

SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from
academic year 2022 onwards.

Semester: VIII	Session: 2025 - 26
Course Type: DSC	Title: Recombinant DNA Technology



Department of Biotechnology
**GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE
COLLEGE, RAJNANDGAON (C.G.)**



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

FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025 - 26	Program: FYUG
Semester: VIII	Subject: Biotechnology
Course Type: DSC	Course Code:
Course Title: Recombinant DNA Technology	
Credit: 4	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	<ul style="list-style-type: none">• After completing this course, the students will be able to -• Understand various tools of genetic engineering.• Develop competency in genetic exploitation for human welfare.• Understand the practical application of recombinant DNA technology.• Understand the use of information technology in the field of genome and proteome analysis.

Theory

Units	Lectures	Lectures	Credit
I	15	Prerequisites of rDNA technology - Recombinant DNA technology: General concept. Steps and application. Host controlled Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq, Pfu polymerase. Nuclease (Endo, Exo, and restriction endonuclease). Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyltransferase), Reverse Transcriptase	1
II	10	Gene transfer - Vectors: Based on Plasmid, Bacteriophages, Cosmid. High capacity vectors. The basic concept of Gene Transfer Methods: Microinjection,	2

		Electroporation, Lipofection, and Microprojectile. Selection and Screening of Recombinants: Genetic and hybridization method	
III	10	Genomic validation - PCR: Types of PCR, Steps, Applications, Advantages and Limitations of PCR. Molecular Marker-RFLP, RAPD, and Microarray. Human Genome Project. Gene Library: Genomic and cDNA library, Chromosome walking and jumping	
IV	10	Application of genetic technology - Gene Therapy: In vivo and Ex vivo, germline and somatic gene therapy. Basic idea of stem cell technology: Types of stem cell cultures and their Significance. Introduction to protein structure, Chemical properties of proteins, physical interactions that determine the property of proteins, short-range interactions, electrostatic forces, van der Waal interactions, hydrogen bonds, and Hydrophobic interaction	

Practical Course

Credit = 01; Lecture/Lab hour = 15

- Isolation of chromosomal DNA from plant cells
- Isolation of chromosomal DNA from *E.coli*
- Qualitative and quantitative analysis of DNA using spectrophotometer
- Plasmid DNA isolation
- Restriction digestion of DNA.
- Ligation of DNA.
- Transformation of competent cells.
- Demonstration of PCR.
- Use of SNP databases at NCBI and other sites.
- Use of OMIM database
- Detection of Open Reading Frames using ORF Finder

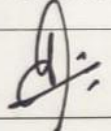
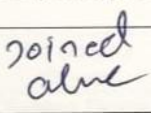
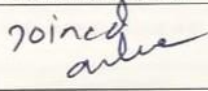

List of Books

- Molecular Biology; Watson.
- Gene VIII; Benjamin Lewin.
- The Cell, A molecular Approach; Geoffrey M. Cooper.
- Molecular Biology of the Cell; Alberts
- Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.
- Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
- Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001

Evaluation Scheme		
Exam Type	Mode of Exam	Marks
Theory	External	80
	Internal	20
Practical	External	40
	Internal	10

Evaluation Scheme for Theory (External)					
Type of Question	No. of questions	Marks	Word Limit	Choice	Total Marks
Very Short Answer	08	02	30	No	16
Short Answer	04	06	75	Yes	24
Long Answer	04	10	150	Yes	40
Evaluation Scheme for Theory (Internal)					
Based on Mid-term Exam					20
Total					100

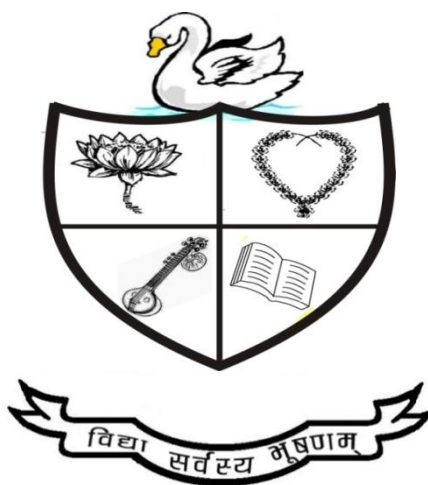
Evaluation Scheme for Practical			
S. No.	Evaluation	Type	Marks
1	Experiment 1	External	10
2	Experiment 2	External	10
3	Experiment 3/ Instrumentation	External	05
4	Spotting	External	10
5	Viva	External	05
6	Sessional	Internal	10
Total			50

Approval of the Board of Studies						
Date: 14/05/25						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature						

SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from
academic year 2022 onwards.

Semester: VIII	Session: 2025-26
Course Type: DSE I	Title: Microbial products for human consumption



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FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025-26	Program: B.Sc.
Semester: VIII	Subject: Biotechnology
Course Type: DSE I	Course Code:
Course Title: Microbial products for human consumption	
Credit: 4 (3+1)	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	After completing this course, the students will be able to - <ul style="list-style-type: none">• Understand the concept of antibiotic fermentation and application.• Develop concepts for the production of various pharmaceuticals.• Develop an understanding of biotechnological approaches for food and nutraceuticals.• Develop a skill in the production of various kinds of alcoholic drinks.

Theory

Units	Lectures	Lectures	Credit
I	15	Antibiotics and microbes 1. Antibiotic fermentations for production of β lactams (penicillins), semi-synthetic penicillins and cephalosporins. 2. Antibiotic fermentations for production of amino-glycosides (streptomycin). 3. Antibiotic fermentations for the production of macrolids (erythromycin). 4. Antibiotic fermentations for the production of quinines.	1
II	10	Microbes and metabolic products 1. Production of vitamins (B12, riboflavin, A),	2

		2. Production of enzymes for pharmaceutical industries, 3. Production of recombinant proteins (insulin, interleukins and interferons), 4. Biotransformations - hormones	
III	10	Microbes and food technology 1. Microbes in the food industry. 2. Biotechnological approaches for fermented foods (sauerkraut, pickles, tofu), 3. Biotechnological approaches for dairy products (cheese, curd, yogurt) 4. Microbes as food - single cell protein, mushrooms, probiotics.	
IV	10	Microbes and Bakery products 1. Role of microbes in bakery fermentation 2. Microbial enzyme in bakery fermentation 3. Microbial bakery products – bread, Pastries and Cakes, cookies and muffins 4. Enhancement of flavor and texture in bakery by the use of microbes	

Practical Course

Credit = 01; Lecture/Lab hour = 15

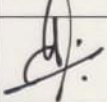

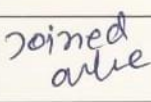
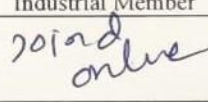
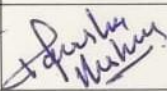

- 1) Production of Penicillin by using microbes.
- 2) Production of enzymes by using microbes.
- 3) Preparation of fermented food, viz., bread, tofu, etc.
- 4) Production of yogurt, and cheese by using microbes.
- 5) Production of alcohol by using microbes.

List of Books	<ul style="list-style-type: none"> • Mantesh singh, Gajendra Pratap Singh and Shivani Tyagi – Microbial Product(Part of Microbial Biotechnology for Food, Health and the Environment, 1 st Edition, CPC Press. • Microbial Products – S Singh • Microbial Products for Health, Environment and Agriculture – P K Aurora. • Microbial Products – S Singh
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Evaluation Scheme		
Exam Type	Mode of Exam	Marks
Theory	External	80
	Internal	20
Practical	External	40
	Internal	10

Evaluation Scheme for Theory (External)					
Type of Question	No. of questions	Marks	Word Limit	Choice	Total Marks
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Short Answer	04	06	75	Yes	24
Long Answer	04	10	150	Yes	40
Evaluation Scheme for Theory (Internal)					
Based on Mid-term Exam					20
Total					100

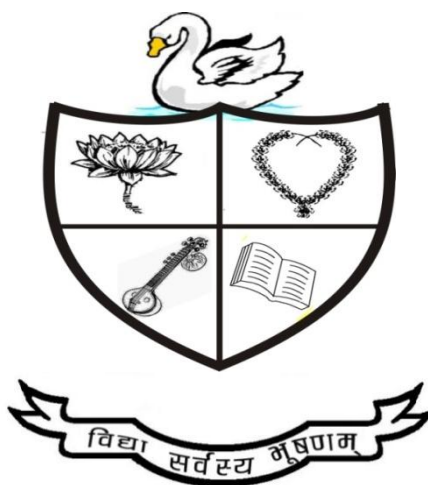
Evaluation Scheme for Practical			
S. No.	Evaluation	Type	Marks
1	Experiment 1	External	10
2	Experiment 2	External	10
3	Experiment 3/ Instrumentation	External	05
4	Spotting	External	10
5	Viva	External	05
6	Sessional	Internal	10
Total			50

Approval of the Board of Studies						
Date: 14/05/25	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature						

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Semester: VIII	Session: 2025-26
Course Type: DSE II	Title: Microbial products for agriculture



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FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025-26	Program: B.Sc.
Semester: VIII	Subject: Biotechnology
Course Type: DSE II	Course Code:
Course Title: Microbial products for agriculture	
Credit: 4 (3+1)	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	After completing this course, the students will be able to - <ul style="list-style-type: none">• Develop skills in biofertilizer production.• Develop skills in biopesticide production.• Develop skills in BT-based GM crop development.• Understand bio composting, biofuels, and metal recovery.

Theory

Units	Lectures	Lectures	Credit
I	15	Microbes and biofertilizers <ol style="list-style-type: none">1. Biofertilizers – history of, production of biofertilizers.2. Production of biofertilizers from symbiotic and asymbiotic nitrogen fixers.3. Phosphate solubilizing microbes, phytohormones from microbes.4. Applications of microbes in fields.	1
II	10	Microbes and biopesticides <ol style="list-style-type: none">1. Biopesticides-history of development.2. Production of biopesticides from bacteria.3. Production of biopesticides from fungi and viruses.4. Production of biopesticides from insect hormones.	2
III	10	Transgenic crops <ol style="list-style-type: none">1. Bacillus thuringiensis (Bt) as a major biopesticide.2. Role of Bt in pest control3. Transgenic crops from Bt.	

		4. Issues related to GM crops	
IV	10	Microbial role in geological product <ol style="list-style-type: none"> 1. Composting – static pile, aerated pile. 2. Bioreactor process for composting. 3. Biofuels – ethanol, methane, hydrogen, and biogas. 4. Recovery of metals – bioleaching of copper, gold, and uranium. 	

Practical Course

Credit = 01; Lecture/Lab hour = 15


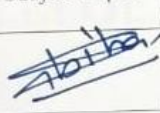
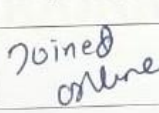
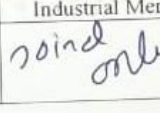
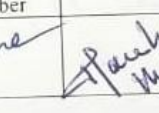
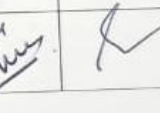
1. Isolation and characterization of asymbiotic bacteria.
2. Isolation and characterization of symbiotic bacteria.
3. Isolation and characterization of *Bacillus thuringensis* (BT).
4. Preparation of biofertilizers by using microbes.
5. Preparation of biopesticides by using plant products.
6. Determination of comparative efficiency of plant-based biofertilisers.
7. Determination of comparative efficiency of plant-based biopesticides against various pests.
8. Comparative study on growth of plant by using non-Bt and Bt strains.
9. Preparation of compost.
10. Comparative study of the efficacy of compost and inorganic fertilizers.

List of Books	<ul style="list-style-type: none"> • Gupta PK ad genetics and biotechnology in crop improvement- Rastogi Publication • Pathak VN Khatri, Pwathak M- Fundamentals of plant pathology- Arobotanoical publication. • Industrial Microbiology- A.H. Patel. • Bilgrami KS and Dubey HG- Textbook of modern plant pathology, Vikas publication. • Vyas S and Modi HA- Biofertilisers and organic farming- AKTA Prakashan • Microbiology- Pelczar&Pelczar. • Principles of Fermentation Technology; Stanburry. • Industrial Microbiology; Casida.
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Evaluation Scheme		
Exam Type	Mode of Exam	Marks
Theory	External	80
	Internal	20
Practical	External	40
	Internal	10

Evaluation Scheme for Theory (External)					
Type of Question	No. of questions	Marks	Word Limit	Choice	Total Marks
Very Short Answer	08	02	30	No	16
Short Answer	04	06	75	Yes	24
Long Answer	04	10	150	Yes	40
Evaluation Scheme for Theory (Internal)					
Based on Mid-term Exam					20
Total					100

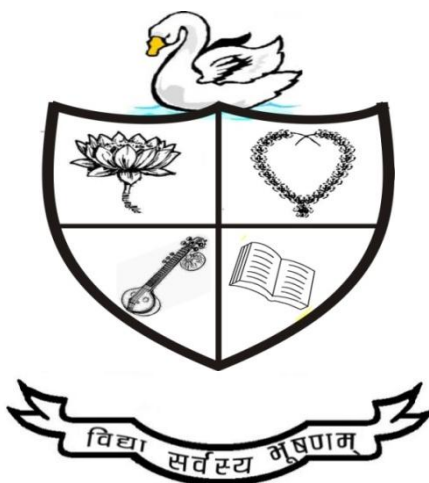
Evaluation Scheme for Practical			
S. No.	Evaluation	Type	Marks
1	Experiment 1	External	10
2	Experiment 2	External	10
3	Experiment 3/ Instrumentation	External	05
4	Spotting	External	10
5	Viva	External	05
6	Sessional	Internal	10
Total			50

Approval of the Board of Studies						
Date: 14/05/25	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
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SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

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academic year 2022 onwards.

Semester: VIII	Session: 2025-26
Course Type: DSE III	Title: Microbial products for industrial use and application



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FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025-26	Program: B.Sc.
Semester: VIII	Subject: Biotechnology
Course Type: DSE III	Course Code:
Course Title: Microbial products for industrial use and application	
Credit: 4 (3+1)	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	After completing this course, the students will be able to - <ul style="list-style-type: none">• Develop skills in the production of sugar-based products.• Develop skills in the production acid acid-based products.• Develop skills in the production of alcohol-based products.• Develop skills in microbial production at the industrial level.

Theory

Units	Lectures	Lectures	Credit
I	15	Production of enzymes 5. Production and applications of amylase, proteases, and invertase. 6. Production and applications of pectinase and cellulase. 7. Production and applications of glucose oxidase and glucose isomerase. 8. Production and applications of catalase, lipase, and polymerase.	1
II	10	Production of acids 2. Production and applications of citric acid and fumaric acid. 3. Production and applications of lactic acid and benzoic acid.	2

		<p>4. Production and applications of gluconic acid and kojic acid.</p> <p>1. Production and applications of itaconic acid and acetic acid.</p>	
III	10	<p>Production of alcohol and glycerol</p> <p>1. Production and applications of industrial alcohol,</p> <p>2. Production and applications of acetone-butanol</p> <p>3. Production and applications of glycerol from yeasts.</p> <p>4. Production and applications of glycerol from bacteria.</p>	
IV	10	<p>Production of pigments and others</p> <p>1. Microbial production of xanthene, dextrane, and alginate.</p> <p>2. Microbial production of gellan, cellulose and curdlan.</p> <p>3. Microbial production of pullulan and scleroglucan.</p> <p>Microbial production of polyesters - bioplastics (polyhydroxyalkanoates).</p>	

Practical Course

Credit = 01; Lecture/Lab hour = 15

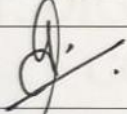
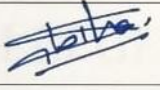
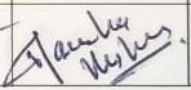

- 6) Production of amylase using microbes.
- 7) Production of catalase using microbes.
- 8) Production of lipase using microbes.
- 9) Production of organic acids using microbes.
- 10) Production of alcohol using microbes.
- 11) Culture and maintenance of industrially significant bacteria.
- 12) Culture and maintenance of industrially significant yeast and fungus

List of Books	<ul style="list-style-type: none"> • Hand book of fermentation technology- E S Minj • Industrial Microbiology- A.H. Patel. • Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, Inc., Tata McGraw Hill, N. Delhi. • Microbiology- Pelczar&Pelczar. • Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi. • Principles of Fermentation Technology; Stanburry. • Industrial Microbiology; Casida.
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Evaluation Scheme		
Exam Type	Mode of Exam	Marks
Theory	External	80
	Internal	20
Practical	External	40
	Internal	10

Evaluation Scheme for Theory (External)					
Type of Question	No. of questions	Marks	Word Limit	Choice	Total Marks
Very Short Answer	08	02	30	No	16
Short Answer	04	06	75	Yes	24
Long Answer	04	10	150	Yes	40
Evaluation Scheme for Theory (Internal)					
Based on Mid-term Exam					20
Total					100

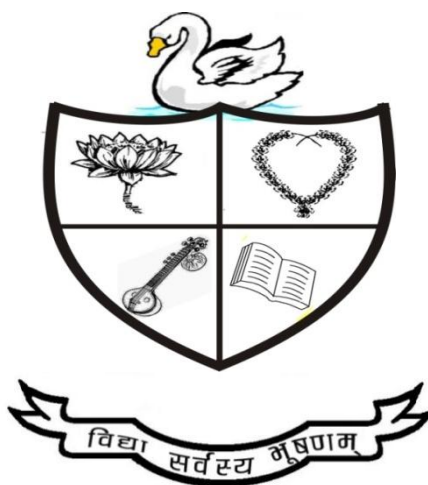
Evaluation Scheme for Practical			
S. No.	Evaluation	Type	Marks
1	Experiment 1	External	10
2	Experiment 2	External	10
3	Experiment 3/ Instrumentation	External	05
4	Spotting	External	10
5	Viva	External	05
6	Sessional	Internal	10
Total			50

Approval of the Board of Studies						
Date: 14/05/25	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature			20128 online	20128 online		

SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

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Semester: VIII	Session: 2025-26
Course Type: DSE IV	Title: IPR, Biosafety, and Bioethics



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FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025-26	Program: B.Sc.
Semester: VIII	Subject: Biotechnology
Course Type: DSE IV	Course Code:
Course Title: IPR, Biosafety, and Bioethics	
Credit: 4 (3+1)	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	After completing this course, the students will be able to - <ul style="list-style-type: none">• Generate basic concepts related to intellectual property.• Develop skills related to patenting and registration of geographical indications.• Develop concepts related to biosafety and its regulation.• Develop skills related to the assessment of biotechnological products.

Theory

Units	Lectures	Lectures	Credit
I	15	Basic concepts of IPR 9. Patent laws, patent application procedure. 10. Copyright laws, ownership, and enforcement of copyrights. 11. Patents and copyrights, transfer. 12. Trademarks – objectives, rights, and protection.	1
II	10	Rights and Conservation 1. Intellectual property rights. 2. Biotechnology and IPR, issues in patenting biotechnological inventions, commercial potential of biotechnology inventions, 3. Patenting of life forms (GEMs) – objectives, rationale, international treaties, Indian perspectives.	2

		2. Geographical indications.	
III	10	Legal protection of biosafety <ol style="list-style-type: none"> 1. Biosafety regulation of products. 2. Individual, national, and international concern of biosafety. 3. Biosafety regulations in laboratories. 5. Handling of recombinant products. 	
IV	10	Protocol and assessment <ol style="list-style-type: none"> 1. Assessment of the impact of transgenic crops- foods, drugs, and vaccines. 2. Assessment of recombinant products. 3. International biosafety protocols Biological weapons and their control.	

Practical Course

Credit = 01; Lecture/Lab hour = 15

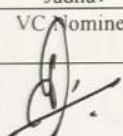

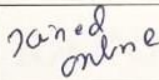
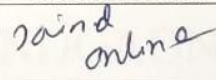
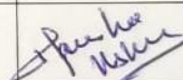

1. Preparation of application for patent filing.
2. Suitability study for patenting of products.
3. Suitability study for geographical indications.
4. Suitability study for trademark.
5. Suitability study for copyright claim.

List of Books	<ul style="list-style-type: none"> • IPR, Biosafety, and Bioethics by Goel and Parashar. • Intellectual property rights, biosafety, and bioethics (ethical frontiers) by Dr. Alok Kumar Srivastav et al. • PR Handbook for Pharma Students and Researchers- P Bansal. • Law relating to intellectual property right- V K Ahuja.
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Evaluation Scheme		
Exam Type	Mode of Exam	Marks
Theory	External	80
	Internal	20
Practical	External	40
	Internal	10

Evaluation Scheme for Theory (External)					
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Short Answer	04	06	75	Yes	24
Long Answer	04	10	150	Yes	40
Evaluation Scheme for Theory (Internal)					
Based on Mid-term Exam					20
Total					100

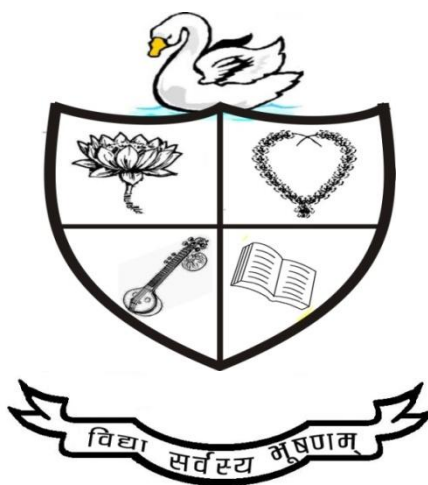
Evaluation Scheme for Practical			
S. No.	Evaluation	Type	Marks
1	Experiment 1	External	10
2	Experiment 2	External	10
3	Experiment 3/ Instrumentation	External	05
4	Spotting	External	10
5	Viva	External	05
6	Sessional	Internal	10
Total			50

Approval of the Board of Studies						
Date: 14/05/25	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC/Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature						

SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from
academic year 2022 onwards.

Semester: VIII	Session: 2025-26
Course Type: Research Project	Title: Research Project



Department of Biotechnology
**GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE
COLLEGE, RAJNANDGAON (C.G.)**



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

FYUGP (NEP 2020 Course)

Department: Biotechnology

Session: 2025-26	Program: B.Sc.
Semester: VIII	Subject: Biotechnology
Course Type: Project	Course Code:
Course Title: Research Project	
Credit: 12	Lecture: 180
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40%

Title	Calculus
Course Learning Outcome:	<p>After completing this course, the students will be able to -</p> <ul style="list-style-type: none">• Conceptualize research• Get research aptitude• Find statement of problem and research gap• Review literatures• Design research methods• Compilation and processing of data• Present result• Discuss outcomes• Recommendation based on findings

1. A student of VIII semester (scored 75% CGPA) will have the option to opt for project work in lieu of two theory papers and one lab courses.
2. The project has to be carried out in recognized national laboratories or UGC recognized universities or any other organization of public or private concern. The duration of project will be 90 days.
3. The department also gives opportunity to do project work maximum 04 students per faculty based on merit marks obtained in last exams.
4. The valuation of all the projects will be carried out by the external examiner.

The project work should be related to the field of Biotechnology. The project report should include declaration by the candidate, certificate by the supervisor, acknowledgement, title and introduction along with the following points:

1. Introduction
2. Review of Literature

3. Materials and Methods
4. Results & Discussion
5. Summary
6. Bibliography

Project Work	External	Internal	Total
Dissertation	105	45	150
Seminar based on project	70	30	100
Viva-voce	35	15	50
Total			300

Approval of the Board of Studies						
Date: 14/05/25	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
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