks: 100</b>			
<b>Theory:100</b>		<b>Practical: 50</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>

**Unit-1 Computer Programming For Biologists (15Hrs.)**

Fundamentals of computers, algorithms, computer basics, Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts.

**Unit-2 Simple programming in Python: (15Hrs.)**

Getting started with Python program Variables, keywords and Operators, Control flow statements, Numbers and Functions, Strings, Lists, Tuples, Dictionary and Sets, More of Python functions, Object oriented programming with Python, Exception Handling in Python, File handing, Regular expression, Multithreading, Database Management, Python Debugging and Automation, Usage of standard module and web-scraping.

**Books Recommended:**

1. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).
2. Let us Python by Kanetkar, BPB Publication, Noida

**Practical: BSMBAE-204-P Credit:1**

**Computer practical (Programming in Python)**

1. To calculate perimeter/ circumference and area of shapes such as triangle, rectangle, square and circle
2. To find largest and smallest numbers in a list
3. To find the sum of squares of the first 100 natural numbers
4. Create a dictionary to store names of states and their capitals
5. To find average and grade for given marks
6. To print the highest and lowest values in the dictionary
7. Create a dictionary of students to store names and marks obtained in 5 subjects

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: MANAGEMENT OF HUMAN MICROBIAL DISEASES**

**SUBJECT CODE: - BSMBSE-205**

**SEMESTER – II**

**TOTAL HOURS: 30 CREDITS: 3**

Course Objectives:

1. Students will be able to correlate disease symptoms with causative agent, isolate and identify pathogens.
2. They will gain knowledge of mechanism of action of antimicrobial drugs and prophylaxis.

<b>Total Number of Hrs. : 30</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>	<b>3</b>	-	-
<b>Hrs/Week</b>	<b>3</b>	-	-
<b>SCHEME OF EXAMINATION</b>			
<b>Total marks: 100</b>			
<b>Theory:100</b>		<b>Practical:00</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>		
<b>75</b>	<b>25</b>	<b>Nil</b>	

**Unit 1 Human Diseases (15 Periods)**

Infectious and non infectious diseases, microbial and non microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections.

**Unit 2 Microbial diseases (15 Periods)**

Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, skin diseases, eye diseases, urinary tract diseases, Sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (SARS/ Swine flu/Ebola) – causes, spread and control, Mosquito borne disease – Types and prevention.

**Unit 3 Therapeutics of Microbial diseases (14 Periods)**

Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and amino glycosides. Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART.

## **Unit 4 Prevention of Microbial Diseases (16 Periods)**

General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors. Vaccines: Importance, types, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.

### **Suggested Readings**

- 1.** Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
- 2.** Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
- 3.** Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
- 4.** Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
- 5.** Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edit

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**PROJECT**

Credit-3

Code: BSMBVA-206

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>-</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Project:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>			
<b>75</b>	<b>25</b>	<b>Nil</b>		

**2<sup>nd</sup> Year**

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Microbial Physiology & Metabolism**

**SUBJECT CODE: - BSMBMJ-301**

**SEMESTER – III**

**Course Objectives:**

1. Students learn how microorganisms metabolize nutrients like carbon, nitrogen, sulphur, and phosphorus.
2. Students learn how microbes grow and how to control them.
3. Students learn about the biochemical processes involved in biosynthesis, respiration, and fermentation.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>5</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>5</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>		<b>Practical:50</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**UNIT I No. of Hours: 15**

**MICROBIAL NUTRITION**

A. Classification of microorganisms based on energy- Phototroph and chemotroph, electron-lithotroph and organotroph and carbon source- Autotroph and Heterotroph Major nutritional type of Microorganisms: chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph and Photoorganoheterotroph.

B. Nutritional requirements of Microorganisms. Elementary nutrients: Carbon, Nitrogen, Sulphur, Oxygen and Energy sources, Vitamins and Growth factors.

C. Uptake of nutrients: Diffusion- Simple and Facilitated, Active transport (use of Proton Motive force, ATP: ABC transporter), Group translocation, Iron uptake.

**MICROBIAL GROWTH**

A. Definition, Growth rate and generation time. The growth curve in batch culture - Phases of growth and their significance. Diauxic growth.

B. Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles),



solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe) and barophilic.

C. Measurement of growth by cell number (Haemocytometer) and cell mass (Turbidometer).  
D. Batch culture and continuous culture of microorganisms – Chemostat, Turbidostat. Synchronization of cell division.

## **UNIT II No. of Hours: 15**

### **METABOLISM**

A. Microbial Enzymes: Definition, Nomenclature, Classification, Properties, Mode and Mechanism of enzyme action, Factors effecting enzyme action, Enzyme regulation, Inhibition: Competitive and Non competitive and Allosteric enzymes, their importance. Cofactors and Coenzymes.

B. Nitrogen metabolism: Biological N<sub>2</sub> Fixation-Symbiotic and asymbiotic N<sub>2</sub> Fixation, nodule formation, bacteroids, Leg haemoglobin in Nitrogen fixation, Mechanism and Biochemistry of Nitrogen fixation, Role of Nitrogenase and Hydrogenase in Nitrogen fixation. Nitrogen assimilation.

C. Lipid metabolism: Breakdown of lipids by microorganisms, beta-oxidation of fatty acids.

## **UNIT III No. of Hours: 15**

### **CHEMOHETEROTROPHIC METABOLISM**

A. Aerobic respiration: Concept of respiration: aerobic, anaerobic respiration and fermentation. Ultra structure of Mitochondrion, Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, Formation of acetyl CoA from pyruvate, TCA cycle, Electron transport system and Oxidative phosphorylation .

B. Anaerobic respiration and Fermentation Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction) Fermentation - Alcohol fermentation and Pasteur Effect; Lactate fermentation (homo fermentative and hetero fermentative pathways).

## **UNIT IV No. of Hours: 15**

### **CHEMOLITHOTROPHIC AND PHOTOTROPHIC METABOLISM**

A. Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction)

B. Photosynthesis: Definition, Photosynthetic microorganisms, Anoxygenic and Oxygenic photosynthesis, Light as a source of energy, Pigments of photosynthetic bacteria and photosynthetic apparatus in prokaryotes and eukaryotes. Mechanism of photosynthesis in bacteria. Comparison of photosynthesis in bacteria and eukaryotes.

### Suggested Readings:

1. Microbial Physiology By S.Meena Kumari
2. Text Book of Microbial Physiology By S.Ram Reddy
3. Microbial Physiology By Moet & foster

### **MICROBIAL PHYSIOLOGY AND METABOLISM (PRACTICAL)**

#### **Code: BSMBMJ-301-P**

1. Effect of temperature on growth of microorganisms.
2. Effect of pH on growth of microorganisms.
3. Effect of carbon and nitrogen sources on growth of E.coli
4. Effect of salt on growth of E. coli
5. Study and plot the growth curve of E. coli by turbidometric method
6. Measurement of growth by cell number using Haemocytometer.
7. Detection of amino acids by paper chromatography.
8. Acid and gas production from carbohydrates- Demonstration of fermentation of lactose
9. Starch hydrolysis.
10. Gelatin hydrolysis.
11. Detection of Catalase production by microorganisms.
12. Urease test
13. Isolation and culturing of photosynthetic bacteria
14. Demonstration of fermentation of glucose using Kuhne's fermentation vessel.

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Microbes in Sustainable Agriculture & development (THEORY)**

**SUBJECT CODE: - BSMBMN-302**

**SEMESTER – III TOTAL HOURS: 60 CREDITS: 4**

Course Objective:

Here students will learn the role of microbes in soil, the benefits of microbial bio-fertilizers, and how microbes can help with pest control.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>4</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>		<b>4</b>		<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical: NIL</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>NIL</b>	<b>NIL</b>	

**Unit I (15Hrs)**

Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil, Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium

**Unit II (5Hrs)**

Carbon dioxide, methane, nitrous oxide, nitric oxide – production and control

**Unit III (10Hrs)**

Bio control mechanisms and ways, Microorganisms used as bio control agents against Microbial plant pathogens, Insects, Weeds.

**Unit IV (15Hrs)**

Plant growth promoting bacteria, biofertilizers – symbiotic (Bradyrhizobium, Rhizobium, Frankia, VAM, potash solubilizer), Non Symbiotic (Azospirillum, Azotobacter, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs

**Unit V (15Hrs)**

Biotech feed, Silage, Bio manure, biogas, bio fuels – advantages and processing parameters, Advantages, social and environmental aspects, BT crops, golden rice, transgenic animals.

## SUGGESTED READINGS

1. Agrios GN. (2006). Plant Pathology.5th edition.Academic press, San Diego.
2. Singh RS. (1998). Plant Diseases Management.7th edition.Oxford & IBH, New Delhi.
3. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4 th edition, ASM Press,
4. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings SciencePublishing, USA.
5. Maier RM, Pepper IL and Gerba CP. (2009).Environmental Microbiology.2nd edition, Academic Press.
6. Barton LL & Northup DE (2011). Microbial Ecology.1st edition, Wiley Blackwell, USA.
7. Campbell RE. (1983). Microbial Ecology.Blackwell Scientific Publication, Oxford, England.
8. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
9. Altman A (1998). Agriculture Biotechnology, Ist edition, Marcel decker Inc.
10. Mahendra K. Rai (2005). Hand Book of Microbial Biofertilizers, The Haworth Press, Inc. New York.
11. Reddy, S.M. et. al. (2002).Bioinoculants for Sustainable Agriculture and Forestry, Scientific Publishers.
12. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Biostatistics (THEORY)**

**SUBJECT CODE: - BSMBMN-303**

**SEMESTER – III TOTAL HOURS: 30 CREDITS: 2**

**Course Objectives:**

It aims to equip students with the ability to: understand fundamental statistical concepts relevant to biomedical research, interpret different types of study designs, collect and manage data, analyze data using statistical methods, and effectively communicate statistical results, including the ability to interpret and explain findings from published research within the healthcare field

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>2</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>		<b>2</b>		<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>			<b>Practical: NIL</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>		<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>		<b>NIL</b>	<b>NIL</b>

**Unit-1 Biostatistics (5hrs)**

Definition –statistical methods – basic principles, Variables-measurements, functions, limitations and uses of statistics.

**Unit-2 Collection of data primary and secondary (5hrs)**

Types and methods of data collection procedures-merits and demerits. Classification-tabulation and presentation of data-sampling methods.

**Unit-3 Measures of central tendency (5hrs)**

Mean, median, mode, geometric mean – merits & demerits. Measures of dispersion-range, standards deviation, mean deviation, quartile deviation-merits and demerits; Co-efficient of variations.

**Unit 4 Correlation (5 hrs)**

Correlation: Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression. Statistical inference: Hypothesis- simple hypothesis – student ‘t’ test –chi square test.

**Unit 5 Population and Sample (5 hrs)**

Population and sample, Sampling, Type of sampling, Simple Random Sampling and Stratified Random sampling (description without mathematical details). Analysis of Variance, one way and two way classified data, Design of experiment (DOE), principle of DOE, CRD, RBD, LSD (Description without mathematic details)

#### **Unit 6 Vital events (5 hrs)**

Vital events, Vital statistics, Rates and Ratios, Measures of fertility and mortality, Gross and Net reproduction rates, Life tables, complete and abridged life tables, description of life table, uses of life tables, population projection, population projection models.

#### **SUGGESTED READINGS**

1. Danniell, W.W. (1987), Biostatistics, New York, John Wiley Sons.
2. Banerjee, P. (2001), Introduction to Biostatistics, S. Chand Publication, Delhi.
3. Goon, Gupta & das Gupta: Fundamentals of Statistics Vol II, Calcutta: The world press.

**University of Patanjali, Haridwar**  
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**COURSE DETAILS**

**SUBJECT TITLE: Organic Chemistry (THEORY)**

**SUBJECT CODE: - BSMBID-304**

**SEMESTER – III TOTAL HOURS: 60 CREDITS: 4**

Course Objectives:

Its main objective is to understanding organic compounds, their reactivity, and their role in chemical reactions.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>4</b>	-	-
<b>Hrs/Week</b>		<b>4</b>	-	-
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	-	-	

Unit1. Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper conjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reaction intermediates: Carbocations, Carbanions and free radicals. Electrophiles and nucleophiles Aromaticity: Hückel's rule, Stereochemistry (20Hrs)

Unit 2. Aliphatic Hydrocarbons, Aromatic hydrocarbons, Alkyl Halides, Alcohols, Phenols, Esters, Aldehydes and ketones, Carboxylic acids, Amines (preparations, physical properties & chemical reactions) (15Hrs)

Unit 3. Polymers: Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polythene, nylon, polyesters, Bakelite, rubber. Biodegradable and non-biodegradable polymers.(20Hrs)

Unit 4. Chemistry in everyday life: Chemicals in Medicine, Cleansing agents (5Hrs)

Books recommended:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.
5. Berg, J. M., Tymoczko, J. L. & Stryer, L. Biochemistry 7th Ed., W. H. Freeman



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**COURSE DETAILS**

**SUBJECT TITLE: Personality Development & Technical Writing**

**SUBJECT CODE: - BSMBAE-305**

**SEMESTER – III TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. The course intends to develop talent, facilitate employability enabling the incumbent to excel and sustain in a highly competitive world of business.
2. The programme aims to bring about personality development with regard to the different behavioural dimensions that have far reaching significance in the direction of organisational effectiveness.
3. To make students know about self-awareness, life skills, soft skills, need for personal development etc.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>2</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>		<b>2</b>	<b>-</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>			<b>Practical:00</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>		<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>		<b>-</b>	<b>-</b>

**Personality Development**

**UNIT 1. Introduction to Personality Development:- (10 HRS)**

Define Personality, types, Determinants of Personality Development, Perception – Definition, Perceptual Process, Personality traits and theories, Self-Image and Self-Concept, Dressing Sense and Table Mannerisms, Diet, Exercise and Mental Health, Body Language.

**UNIT 2. Self Grooming: (10 HRS)**

Group Dynamics, Team Building, Time management: Importance of time management, Techniques of time management, Time management styles. Positive Attitude, Self-esteem, Self-confidence, Assertiveness, Motivation.

**UNIT 3. Social and Corporate Etiquettes: (10 HRS)**

Interpersonal Relations, Communication in organizations, Personal Branding, Leadership Skills, Presentation Skills, Personal skills- Stress Management,

Negotiation skills, Conflict Management, Anger Management.

## **Technical Writing**

### **Unit I: (10 HRS)**

1. Sources of scientific information, primary, secondary, and tertiary sources
2. Books, monographs, encyclopaedia, etc.
3. Research journals, magazines, websites, AI tools, chat GPT, etc.
4. Theses, conference proceedings, dissertations, patents, databases, etc.
5. Orations, discussions, interviews, etc.

### **Unit II: (10 HRS)**

1. Technical jargon, terminology, glossary etc.
2. Listening, understanding, appreciation, assimilation, internalisation
3. Ideation, keywords, points, notes, synopsis
4. Popular writing, semi-technical writing, technical writing
5. Different genres of writing, editing, punctuation, proofreading

### **Unit III: (10 HRS)**

1. Writing research paper, review paper, research note etc.
2. Power point presentation, animation, simulation, graphics etc.
3. Talk, lecture, discussion, radio/ television presentation
4. Exhibition, demonstration, models, competitions, debates, posters, films, etc.
5. Writing for blogs, social media, etc.

## **Suggested Books**

- Think and Grow Rich - Napoleon Hill, Ross Cornwell
- I'm Ok, you're Ok-Thomas A.Harris
- Rich dad poor dad - Robert Kiyosaki
- The Monk Who Sold his Ferrari - Robin Sharma
- The Power of Habit - Charles Duhigg
- Technical writing, B. N. Basu, Atlantic

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**COURSE DETAILS**

**SUBJECT TITLE: Yagna Chikitsa**

**SUBJECT CODE: - BSMBSE-306**

**SEMESTER – III TOTAL HOURS: 30 CREDITS: 2**

Total Number of Hrs. : 30	Theory	Practical	Tutorial
Credits	2	-	-
Hrs/Week	2	-	-
<b>SCHEME OF EXAMINATION</b>			
Total marks: 100			
Theory:100		Practical:00	
Final Exam (SEE)	Internal Assessment (CT+TA)	Final Exam (SEE)	Internal Assessment (CT+TA/PR)
75	25	-	-

**पाठ्यक्रम के उद्देश्य:-**

- यज्ञ के शास्त्रीय अर्थ से परिचय कराना तथा यज्ञों के प्रकार पर प्रकाश डालना।
- ऋषि परम्परा से चले आ रहे इस वैज्ञानिक यज्ञ चिकित्सा का बेध कराना।
- सृष्टि चक्र के संतुलन के परिपेक्ष्य में यज्ञीय विधान का परिचय।
- आत्मिक, शारीरिक, मानसिक, आध्यात्मिक, सामाजिक, वैश्विक समस्याओं/रोगों के समाधान
- पर्यावरण संरक्षण एवं सुख शांति हेतु।

**इ काई प्रथम-**

1. वैदिक धर्म एवं वैदिक देवताओं का परिचय एवं इतिहास।
2. यज्ञ सस्था का परिचय एवं विवेचन।
3. यज्ञ के प्रकार एवं उपदेयता एवं वैज्ञानिकता।
4. नित्य पंचमहायज्ञ (ब्रह्मयज्ञ, देवयज्ञ, पितृयज्ञ, बलिवैश्वदेवयज्ञ, अतिथियज्ञ)।

**इ काई द्वितीय-**

1. यज्ञीय पदार्थ- हवनकुण्ड आदि पात्र, समिधा, सामगीर व घी।
2. यज्ञ प्रक्रिया विधि- आचमन, अंड स्पर्शन, ईश्वर-स्तुतिप्रार्थनोपासना, द्वीप प्रज्ज्वलन, अग्न्याधान इत्यादि।

**इ काई तृतीय-**

1. यज्ञकुण्ड का परिमाण एवं स्वरूप एवं मंत्रविज्ञान।

2. शास्त्रों में यज्ञ की महिमा-बल, शत्रुपराजय, ऐश्वर्य, स्वर्ग कल्याणादि।
3. नैमित्तिक-16 संस्कार, भूमि पूजन, गृह प्रवेश, होली, दीपावली पर्व आदि।
4. काम्य-पुत्रेष्टि, वर्षेष्टि, शारीरिक व मानसिक रोग हेतु यज्ञ। कृषि वर्षा पर्यावरण यज्ञ।
5. विभिन्न समप्रदायों में यज्ञ एवं उसकी प्रक्रियाएं।

#### इंकाई चतुर्थ -

1. यज्ञ चिकित्सा/थरेपी
2. यज्ञ चिकित्सा का शास्त्रीय प्रमाण-वेदादि शास्त्रों में रोग निवारण हेतु बताये गये मन्त्र-श्लोक।
3. यज्ञ चिकित्सा के वैज्ञानिक प्रमाण-अनेक वैज्ञानिकों द्वारा किये गये शोध का विवरण।
4. रोगानुसार हवन सामग्री-प्राणोष्टि, मेधेष्टि, पित्तेष्टि, कफेष्टि, कर्कटोष्टि, वातेष्टि, चर्मोष्टि, सन्ततीष्टि, हृदयेष्टि, मधु-इष्टि, दिव्येष्टि, प्रारब्धेष्टि, गुग्गल।

#### इंकाई पंचम-

1. मंत्र स्मरण एवं उच्चारण

#### नर्धारित पाठ्यपुस्तक-

- यज्ञ-याज्ञ-आयुर्वेद चिकित्सा एवं यज्ञ दर्शन, वैदिक नित्यकर्म विधि
- वैदिक साहित्य एवं संस्कृति, डॉ० कपिलदेव द्विवेदी।
- संध्येपासना विधि- पतंजलि योगपीठ।
- पंच महायज्ञ विधि- महर्षि दयानन्द।

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Industrial Microbiology**

**SUBJECT CODE: - BSMBMJ-401 Credits: 6 (Theory 5 & Practical 1)**

**SEMESTER – IV**

**Course Objectives:**

This course in Industrial Microbiology aims to equip students with the knowledge to understand and utilize microorganisms in industrial applications.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>5</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>5</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>		<b>Practical:50</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit I (10Hrs)**

Brief history and developments in industrial microbiology. Sources of industrially important microbes and methods for their isolation, primary and secondary screening methods. Strain improvement method (protoplast fusion, mutation and recombinant DNA technology).

**Unit II (10Hrs)**

Preservation and maintenance of industrial strains. Media formulation (molasses, corn- steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates).

**Unit III (15Hrs)**

Types of fermentation processes – Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors – Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters. Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration.

**Unit IV (10Hrs)**

Separation of cells – filtration and centrifugation. Cell disruption – physical, chemical and enzymatic methods. Product separation – solvent extraction and precipitation. Lyophilization and spray drying. Methods of immobilization, advantages and applications of immobilization.

## **Unit V (15Hrs)**

Microbial production of industrial products-Citric acid, Ethanol, Penicillin, Glutamic acid, Vitamin B12, Enzymes (DHA, amylase, protease, lipase, chitinase) Wine, Beer, probiotics (Lactobacillus, Bacillus and yeast) (micro-organisms involved, media, fermentation conditions, downstream processing and uses)

### **SUGGESTED READINGS**

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
4. Glaze A.N. and Nikaido H. (1995). Microbial Biotechnology: Fundamentals of Applied Microbiology. 1st edition. W.H. Freeman and Company
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
6. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
7. Waites M.J., Morgan N.L., Rockey J.S. and Higon G. (2001). Industrial Microbiology: An Introduction. 1st edition. Wiley – Blackwell.

### **Practical: BSMBMJ-401-P: Industrial Microbiology**

1. Isolation of microorganisms from natural sources.
2. Quantitative estimation of amylase production by bacterial culture.
3. Isolation and screening of bacterial and fungal cultures for enzyme production
4. Quantitative estimation of lipase production by bacterial culture
5. Glucose fermentation and Ethanol production using yeast
6. Demonstration of antibiotic production and activity on agar plate.
7. Display of fermenter /bioreactor design

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**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Drug Discovery**

**SUBJECT CODE: - BSMBMJ-402 Credits: 4 (Theory 3 & Practical 1)**

**SEMESTER – IV**

**Course Objectives:**

It teach students about the process of finding new drugs, including the scientific methods used, the regulatory requirements and the role of bioinformatics and genomics in drug discovery and development.

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>3</b>	<b>1</b>	<b>-</b>
<b>Hrs/Week</b>		<b>3</b>	<b>2</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 150</b>				
<b>Theory:100</b>		<b>Practical:50</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>37</b>	<b>13</b>	

**Unit-1 General Introduction [20HRS]**

Definition and scope of drug design; Drug target classification: Proteins as drug targets: Receptors - receptor role, ion channels, membrane bound enzyme activation, agonist and antagonists, concept of inverse agonist, desensitization and sensitization of receptors, affinity, efficacy and potency. Enzymes - Enzyme inhibitors (competitive, noncompetitive, suicide inhibitors), medicinal use of enzyme inhibitors. Nucleic acids as drug targets: Classes of drugs that interact with DNA: DNA intercalators and DNA alkylators.

**Unit-2 Physicochemical principles of drug action [05HRS]**

Partition coefficient, drug dissolution, acid-base properties, surface activity, bioavailability, stereochemical aspects of drug action.

**Unit-3 Drug receptor interactions [05HRS]**

Kinetic analysis of ligand receptor interactions using scatchard plot, double reciprocal plot, Hill plot, forces involved, relationship between dose and effect (graded and quantal response).

**Unit-4 Principles of drug design [10HRS]**

Introduction to SAR, strategies in the search for new lead compounds, analogue synthesis versus rational drug design, concept of prodrugs.

### **Unit-5 Drug discovery and pharmainformatics [20HRS]**

Drug discovery pipeline, drug target identification and validation for microbial pathogen, selection of gene unique to the pathogen, screening for its presence in other microbes and human host, Drug Databases, PubChem, Calculating drug-like properties, introduction to rational drug design methods, optimization of lead compounds.

### **BSBSMJ-404-P PRACTICALS TOTAL HOURS: 15 CREDITS: 1**

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Preparation of Benzocaine,
2. Preparation of Aspirin and determination of partition coefficient in octanol-water system,
3. Preparation of Paracetamol, Preparation of Phenacetin,

### **SUGGESTED READINGS**

1. Introduction to Medicinal Chemistry, 4th edition (2009), Graham I. Patrick, Oxford University Press. ISBN-13: 978-0199234479.
2. The Organic Chemistry of Drug Design and Drug Action, 2 nd edition (2004), Richard B. Silvermann, Elsevier, Academic Press. ISBN-13: 978-0126437324.
3. Medicinal Chemistry: A Molecular and Biochemical Approach, 3rd edition (2005), Thomas Nogrady and Donal F. Weaver, Oxford University Press. ISBN-13: 978-0195104561



**University of Patanjali, Haridwar**  
**Syllabus of B.Sc. Microbiology under NEP**

**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: Microbial genetics & Molecular Biology**

**SUBJECT CODE: - BSMBMN-403 Credits 4 (Theory)**

**SEMESTER – IV**

**Course Objectives:**

Here students learn

- (1) Concepts of gene, gene cistron relationship in prokaryotes and eukaryotes,
- (2) DNA regulation and replication
- (3) Types of DNA damage, DNA repair pathways (4) Transcription etc

<b>Total Number of Hrs. : 60</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>	<b>4</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>	<b>4</b>	<b>-</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>			
<b>Total marks: 100</b>			
<b>Theory:100</b>		<b>Practical:00</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>	<b>NIL</b>	<b>NIL</b>

**UNIT- I (10Hrs)**

Bacterial and Viral genetics: Bacterial plasmids: structure and properties, replication, incompatibility, plasmid amplification. Transposition: structure of bacterial transposons, IS elements, types of bacterial transposons. Organization of viral genome – DNA (Polio Virus) and RNA (Influenza) Retroviral genome, Bacteriophage genome – T4 and T7 life cycle.

**UNIT –II(10Hrs)**

Gene structure and expression Genes in prokaryotes & Eukaryotes – organization, Molecular mechanism and Enzymology of Transcription in prokaryotes and Eukaryotes, Posttranscriptional modifications, Genetic code, Molecular mechanism and Enzymology of Translation of proteins in prokaryotes and Eukaryotes, Posttranslational modifications. Regulation of gene expression in prokaryotes– Operon concept– lac & Trp Operon.

**UNIT – III(10Hrs)**

Mutations: Spontaneous and induced, mutagens, base pair changes, frameshifts, deletions, inversions and duplications, insertions, useful phenol types (auxotrophic, conditional lethal, resistant), reversion vs. suppression, Ames test. DNA damage and repair mechanism.

#### **UNIT IV (15Hrs)**

Basic Concepts in Molecular Biology – Introduction – Scope – Applications –. Nucleus: Nucleus structure, Nucleoid, Chromatin and Chromosomes, allele, loci, gene. Nucleic acids as genetic material –Discovery of genetic material. Structure, organization, and types of DNA and RNA–Extrachromosomal DNA(Plasmid), DNA supercoiling, DNA replication in prokaryotes, Mechanism and enzymology of replication, Rolling circle replication.

#### **UNIT V (15Hrs)**

Recombination and Gene Transfer mechanisms: Molecular basis of recombination in bacteria. Recombination types, Gene transfer mechanisms-Transformation: natural transformation, competence, DNA uptake, role of natural transformation, artificially induced competence, electroporation. Transduction (generalized and specialized). Conjugation: self-transmissible plasmids, F factor, tra genes, on T, F' and Hfr strains, steps in conjugation, chromosome mobilization.

#### **Suggested readings:**

1. Cell biology,genetics,Molecular Biology by P.S.Agarwal
2. Molecular Biology By S.C.Rastogi
3. Molecular Biology By Lodish
4. Principles of genetics By J.Simmon

**University of Patanjali, Haridwar**  
**Syllabus of B.Sc. Microbiology under NEP**

**COURSE DETAILS**

**SUBJECT TITLE: Bio fertilizers & Bio pesticides**

**SUBJECT CODE: - BSMBID-404 Credits 4 (Theory)**

**SEMESTER – IV**

**Course Objectives:**

<b>Total Number of Hrs. : 60</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>4</b>	-	-
<b>Hrs/Week</b>		<b>4</b>	-	-
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>NIL</b>	<b>NIL</b>	

**Unit I (15Hrs)**

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N<sub>2</sub> fixers: Rhizobium– Isolation, characteristics, types, inoculum production and field application, legume/pulses plants. Frankia – Isolation and characteristics, Alnus, Casuarina plants, non-leguminous crop symbiosis. Cyanobacteria, Azolla – Isolation, characterization, mass multiplication, their role in rice cultivation, crop response and field application. Soil nutrients and plant growth

**Unit II (10Hrs)**

Free living Azospirillum, Azotobacter – isolation, characteristics, mass production and field application. Nitrogen cycle. Zinc solubilizer and potash solubilizing microbes

**Unit III (10Hrs)**

Phosphate potash and zinc solubilizing microbes – Isolation, characterization, mass production, field application. Role of phosphate and zinc in plant growth and yield 62

**Unit IV (10Hrs)**

Introduction of mycorrhizae, Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass production of VAM, field applications of Ectomycorrhizae and VAM. Entomopathogenic fungi

## **Unit V (15Hrs)**

General account of microbes used as bio-insecticides and their advantages over synthetic pesticides, bio nematicide, *Bacillus thuringiensis*, *Pseudomonas*, *Bacillus*, *Streptomyces*-production, Field applications, Viruses – cultivation and field applications.

### **SUGGESTED READINGS**

- 1.Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.
- 2.Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
- 3.Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
- 4.Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. New Delhi.
- 5.Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG.
- 6.Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.

**University of Patanjali, Haridwar**  
**Syllabus of B.Sc. Microbiology under NEP**

**COURSE DETAILS**

**SUBJECT TITLE: Vedic Science**

**SUBJECT CODE: - BSMBAE-405 Credit: 2 (Theory)**

**SEMESTER – IV**

**Course Objectives:**

It would aim to provide students with a comprehensive understanding of ancient Indian knowledge systems, including aspects of cosmology, medicine (Ayurveda), mathematics, astrology (Jyotish), and the philosophy behind Vedic texts, allowing them to analyze and interpret these concepts in modern contexts.

<b>Total Number of Hrs. : 30</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>	<b>2</b>	<b>-</b>	<b>-</b>
<b>Hrs/Week</b>	<b>2</b>	<b>-</b>	<b>-</b>
<b>SCHEME OF EXAMINATION</b>			
<b>Total marks: 100</b>			
<b>Theory:100</b>		<b>Practical:00</b>	
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>
<b>75</b>	<b>25</b>	<b>NIL</b>	<b>NIL</b>

वैदिक गणित, खगोल विज्ञान, भौतिक शास्त्र, रसायन शास्त्र, कृषि शास्त्र, ऋतु विज्ञान, ऊर्जा एवं पर्यावरण विज्ञान का परिचय –

- वैदिक वाङ्मय में गणित विज्ञान।
- वैदिक वाङ्मय में खगोल विज्ञान।
- वैदिक वाङ्मय में भौतिक शास्त्र।
- वैदिक वाङ्मय में रसायन शास्त्र।
- वैदिक धातु विज्ञान (डमजंससनतहलैबपमदबम)।
- वैदिक वाङ्मय में कृषि विज्ञान।
- वैदिक ऋतु विज्ञान।

— वैदिक वाङ्मय में ऊर्जा की अवधारणा एवं प्रयोगविधि।

— स्थाई विकास एवं आधुनिक पर्यावरण समस्या का वैदिक समाधान।

— वैदिक पर्यावरण विज्ञान एवं कृषि विज्ञान के प्रमुख ग्रन्थ एवं ग्रन्थकारों का परिचय (कृषिपराशर, वृक्षायुर्वेद, वेदों में पर्यावरणीय चेतना आदि)।

**University of Patanjali, Haridwar**  
**Syllabus of B.Sc. Microbiology under NEP**

**COURSE DETAILS**

**SUBJECT TITLE: Microbial Diagnosis in Health Clinics**

**SUBJECT CODE: - BSMBSE-406 Credit 2 (Theory)**

**SEMESTER – IV**

**Course Objective:**

It aims to equip students with the knowledge and skills to accurately identify pathogenic microorganisms from clinical samples, interpret the results, and contribute to the diagnosis and management of infectious diseases within a healthcare setting.

<b>Total Number of Hrs. : 30</b>		<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>
<b>Credits</b>		<b>2</b>	-	-
<b>Hrs/Week</b>		<b>2</b>	-	-
<b>SCHEME OF EXAMINATION</b>				
<b>Total marks: 100</b>				
<b>Theory:100</b>		<b>Practical:00</b>		
<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA)</b>	<b>Final Exam (SEE)</b>	<b>Internal Assessment (CT+TA/PR)</b>	
<b>75</b>	<b>25</b>	<b>NIL</b>	<b>NIL</b>	

**Unit 1** Importance of diagnosis of diseases Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.  
No of Hours: 5

**Unit 2** Collection of Clinical Samples How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical Samples to laboratory and storage.  
No of Hours: 5

**Unit 3** Direct microscopic examination and culture. Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, Mac Conkey agar, Distinct colony properties of various bacterial pathogens.  
No of Hours: 5

**Unit 4:** Serological and Molecular methods Serological Methods - Agglutination, ELISA, immune fluorescence, Nucleic acid based methods - PCR, Nucleic acid probe  
No of Hours: 5

**Unit 5:** Kits for rapid Detection of Pathogens Typhoid, Dengue and HIV, Swine flu  
No of Hours: 5

**Unit 6:** Testing for Antibiotic sensitivity in Bacteria Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method  
No of Hours: 5

**3<sup>rd</sup> year**

