GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE RAJNANDGAON, C.G.

As per provision of NEP-2020 to be implemented from Academic Year 2022 onwards

SESSION 2025– 2026

SCHEME OF EXAMINATION & SYLLABUS

OF

B.Sc. (MICROBIOLOGY) V, VI, VII, & VIII SEMESTER

DEPARTMENT OF MICROBIOLOGY

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

B. SC. (Multiple Major)
(Session 2025-26)
Microbiology

THEORY PAPER:

	SEMESTER	COURSE TYPE	COURSE CODE	PAPER TITLE	CREDIT	Max marks	(Theory) ESE	IA
FOURTH YEAR	VII	DSC		ADVANCED IMMUNOLOGY	3	100	80	20
		DSE - 1		CLINICAL MICROBIOLOGY	4	100	80	20
		DSE - 2		AGRICULTURE AND VETERINARY MICROBIOLOGY	4	100	80	20
		DSE – 3		ADVANCED INSTRUMENTATION: PRINCIPLE & APPLICATION	4	100	80	20
		GE		METHODS IN MICROBIOLOGY	4	100	80	20
	VIII	DSC		ENVIRONMENTAL & MICROBIAL ECOLOGY	4	100	80	20
		DSE - 1		BIOSAFETY & INTELLECTUAL PROPERTY RIGHTS	4	100	80	20
		DSE - 2		METAGENOMICS, BASIC COMPUTER & BIOINFORMATICS	4	100	80	20
		DSE - 3		FERMENTATION TECHNOLOGY	4	100	80	20
		DSE - 4		ENZYMOLOGY	4	100	80	20

**ESE- End Semester Exam, **IA-Internal Assessment

Instruction for Question paper setting

End Semester Exam (ESE) for DSC and DSE

There will be 03 sections of question of 80marks

Section A- Section A will be very short answer type questions consisting 8 questions of 2 marks, two question from each unit.

Section B- Section B will be short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.

Section C- Section C will be long answer (Descriptive) type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice.

End Semester Exam (ESE) for SEC

There will be 8 questions of 8 marks each, out of which any 5questions to be answer. Total marks will be 40.

Minimum Pass Marks 40%

Section	Maximum Marks (80)		Maximum Marks (40)	
A	2 x 8 = 16	Very short answer type questions consisting 8 questions of 2 marks, two question from each unit.	8 x 5 = 40	8 questions of 8 mark each, out of which any5 questions to be answer.
B	6 x 4 = 24	Short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.		
C	10 x 4 = 40	long answer (Descriptive) type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice		

PRACTICAL PAPER

	SEMESTER	COURSE TYPE	COURSE CODE	PRACTICAL PAPER TITLE	CREDIT	MAX MARKS	PRACTICAL MARKS	SESSIONAL MARKS
FOURTH YEAR	VII	DSC		LAB: ADVANCED MICROBIOLOGY	1	50	40	10
	VIII	DSC		LAB: ENIVRONMENTAL & MICROBIAL ECOLOGY	1	50	40	10

Scheme of Practical Examination

Time-04 hours **M.M.50**

1. Experiment	25
2. Spotting	10
3. Viva-voce	05
4. Sessional	10

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: 2025-26	Program: B.Sc.
Semester: VII	Subject: Microbiology
Course Type: DSC	Course Code:
Course Title:	Advanced Immunology
Credit: 3	Lecture: 45
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Advanced Immunology
Course Learning Outcome:	After the completion of course students should be: ➢ Able to understand immune responses ➢ Able to understand vaccines and effects ➢ Able to understand immune system related diseases and allergic reactions

Units	Lectures	Lectures = 45	Credit
I	12	**Antigen presenting and processing: -** Antigen presenting cell its function, Major Histocompatibility Complex (MHC)- Role and expression structure, function, class I and II, HL-A system. **Lymphokines and cytokines-** structures, receptors, families and JAK-STAT signaling. **Interferons-** types and structure.	
II	12	**Infectious diseases and vaccines: -** Infection, evasion and immune response of virus, bacteria, protozoa and fungi with one example. **Vaccines-** types, new vaccine technology, DNA vaccine, synthetic peptide vaccine, protein sub-unit vaccine, conjugate and multivalent vaccine, recombinant vaccine.	
III	10	**Tissue transplantation, Auto-immunity, Immunodeficiency and Immuno-haematology: -** **Tissue transplantation-** types and graft versus host reaction. **Auto-immunity and diseases-** theories, mechanism and diseases with their diagnosis. Primary Immunodeficiency (SCID & CVID) and Secondary Immunodeficiency (HIV/AIDS) **Immunohaematology-** blood groups, blood transfusion and Rh incompatibilities.	
IV	11	**Hypersensitivity and Chronic inflammation: -** **Hypersensitivity reactions-** Type I, Type II, Type III and Type IV. **Chronic inflammation-** effect, causes, symptoms, clinical focus on obesity and insulin resistance.	
TOTAL	45		03

List of Books	6. Text book of Microbiology; R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman. 7. Medical microbiology; Chrakraborthy P. 8. A text book of Microbiology; Dubey & Maheshwari. 9. Immunology, A Textbook; C.V. Rao. 10. Immunology; J. Kuby. 11. Fundamental Immunology; W.E. Paul. 12. Essentials of Immunology; Roitt, I.M.

PRACTICAL

Advanced Immunology

LAB COURSE (Credit - 1)
7. Production of monoclonal antibody. 8. Determination of blood group and Rh typing. 9. Analysis and measurement the physical and chemical characteristics of cells or particles in a fluid sample (Flow cytometry). 10. Antigen antibody reaction by double diffusion technique. 11. Antigen antibody reaction by radial immunodiffusion technique. 12. Determination of allergic reaction. 13. Study the mechanism of autoimmune diseases and developing diagnostics and therapeutic approaches. 14. History of different primary and secondary immunodeficiencies. 15. Demonstration of complement fixation test.

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

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RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VII**	Subject: **Microbiology**
Course Type: **DSE -1**	Course Code:
Course Title:	**Clinical Microbiology**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Clinical Microbiology**
Course Learning Outcome:	At the end of this course the student will able to – ➢ Develop a clear vision about various aspects of infectious disease. ➢ Explain the portal of entry of pathogens ➢ Identify the method of collection of clinical samples and their processing ➢ Distinguish different types of infectious diseases ➢ Explain diagnostic procedures of infectious diseases

Units	Lectures	Lectures = 60	Credit = 4
I	15	**Basic concepts in Clinical Microbiology –** **Classification of disease** - infectious, communicable, contagious, nosocomial, iatrogenic& zoonotic diseases. **Chain of infection** - Portal of entry and exit of pathogen. **Collection of clinical samples and Laboratory diagnosis** - precautions required for sample collection (oral cavity, throat, skin, blood, urine, feaces.	
II	15	**Viral Infections and Diseases –** **Study of disease:** AIDS, Polio, Rabies, Hepatitis. (causative agent, infectious dose, portal of entry, virulence, epidemiology, laboratory diagnosis, prophylaxis and treatment) **Newly emerging diseases:** Dengue, Ebola, and COVID.	
III	15	**Bacterial Infections and Diseases –** **Study of disease:** Tuberculosis, Typhoid, Cholera, Tetanus, Syphilis, Gastroenteritis (caused by E. coli) (causative agent, infectious dose, portal of entry, virulence, epidemiology, laboratory diagnosis, prophylaxis and treatment)	
IV	15	**Fungal and Protozoal Diseases –** **Study of disease:** Dermatophytosis, Malaria, Amoebic dysentery (causative agent, portal of entry, pathogenicity, laboratory diagnosis and treatment)	
TOTAL	60		04

List of Books	1. Textbook of Microbiology; Ed 8th, Anantnarayan P. and Paniker, C. K. J., (2009), Universities press, Hyderabad. 2. A text book of Microbiology; Chakraborty P (2013) New Central Book Agency, Delhi. 3. Medical Bacteriology and Microbiology; 16th Ed, Dey, N. C. and Dey, T. K., (1999) Allied Agency, Calcutta. 4. Microorganisms in our world; Atlas, R. M. (1995), Mosby Year Book Inc. 5. Microbiology; 4th Ed., Davis, B. D., Dulbecco, R, Eisen, H. N., Ginsberg, R. S., (1990), Harper and Row Publishers, Singapore. 6. Microbiology; 2nd Ed., Prescott, L. M., Hartley, J. P. and Klein, D. A., (1993), W. M. C. Brown Publishers, England. 7. Microbiology; 8th Ed., Tortora, G. J., Funke, B. R. and Case, C. L., (2004), Person Education (Low Price edition), Delhi

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

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RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VII**	Subject: **Microbiology**
Course Type: **DSE-2**	Course Code:
Course Title:	**Agriculture and Veterinary Microbiology**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Agriculture and Veterinary Microbiology**
Course Learning Outcome:	At the end of this course, the students will be able to- ➢ find the multifarious roles of microorganisms in agriculture ➢ illustrate microbial damages to plants ➢ explain harmful effects fungal toxins on human ➢ examine biological control measures of plant diseases ➢ relate animal diseases due to microorganisms

Units	Lectures	Lectures = 60	Credit
I	15	**Agricultural Microbiology:** History, Contributions of Subba Rao, Dr. M. Swaminathan in Indian agriculture. Microbes and their importance in agriculture. **Bio fertilizers:** classification of biofertilizers, Nitrogen fixers, Phosphate solubilizers, PGPR, biofertilizers. Phyllosphere microflora.	
II	15	**Plant Diseases:** **Fungal diseases of plants:** Rusts of wheat, late blight of potato, red rot of sugarcane; **Bacterial diseases of plants:** Citrus canker, blight of rice; **Viral diseases of plants:** Leaf curl of Papaya, vein clearing of lady's finger **Storage fungi:** Categories of storage fungi, harmful effects. Mycotoxins and their effect on human.	
III	15	**Biological Control of plant diseases:** **Bacterial control of insect pests:** *Bacillus thuringiensis* as bacterial insecticide; **Viral control of insect pests:** Nuclear Polyhedrosis Viruses (NPV) and Cytoplasmic Polyhedrosis Viruses (CPV); **Fungal control of insect pests:** **Entomopathogenic fungi:** *Beauveria bassiana*, *Verticillium lecani.*	
IV	15	**Veterinary Microbiology:** Introduction, history and scope, Sources and routes of infection, Zoonoses. **Study of animal diseases;** with respect to etiology, symptoms, mode of transmission, prophylaxis and control: FMD, swine flu, bird flu, Rabies, bovine tuberculosis, Marek's, Ranikhet disease, brucellosis, distemper, transgenic animals.	
TOTAL	60		04

List of Books	1. Microbial Ecology: Fundamentals & Applications. 4th edition Atlas RM and Bartha R. (2000). Benjamin/Cummings Science Publishing, USA 2. Hand Book of Microbial Biofertilizers, Mahendra K. Rai (2005)., The Haworth Press, Inc. New York. 3. Bioinoculants for Sustainable Agriculture and Forestry, Reddy, S.M. et. al. (2002)., Scientific Publishers. 4. Soil Microbiology: An Exploratory Approach, Coyne MS. (2001). Delmar Thomson Learning. 5. Agriculture Biotechnology; Altman A (1998)., Ist edition, Marcel decker Inc. 6. Development of Bioinsecticide, Saleem F and Shakoori AR (2012), Lap Lambert Academic Publishing GmbH KG

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VII**	Subject: **Microbiology**
Course Type: **DSE-3**	Course Code:
Course Title:	**Advanced Instrumentation: Principle and Application**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Advanced Instrumentation: Principle and Application**
Course Learning Outcome:	By the conclusion of this course, the students have – 1. Developed understanding of principals, and applications of different microscopic and spectrophotometric methods. 2. Developed understanding of principals, and applications of different separation techniques especially chromatographic, electrophoretic and centrifugation techniques. 3. Skills in handling and use of light microscope, spectrophotometer and centrifugation equipment to study/analyze various microbiological samples.

Units	Lectures	Lectures = 60	Credit
I	21	**Microscopy:** Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry. **Chromatography:** Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection. Gel filtration chromatography, ion- exchange chromatography and affinity chromatography, GLC, HPLC.	
II	13	**Electrophoresis:** Principle and applications of native polyacrylamide gel electrophoresis, SDS polyacrylamide gel electrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.	
III	13	**Centrifugation:** Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.	
IV	13	**Spectrophotometry:** Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry.	
TOTAL	60		04

List of Books	1. Textbook Of Biophysical Chemistry by U N Dash Macmillan Publishers India (2006) 2. Biophysical chemistry by Nath, Nath and Upadhyay 3. Wilson& Walker. Principles and Techniques in Practical Biochemistry. 5th Edition Cambridge University Press (2000). 4. Khan I A and Khan I A. Fundamentals of Biostatistics, Ukaaz Publications, (1994). Murphy D.B. 5. Fundamental of Light Microscopy& Electron Imaging.1st Edition. Wiley-Liss.(2001). 6. David Plummer. An Introduction To Practical Biochemistry 2006

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VII**	Subject: **Microbiology**
Course Type: **GE**	Course Code:
Course Title:	**Methods in Microbiology**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Methods in Microbiology**
Course Learning Outcome:	At the end of this course the student will able to – ➢ Develop a clear vision about various methods in microbiology. ➢ Understand the mode of action of physical and chemical agents used in sterilization. ➢ Understand the detailed mechanism of staining techniques to observe different types of organisms ➢ Develop competency in performing basic experiments to grow and study microorganisms in the laboratory, including isolation, identification, and manipulation

Units	Lectures	Lectures = 60	Credit = 4
I	15	**Sterilization techniques:** Physical method – heat, moist, filtration, radiation. Chemical method – phenol, alcohol, halogen, gaseous agents, dyes. Properties and uses of Disinfectants and antiseptic	
II	15	**Media preparation and isolation techniques** Culture media - types of culture media, uses of different media, preparation method and composition of common media. Isolation technique - Air exposure method, Serial dilution method, Gradient plate method, Warcup's method.	
III	15	**Cultivation technique and maintenance** Cultivation - pure culture technique and its maintenance, streak plate, pour plate, spread plate, stabbing and swabbing. Types of cultivation - bacterial cultivation (aerobic and anaerobic culture, shake and still culture) virus cultivation (embryonated egg and experimental animals)	
IV	15	**Staining and biochemical test** Staining techniques - stains and purpose of staining; Simple staining, Negative staining, Gram's staining, Acid-fast staining, Lactophenol cotton blue staining. Biochemical test - purpose of biochemical testing; Amylase, Catalase, H2S, IMViC, TSIA.	
TOTAL	60		04

List of Books	8. Textbook of Microbiology; Ed 8th, Anantnarayan P. and Paniker, C. K. J., (2009), Universities press, Hyderabad. 9. Text book of Microbiology; R.P. Singh, Kalyani publication. 10. General microbiology; Vol. I and Vol. II, Power and Daginawala, Himalaya Publication. 11. Microbiology; Pelczar, MJ Chan ECS and Krieg NR, McGraw-Hill. 12. Prescott's Microbiology. Wiley J M, Sherwood L M and Woolverton C J. 13. Experiments in microbiology, plant pathology, tissue culture and microbial biotechnology. Ed 5th, K.R. Aneja. New age international publishers.

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VIII**	Subject: **Microbiology**
Course Type: **DSC**	Course Code:
Course Title:	**Environmental and Microbial Ecology**
Credit: **3**	Lecture: **45**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Environmental and Microbial Ecology**
Course Learning Outcome:	At the end of this course the student will able to – ➢ Relate different types of environments and their habitats ➢ Explain the extremophiles ➢ Identify the role microorganisms in solid/ liquid waste management ➢ Compare beneficial and harmful microbial interaction ➢ Examine biogeochemical cycles and their importance

Units	Lectures	Lectures = 45	Credit
I	12	**Microorganisms of different habitats:** Terrestrial Environment - Soil profile and soil microflora; Aquatic Environment Microflora of fresh water and marine habitats; Air Atmosphere – Aero-microflora and dispersal of microbes; Animal Environment - Microbes in/on human body (microbiomics) & animal (ruminants) body; Extreme Habitats -Extremophiles, Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity and low nutrient levels.	
II	12	**Waste management:** Sources and types of solid waste; Methods of solid waste disposal (Composting and sanitary landfill); Composition of Liquid waste, strength of sewage (BOD and COD); Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.	
III	10	**Ecosystems:** Structure, types and role of microorganisms in ecosystems. **Biological Interaction:** Microbe-Microbe Interactions: Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation; Biocontrol agents; Microbe-Plant Interactions: Roots, Aerial Plant surfaces.	
IV	11	**Biogeochemical Cycles:** Carbon cycle- Microbial degradation of cellulose, hemicelluloses, lignin and chitin; Nitrogen cycle- Biological Nitrogen fixation (symbiotic/nonsymbiotic), ammonification, nitrification, denitrification and nitrate reduction; Phosphorus cycle- Phosphate immobilization and solubilization; Sulphur cycle-Microbes involved in Sulphur cycle.	
TOTAL	45		03

List of Books	13. Text book of Microbiology; R.P. Singh, Kalyani publication. 14. General microbiology; Vol. I and Vol. II, Power and Daginawala, Himalaya Publication. 15. Microbiology; Pelczar, MJ Chan ECS and Krieg NR, McGraw-Hill. 16. Prescott's Microbiology. Wiley J M, Sherwood L M and Woolverton C J. 17. Microbiology; Tortora, Funke, Case. Pearson Benjamin Cummings. 18. Microbial Ecology; Alexander, M John. Wiley & Sons, Inc., New York.

PRACTICAL

Environmental and Microbial Ecology

LAB COURSE (Credit - 1)
1. Analysis of soil for pH, moisture content
2. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane
3. Assessment of microbiological quality of water by presumptive test/MPN test
4. Confirmed and Completed tests for faecal coliforms
5. Determination of BOD of wastewater sample
6. Study of biological interactions (Competition, Parasitism).
7. Isolation of Rhizobium from root nodules.
8. Study the Effect of salt concentration/ pH on growth of microbes.
9. Demonstration of Winogradsky's Column Preparation.

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)

B. Sc. (Multiple Major)

HONORS COURSE

(Session 2025-26)

Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VIII**	Subject: **Microbiology**
Course Type: **DSE-1**	Course Code:
Course Title:	**Biosafety and Intellectual Property Rights**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Biosafety and Intellectual Property Rights**
Course Learning Outcome:	At the end of this course, the students will be able to 1. define biosafety and discuss its importance 2. explain the guidelines regarding GMO 3. assess the risk of release of GMO and study its management 4. identify the basic concepts related to IPR 5. relate the knowledge of patent filing and examine case studies of IPR

Units	Lectures	Lectures = 60	Credit
I	15	**Introduction to Biosafety:** Biosafety issues in biotechnology; Biosafety Cabinets & their types; Biosafety Levels of Specific Microorganisms, AERB/RSD/ RES guidelines for using radioisotopes in laboratories and precautions.	
II	15	**Biosafety Guidelines:** Biosafety guidelines and regulations (National and International); GMOs/LMOS- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO, applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk assessment; Risk management and communication.	
III	15	**Introduction to Intellectual Property Right:** Patents, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Geographical Indications-importance of IPR Patentable and non -patentable, patenting life, legal protection of biotechnological inventions, World Intellectual Property Rights Organization (WIPO) **Plagiarism:** Types and academic punishments	
IV	15	**Grant of Patent and Patenting Authorities:** Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; introduction to Patent Filing Procedures; Patent licensing and agreement; Rights and Duties of patent owner, GATT, TRIPS Agreements; Budapest Treaty on international recognition of the deposit of microorganisms; Indian Patent Act 1970 & recent amendments.	
TOTAL	60		04

List of Books	1. Bioethics and Biosafety; MK Sateesh, Kindle Edition 2. IPR, Biosafety and Bioethics; Shomini Parashar, Deepa Goel Pearson India 2013 3. Private Power, Public Law: The Globalization of Intellectual Property Rights; Susan K. Sell Cambridge University Press, 2000 4. Essentials of Intellectual Property: Law, Economics, and Strategy; Alexander I. Poltorak; Paul J. Lerner Wiley, 2011 (2nd edition) 5. Biological Safety: Principles and Practices; Diane O. Fleming, Debra L. Hunt, 4th Edition. ASM 2006

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B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VIII**	Subject: **Microbiology**
Course Type: **DSE-2**	Course Code:
Course Title:	**Metagenomics, Basic Computer & Bioinformatics**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Metagenomics, Basic Computer & Bioinformatics**
Course Learning Outcome:	At the end of this course, the students will be able to ➢ explain the concept and importance of metagenomics ➢ examine the perception of Microbiome ➢ develop an understanding of host-microbe interactions ➢ relate computer fundamentals and their applications ➢ examine resources and tools of Bioinformatics

Units	Lectures	Lectures = 60	Credit
I	15	**Metagenomics:** Brief history and development of metagenomics, understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using Metagenomics, Basic knowledge of viral metagenome, meta transcriptomics, meta-proteomics and metabolomics.	
II	15	**Microbiomes:** Importance of microbial communities, VBNC (viable but not culturable bacteria). Modern methods of rapid identification of microbes (PCR, mass spectrometry, fluorescence techniques). CRISPR-Cas system **Molecular Basis of Host-Microbe Interaction:** Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens.	
III	15	**Computer fundamentals:** Basic concept of computer organization, generations of computer, hardware, software, basics of operating systems (windows, unix), Classification of computers and computer languages, MS office. **Internet & Web:** introduction; importance, requirements of internet, electronic mailing, chatting, search engines, webpages.	
IV	15	**Concept of Bioinformatics:** Aim and branches, Applications, Basic biomolecular concepts: Protein, Amino acids, DNA, RNA sequences, structure and functions, Forms of biological information, Bioinformatics resources: NCBI, EBI, ExPASy, RCSB, DDBJ, available tools, Open access bibliographic resources and literature data bases: PubMed, BioMed Central, Public Library of Science (PloS), CiteXplore.	
TOTAL	60		04

List of Books	1. Fundamentals of Gene, Genomics and Genetic Engineering, Irfan Khan and Atiya Khanum, Ukaaz Publications Hyderabad. 2. Basic Bioinformatics, C.R. Hemlata 3. Bioinformatics, R. Sundaralingam, Saras Publications. 4. Bioinformatics and Computational Biology, Dr. Chittaranjan Baruah. 5. Computer Basics, G. Manjunath, Vasan Publications 6. Introduction to Bioinformatics; Teresa K. Attwood, David J. Parry-Smith, Pearson Education. (1999). 7. Introduction to bioinformatics; Arthur M. Lesk. Oxford University Press (2004) 8. Fundamental Concepts of Bioinformatics; Dan E. Krane and Michael L. Raymer (2002) 9. Gene VII; Benjamin Lewin, Oxford University Press, (2000). 10. Molecular Biology of Gene; Watson. J. D, Baker. T. A, Bell S. P, Gann A. Levine. M. Losick R, 5th Edition. 11. Molecular biology and Microbial genetics; David Frifielder, Stanely R. Maloy, 2nd Edition, Jones and Barlett Publishers. (1994). 12. Molecular Biotechnology; Glick B. R. and Pasternak J.J., 2nd Ed.ASM press. (2003).

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B.Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VIII**	Subject: **Microbiology**
Course Type: **DSE-3**	Course Code:
Course Title:	**Fermentation Technology**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Fermentation Technology**
Course Learning Outcome:	At the end of this course, the students will be able to ➢ classify the microorganisms for fermentation ➢ illustrate the basic concept of fermenter design ➢ explain the raw materials used in fermentation technology ➢ examine the methods of food preservation and assess quality ➢ compare the characteristics of fermented products

Units	Lectures	Lectures = 60	Credit
I	15	**Microbial growth and Design of fermenters:** Microbial culture selection for fermentation, Media formulation and optimization, inoculums development, strain improvement, microbial growth kinetics and yield kinetics. Design and operation of Fermenters, Basic concepts for selection of a reactor.	
II	15	**Processes involved in fermentation:** Scale-up process and scale-down process: Stages of fermentation-laboratory scale, pilot plant scale and production scale: Criteria of scale-up for critical parameters- aeration, agitation and sterilization; Scale down- Cell disruption; Filtration; Centrifugation; Chromatography; Lyophilization.	
III	15	**Quality control & quality assurance test:** Principles of validation for pharmaceutical industry; QA Tests of finished product-Sterility testing, pyrogen testing, Ame's test toxicity testing, shelf-life testing.	
IV	15	**Food preservation methods and Fermentation products:** High temperature, drying, food additives and radiation, preservation of milk, meat, fish, fruits and vegetables; food hygiene maintenance, large scale fermentation of Beer, Wine, Riboflavin, Streptomycin, Citric acid, Glutamic acid.	
TOTAL	60		04

List of Books	1. A Text Book of Microbiology: Dr. R. C. Dubey& Dr. D. K. Maheshwari 2. Industrial Microbiology, Casida, L. E. 1984, Wiley, Easterbs, New Delhi. 3. Industrial Microbiology. A. H. Patel 2nd Edition. 4. Fermentation Microbiology and Biotechnology by M. El-Mansi and C. Bryce 5. Principles of Fermentation Technology Stanbury P.F., Whitaker A, and Hall S.J. (1997) Aditya Books Pvt. Ltd, N. Delhi. 6. Food Microbiology. 3rd edition. Frazier WC and Westhoff DC. (1992). Tata McGraw-Hill Publishing Company Ltd, New Delhi, India 7. Microbial Technology Vol. I and II by H. J. Peppler and D. Perlman. Academic Press INC.

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE
RAJNANDGAON (C.G.)
B. Sc. (Multiple Major)
HONORS COURSE
(Session 2025-26)
Major 1- Microbiology

Session: **2025-26**	Program: **B.Sc.**
Semester: **VIII**	Subject: **Microbiology**
Course Type: **DSE- IV**	Course Code:
Course Title:	**Enzymology**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Enzymology**
Course Learning Outcome:	At the end of this course the student will able to – ➢ Have acquired knowledge how microbes serve as a source for a large number of enzymes. ➢ How these enzymes are produced in the laboratory. ➢ How their production is increased by different conditions. ➢ How the enzymes are purified. ➢ Practical skill for production and purification of enzymes; factors affecting microbial enzyme production; immobilization of enzymes.

Units	Lectures	Lectures = 60	Credit = 4
I	15	**Basic concepts of enzymes:** Nomenclature, classification, Lock & key model of enzyme. **Enzyme kinetics**: Michaelis-Menten equation, effect of pH, substrate concentration, temperature and inhibitors. **Enzyme inhibition**- competitive and non-competitive inhibition. Isoenzymes and Allosteric enzymes.	
II	15	**Production of Enzyme:** Enzymes from microbial sources, large scale production of enzymes, recovery of enzymes. Enzyme purification methods - enzyme precipitation, separation by chromatography, Enzyme reactors- types of reactors, advantages of enzyme reactors	
III	15	**Enzyme Immobilization:** Immobilized enzymes: Physical and chemical methods of immobilization, immobilization supports, kinetics of immobilized enzymes. Enzyme catalysis in apolar medium, reverse micellar entrapment of enzymes and its applications.	
IV	15	**Application of enzymes:** Synthesis of chemicals, food technology and medicine. Enzymes in diagnostic assays. Enzymes in textile, leather, wood industries and detergents. Enzymes in environmental analysis and biofuel production.	
TOTAL	60		04

List of Books	1. Berg JM,Tymoczko JL,StryerL., Biochemistry. 6th Edition.Freeman (2006). 2. Prakash Singh Bisen, Anjana Sharma, Introduction to Instrumentation in Life Sciences, Taylor and Francis, (2012). 3. James Bailey and David Ollis, Fundamentals of Biochemical Engineering, 2nd edition, McGraw-Hill, (1986). 4. Casida LE, Industrial Microbiology, J. Wiley, (1968). 5. Chisti. Y. Encyclopedia of Bioprocess Technology, Vol-5, John Wiley and Sons, New York. 6. Michael L. Shuler and Fikret Kargi. Bio-process Engineering: Basic Concepts, 2nd Edition. Prentice Hall. (2001). 7. Fogarty, W.M., Kelly, C.T. Microbial Enzymes and Biotechnology 8. Goutam Brahmachari. Biotechnology of Microbial Enzymes.Academic Press (2016)

Chairperson/ HOD **Subject Expert** **Subject Expert** **VC Nominee**

Educationist Representative **Student Nominee**