GOVERNMENT VISHWANATH YADAV TAMASKAR POST

GRADUATE AUTONOMOUS COLLEGE

DURG (C.G.)

(Former Name – Govt. Arts & Science College, Durg)
Phone-0788-2211688, Fax- 0788-2212030
NAAC Accredited Grade 'A+'; CPE Phase - III (UGC, N. Delhi);
Website – www.govtsciencecollegedurg.co.in

SYLLABUS

MASTER OF SCIENCE

BIOTECHNOLOGY

2025-26

SEMESTER-IV

M.SC. SUBJECT: BIOTECHNOLOGY I/II/III/IV SEMESTER

Approved syllabus for M.Sc. Biotechnology by the members of Board of Studies for Session 2025-26

The proposed syllabus with the paper combinations is as under

Semester IV:

Course Code	Paper No. & Title of the Paper	Course Code	Paper No. & Title of the Paper
MBT 401	Paper I: Animal Cell Science and Technology	MBT 402	Paper II: Clinical Research and Bioinformatics
MBT 403	Paper III: Bioprocess Engineering and Technology	MBT 404	Paper IV: External Project
	Paper V / Lab Course I:		Lab Course II:

Field work/Project work: Rules :- The External Project will be carried out by students between Semester II and III in lieu of Paper IV of Semester III and IV. Besides project work, students are supposed to participate in excursion tour also.

Method of Evaluation and Marking: Appended at last of the Syllabus

The syllabus for M.Sc. Biotechnology is hereby approved for the session 2025-26.

Name and Signatures	Expert from other subject – Prof. G. S. Thakur……..
University Nominee - Prof. K.K. Sahu……	Teacher Representation - Dr. Nikhil Mishra …….
Subject Expert- Dr.Pramod Mahish …….	Industrial Representation – Mr.Premanjan Biswas ……
Subject Expert- Prof. M. M. Rai …….	Student Representation – Mr.Somendra Kumar ……
Chairperson – Dr.Shweta Pandey ……	Faculty Member – Mr. Dinesh Kumar ……

Syllabus and Marking Scheme for First/ Second/Third/Fourth Semester

4 Theory papers - 320

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Marks Allotted in Practical
		Max	Min	Max.	Min.	
I	**MBT 401 - Animal Cell Science and Technology**	80	16	20	04	Lab Course I 100
II	**MBT 402 - Clinical Research and Bioinformatics**	80	16	20	04	
III	**MBT 403 - Bioprocess Engineering and Technology**	80	16	20	04	Lab Course II 100
IV	**MBT 404 – External Project**	-	-	-	-	100
	Total	240		60		300

04 Internal Assessment - 80

02 Practical - 200

Total Marks - 600

For particular Semester

Field Work/ Project work –Rules :The External Project will be carried out by students between Semester II and III in lieu of Paper IV of Semester III and IV.

Marks allotted for field Report/ Project work – 80/ 150

- Marks allotted for Viva/ Presentation – 20/50
- Total marks – 100/200

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GOVT. V.Y.T.PG. Autonomous College

(Syllabus for PG Classes)

Session -2025-26 **Fourth Semester Examination**

Class – M.Sc. Final. **Paper No. 1 (MBT 401)**

Title of Paper – ANIMAL CELL SCIENCE AND TECHNOLOGY Max.Marks – 80.

SpecificOutcome-

The outcome of course will be development of competency among students about animal cell culture and cell-based productions for industrial and health applications.

Learning Outcome-

The student will be competent to culture, maintain and preserve the cell line, and to perform cell culture-based vaccine.

SEMESTER IV

PAPER I – ANIMAL CELL SCIENCE AND TECHNOLOGY (MBT 401)

Unit I

1.1 Aseptic technique: Objectives, Elements of aseptic environment, Sterile handling, Standard procedure, Apparatus and equipment.

1.2 Biology of cultured cell: Culture environment, Cell adhesion, Cell proliferation, Differentiation, Cell signaling, Energy metabolism, Origin of cultured cells.

1.3 Defined media and supplements: Physicochemical properties, Balanced salt solution, Complete media, Serum and its selection, Other supplements.

1.4 Serum free media: Disadvantages of serum, Advantages of serum free media, Disadvantages, Replacement of serum, Development and preparation of serum free media.

Unit II

2.1 Primary culture: Initiation, Isolation of tissue, Types of primary culture.

2.2 Sub culture and cell line: Subculture and propagation, Choosing a cell line, Routine maintenance, Subculture.

2.3 Mammalian cell culture: Brief history of mammalian cell cultures, Primary and Continuous Cultures, CHO cells, VERO Cells, Methods of mammalian cell cultures.

2.4 Stem cell / embryonic stem cell culture: Invitro limitation, Nature of Assay, Application of Assay.

Unit III

3.1 Organ and histotypic culture: Gas and Nutrient exchange, Structural integrity, Protocol, Types, Limitation

3.2 Scaling up of animal cell cultures: Scale up in monolayer, Process control, Automation.

3.3 Cell preservation: Methods, Condition of preservation, Limitation, Cryopreservation (Process, Advantages), Cell bank.

3.4 Applications of Cell Culture: Good cell culture practice, standards for cell and tissue culture, principle of cell culture practice, uses of cell and tissue culture.

Unit IV

4.1 Cell culture based vaccines:

4.2 Cytotoxicity and Cell Viability: Limitation, Nature of assay, Application, Genotoxicity, Inflammation.

4.3 Transformation and Immortalization: Transformation, Immortalization, Aberrant growth control, Tumorigenicity in cultured cells.

4.4 Genetic modification in cultured cells: Transfection, Micro-cell mediated chromosome transfer, Irradiation fusion gene transfer.

Suggested Readings –

- Animal cell culture – Freshney
- Culture of Animal cell – John Paul
- Animal cell biotechnology ,methods and protocol – Portner

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Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

Autonomous Examination Cell

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Some papers of English Literature consist of Literary Text. In such question papers, one annotation of 4 marks from each unit will be asked instead of short answer type question. The papers which do not contain literary texts the question paper format and marking scheme will remain the same.
5. For Hindi Literature, refer the Hindi version.
6. Internal Assessment Examination will be as follows :
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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(Syllabus for PG Classes)

Session - 2025-26 **Fourth Semester Examination**

Class – M.Sc. Final. **Paper No. 2 (MBT 402)**

Title of Paper – CLINICAL RESEARCH AND BIOINFORMATICS Max.Marks – 80.

SpecificOutcome-

The outcome of the course will be to develop competency among students for clinical trial of drugs and to interpret biological data by the help of bioinformatics.

Learning Outcome-

The learning outcome will be the ability of genetic and pharmaco- epidemiological study and understanding of genomic and proteomic data base.

SEMESTER IV

PAPER II – CLINICAL RESEARCH AND BIOINFORMATICS (MBT 402)

Unit I

1.1 Introduction tohealth research.

1.2 Measures of disease frequency.

1.3 Descriptive study design.

1.4 Analytical study design.

Unit II

2.1 Experimental study design.

2.2 Validity of epidemiological studies.

2.3 Qualitative research method.

2.4 Measurement of study variable and sampling methods.

Unit III

3.1 Introduction to biological databases.

3.2 Sequence alignment.

3.3 Database similarity search.

3.4 Gene prediction.

Unit IV

4.1 Profiles and Hidden Markov Models.

4.2 Protein motifs and domain prediction.

4.3 Protein structure prediction.

4.4 Phylogenetics.

Suggested Readings –

- Binformatics :A Practical Guide to the Analysis of Genes and Proteins Second Edition; Andreas D. Baxevanis& B. F. Francis Ouellette.
- Practical Bioinformatics; Janusz M. Bujnicki (Ed.)
- Introduction to Bioinformatics; Arthur M. Lesk ,University of Cambridge.
- Bioinformatics and Drug Discovery; Richard S. Larson.
- Bioinformatics; Andrzej Polanski, Marek Kimmel.

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2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Some papers of English Literature consist of Literary Text. In such question papers, one annotation of 4 marks from each unit will be asked instead of short answer type question. The papers which do not contain literary texts the question paper format and marking scheme will remain the same.
5. For Hindi Literature, refer the Hindi version.
6. Internal Assessment Examination will be as follows :
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
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GOVT. V.Y.T.PG. Autonomous College

(Syllabus for PG Classes)

Session - 2025-26 **Fourth Semester Examination**

Class – M.Sc. Final. **Paper No. 3 (MBT 403)**

Title of Paper – BIOPROCESS ENGINEERING & TECHNOLOGY **Max. Marks – 80.**

Specific Outcome-

The outcome of the course will be to develop competency among students to bridge production industry and academia and to produce suitable resource persons for the industry.

Learning Outcome-

The learning outcome will be students will learn the technological involved in bioprocess, drug and food industry.

SEMSTER IV

Paper –III BIOPROCESS ENGINEERING AND TECHNOLOGY (MBT 403)

Unit – I

1.1 **Introduction to bioprocess engineering:** Isolation, preservation & maintenance of industrial micro-organism

1.2 **Fermentation Media:**Media of industrial fermentation, Inoculums preparation and its maintenance.

1.3 **Kinetics**: Kinetics of microbial fermentation.

1.4 **Industrial Sterilization Methods:**Air& media sterilization.

Unit – II

2.1 **Types of fermentation process:** Batch, fed-batch and Continuous Processes.

2.2 **Analysis of Bioreactor Operations:**batch, fed – batch & continuous systems. Stability of microbial reactors, analysis of mixed microbial Populations.

2.3 Specialized bioreactors (Pulsed, fluidized, photo bioreactors etc.)

2.4 Measurement & control of bioprocess parameters.

Unit – III

3.1 Downstream processing: introduction, removal of microbial cells & Solid matter,precipitation, filtration, centrifugation, cell disruption, liquid – liquid extraction.

3.2 Effluent treatment: DOC & COD treatment & disposal of effluent.

3.3 ImmobilizationTechniques: Whole cell immobilization & their industrial application.

3.4 Bio-mining: Use of microbes in mineral beneficiation & oil recovery.

Unit – IV

4.1 Industrial Fermentation:Production of alcohol (Ethanol) Acids (Citric, acetic &gluconic), solvent (glycerol, acetone, butanol).

4.2 Industrial production Drugs: antibiotics (Penicillin, streptomycin, tetracycline)

4.3 Industrial production of amino acids:Lysine, Glutamic acid.

4.4 Industrial production ofbiopharmaceuticals: Production of Interferon, Interleukins.

Suggested Readings –

1. Industrial Microbiology- A.H. Patel.
2. Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, inc, Tata Mcgraw Hill, N.Delhi.
3. Microbiology- Pelczar&Pelczar.
4. Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi.
5. Principles of Fermentation Technology; Stanburry.
6. Industrial Microbiology; Casida.

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   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
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SEMESTER IV

LAB COURSE I

Bioprocess engineering and technology

1. Isolation of industrially important microorganism for microbial processes .
2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism .
3. Comparative studies of ethanol production using different substrate .
4. Microbial production of citric acid using *Aspergillusniger.*
5. Microbial production of antibiotics *(Penicillin*)
6. Production and estimation of alkaline protease.
7. Souerkrate fermentation.
8. Use of alginate for cell immobilization.
9. Strain improvement by UV treatment.
10. Production of amino acid (L-Lysine) from bacteria.

Clinical Research & Bioinformatics

1. Literature mining using PubMed central
2. Literature mining using Medline
3. DNA sequencing & Data analysis
4. Browse the ExPASy sites and write information received in your record.
5. To retrieve metabolic pathways using KEGG PATHWAY Database
6. Retrieving Protein and DNA Sequences using Entrez at NCBI
7. Retrieving Protein and DNA Sequences using SRS at EBI
8. Nucleotide BLAST – Search nucleotide database using nucleotide query
9. Protein BLAST – Search Protein database using protein query

10. BLAST – X : Search Protein database using a translated nucleotide query

11. Multiple Sequence Alignment – CLUSTALW.

12. Immunoassyas.

13. Kinetic analysis.

14. Immunization assessments.

15. Field study of drug efficacy.

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LAB COURSE – I

Scheme of Marks Distribution

Duration –2 days (8 hrs + 8hrs). M.M. 100

1.	2 Expts. based on Clinical Research and Bioinformatics (Each carrying 20 marks)	40
2.	2 Expts. based on BioprocessEng.and Technology (Each carrying 20 marks)	40
3.	Viva	10
4.	Sessional	10
	Total	**100 marks**

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SEMESTER IV

LAB COURSE II

Animal cell science and Technology

1. Preparation of different Medium.
2. Primary explants culture from Chick embryo.
3. Tissue disaggregation in cold trypsin
   Tissue degradation in warm trypsin.
4. Subculturing in suspension.
5. Culture of Corneal epithelial cell.
6. Culture of smooth muscle cell.
7. Preparation of insect cell
8. Preparation of lymphocyte
9. Cryopreservation of culture cells
10. Thawing frozen cells
11. Cell counting by hemocytometer
12. Estimation of viability by dye exclusion
13. MTT assay for cell viability and growth

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   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
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Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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LAB COURSE II

Scheme of marks distribution

1. Four Expts. based on Animal Science
   (Each carrying 20 marks) 80
2. Viva 10
3. Sessional 10

Total **100 marks**

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Subject Expert- Dr.PramodMahish ……	**Industrial Representation – Mr.PremanjanBiswas ……..…**
Subject Expert- Prof. M. M. Rai ……	**Student Representation – Mr.Somendra Kumar ……**
Chairperson – Dr.ShwetaPandey ……	**Faculty Member – Mr. Dinesh Kumar ……**

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

Autonomous Examination Cell

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Some papers of English Literature consist of Literary Text. In such question papers, one annotation of 4 marks from each unit will be asked instead of short answer type question. The papers which do not contain literary texts the question paper format and marking scheme will remain the same.
5. For Hindi Literature, refer the Hindi version.
6. Internal Assessment Examination will be as follows :
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

The syllabus for M.Sc. Biotechnology is hereby approved for the session 2025-26.

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GOVT. V.Y.T.PG. Autonomous College

(Syllabus for PG Classes)

Session - 2025-26 **Third& Fourth Semester Examination**

Class – M.Sc. Final. **Paper No. 4 (MBT 304+404)**

Title of Paper – EXTERNAL PROJECT **Max.Marks – 200.**

(For in between Semester III & IV)

Specific Outcome-

There is provision to undertake Research problem with external institutions/ academia/ industry for three months from June-July &August (in between Semester III & IV) and specific outcome of the course is, students will be competent to understand research problem, to develop hypothesis & objectives, to validate hypothesis and prove objectives by applying suitable methodology to generate and interpret data after statistical validation and to infer findings in correlation of review of literature.

Learning outcome-

The student will be learn different parameters of research work and will be able to conduct independent research problem, and will develop competency for application of knowledge and biotechnology through research work.

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1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
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Note:

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