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-III

GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE DURG

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 III:

Course Code	Paper No. & Title of the Paper	Course Code	Paper No. & Title of the Paper
MBT 301	Paper I: Instrumentation, Nano-Biotechnology and Drug Designing	MBT 302	Paper II: Genetic Engineering
MBT 303	Paper III: Plant Biotechnology	MBT 304	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.PramodMahish ……	**Industrial Representation – Mr.PremanjanBiswas ……..…**
Subject Expert- Prof. M. M. Rai ……..	**Student Representation – Mr.Somendra Kumar ……**
Chairperson – Dr.ShwetaPandey ……	**Faculty Member – Mr. Dinesh Kumar ……**

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

4 Theory papers - 320

Paper No.	Course Code &Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Marks Allotted in Practical
		Max	Min	Max.	Min.	
I	**MBT 301 - : Instrumentation, Nano-Biotechnology and Drug Designing**	80	16	20	04	Lab Course I 100
II	**MBT 302 - Genetic Engineering**	80	16	20	04	
III	**MBT 303 - Plant Biotechnology**	80	16	20	04	Lab Course II 100
IV	**MBT 304 - 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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(Syllabus for PG Classes)

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

Class – M.Sc. Final. **Paper No. 1 (MBT 301)**

Title of Paper – INSTRUMENTATION , NANOBIOTECHNOLOGYAND DRUG DESIGNING **Max. Marks – 80.**

SpecificOutcome -

This course is dedicated to in-depth knowledge about instrumentation, Nanobiotechnology, and Drug designing so related to development of competency in these three fields.

Learning Outcome –

The student will be able to understand about operations and applications of instruments and mechanism of drug developments.

SEMESTER III

PAPER -I – INSTRUMENTATION, NANOBIOTECHNOLOGYAND DRUG DESIGNING (MBT 301)

Unit I – Instrumentation I

1.1 Separation Techniques: HPLC, HPTLC
1.2 Physico Chemical techniques – Sedimentation and ultracentrifugation
1.3 Spectroscopy: UV/ Visible, Fluorescence spectroscopy, Electron spin resonance, Atomic absorption spectroscopy.
1.4 NMR spectroscopy: basic principle, parameters and application

Unit II – Instrumentation II

2.1 Electron microscopy: TEM, SEM , Preparation of specimen, atomic force microscopy.
2.2 X ray crystallography: crystal and symmetries, x ray diffraction, x ray data collection, structure solution.
2.3 FTIR, Mass Spectroscopy, Raman Spectra.
2.4 Some useful techniques in biology: ELISA, Zetapotential/ECSA/EDAx, Cryo-preservation, Lyophilization, Sonication.

Unit III –Nanobiotechnology

3.1 Nano-science- Classification, size dependent properties of nanomaterials, nanoparticle, nanowires etc.

3.2 Synthesisofnanoporousmaterials (Sol-Gel process), nanomaterials (chemical vapour deposition/physical vapour deposition), carbon nanotubes, nanomaterials (3D-2D-1D-0D) and Top-down approach/bottom-up approach.

3.3 Nanoparticle characterization and properties.

3.4 Applications of nanoparticles in various fields.Drug delivery application of nanoparticle

Unit IV Drug Designing

4.1 Basic chemistry for drug designing

4.2 Technologies for drug discovery

4.3 Pharmacology

4.4 Enzyme inhibitors and drug design.

Suggested Readings –

- Biochmistry – Voet, Voet and Prat
- Nanoprticle Technology for Drug Delivery- R.B. Gupta
- Biophysical Chemistry – Upadhyaya and Nath
- Biophysics; VasanthaPattabhi and N. Gautham.

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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 **Third Semester Examination**

Class – M.Sc. Final. **Paper No. 2.**

Title of Paper – GENETIC ENGINEERING **Max. Marks – 80.**

SpecificOutcome –

The outcome of course will be development of competency among students for genetic alterations and applications for improvement of quality of life.

Learning Outcome –

The student will learn about gene analysis, operation & silencing.

SEMESTER III

PAPER II – GENETIC ENGINEERING (MBT 302)

Unit I

1.1 **Nucleic acid purification:** Technique applied for DNA and RNA isolation in bacteria, plants and animals and electrophoresis: Principle, Method and Analysis of bands

1.2 **Molecular tools:** Restriction enzymes (Nomenclature, Types, Mechanism of action with examples) and Modification enzymes (Terminal nucleotidyltransferase, Alkaline phosphatase, Polynucleotide kinase, RNAse A, RNAse P, S1 nuclease, DNAse) and ligases.

1.3 **DNA primers:** Properties**,** General concept and Development of primers,linkers and adaptors, their importance in genetic egineering.

1.4 **In situ hybridization techniques:** ISH probes, Labelling techniques, Process, Challenges of ISH, Application of ISH

Unit II

2.1 **Vectors:**Properties, Types (Plasmid, Cosmid, Phagemid, M13 vector, Shuttle vector, YAC, BAC, Bacteriophage vector), Cloning vs Expression vectors, Method for development ofcompetent host for vectors,,

2.2 **Transformation and transfection techniques:** General consideration for DNA Transformation, Liposome mediated transformation, Non-viral mediated methods (Calcium phosphate precipitation, Electroporation, Microinjection, Gene gun method, Lipofection, Virus mediated transformation in plants and animals; Stable and transient transfection.

2.3 **Screening and selection of recombinant clone:**Insertional inactivation, Methods for screening (Blue white screening, Antibiotic selection, Positive selection vector, Diagnostic restriction digest, Colony PCR, Sequencing), Biological significance

2.4 Chromosome walking: General concept, Requirements, Technique and Application.

Unit III

3.1 cDNA library and genomic library: General concept and components, construction and screening of libraries, Application.

3.2 Polymerase chain reaction and Molecular markers: Requirements, General process, Types and applications.RAPD, RFLP, AFLP, SSR, STS, QTL etc.

3.3 Restriction mapping: Restriction digestion, Electrophoresis and Interpretation and map based cloning.

3.4 Genome sequencing: Early techniques, Present techniques, application, Ethical concerns and Human genome project: Techniques and analysis, Application and proposed benefits, Ethical, legal and social issues.

Unit IV

4.1 Gene therapy: Strategies of gene delivery, gene replacement &augmentation, Applications.

4.2 Gene silencing: Causes, Types: Transcriptional and Post- transcriptional, Research methods (Antisense oligonucleotides, Ribozymes, si and mi RNA) Applications & Gene knockout technology: General concept, Method, Types and Uses.

4.3 Site directed mutagenesis: Basic mechanism, Methods (*invivo* and *in vitro*), Applications and **Protein engineering**: Approaches, Semi- rational design, Method, Screening and selection techniques, Examples of engineered proteins, Enzyme engineering.

4.4 CRISPR/cas-9 Technology: Genome engineering by CRSIPR/cas-9, mechanism and variation.Regulation for CRISPR/cas-9 technology, Applications (CRISPR/cas and immune system of bacteria and archaea, RNA guided human genome engineering via cas-9, Multiplex genome engineering using CRISPR/cas system, Genome scale CRISPR/cas-9 Knock out in human cells, Genetic screening in human cells using CRISPR/cas-9 system).

Suggested Readings –

- Molecular Cloning; Sambrook et al. Vol 1,2, & 3.
- An Introduction to Genetic Engineering; Desmond S.T. Nicholl.
- Genetic Engineering; Old & Primrose.
- Biotechnology, Expanding Horrizons; B.D. Singh.
- Gene Cloning and DNA Analysis; T. A . Brown.

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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
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Note:

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

(Syllabus for PG Classes)

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

Class – M.Sc. Final. **Paper No. 3 (MBT 303)**

Title of Paper – PLANT BIOTECHNOLOGY **Max. Marks – 80.**

SpecificOutcome –

The outcome of the course will be development of ability to culture plants with or without genetic modifications as per industrial and agricultural need.

Learning Outcome –

The students will learn technology for better culture process, transgenic development process and pathogen resistant variety.

SEMESTER III

PAPER III – PLANT BIOTECHNOLOGY

Unit I

1.1 **Callus & Suspension Cultures:**Initiation and Maintenance of callus and suspension culture.

1.2 **Single Cell Culture:**Isolation and cloning of single cell & cell viability test

1.3 **Shoot tip culture:** Rapid clonal propagation & production of virus free plant

1.4 **Embryogenesis in Plant Tissue Culture:**Somatic embryogenesis, Embryo culture & embryo rescue.

Unit II

2.1 **Haploid Plant Generation:**Anther, Pollen and ovary culture for production of hybrid plants.

2.2 **Protoplast Culture:** Protoplast isolation, fusion and its application in hybridization.

2.3 **Plant transformation technology**: Basis of tumor formation, Hairy root, Features of Ti &Ri plasmids, Use of Ti &Ri plasmids as vectors, Mechanism of DNA transfer.

2.4 **Molecular &Physico-chemical Tools**: Marker genes, reporter gene, gene silencing, cryopreservation and germplasm conservation.

Unit III

3.1 Transgenic in crop improvement: Herbicide resistance- glyphoshate, Sulphonyl Urea, Atrazine.

3.2 Insect resistance: Bt toxin gene, proteinase inhibitor, cowpea trypsin inhibitor gene, α amylase inhibitor, lectins, non Bt like protienase inhibitors.

3.3 Virus resistance:coat protein mediated resistance, satellite RNA protection, Ribozyme mediated resistance.

3.4 Disease resistance:pathogenesis related protein (PR), thionins , ribosomal inactivating proteins (RIPs), Antifungal protein (AFPs)

Unit IV

4.1 Transgenic plants as bioreactors:biodegradeable plastic, production of edible vaccine, therapeutic proteins.

4.2 Transgenic plants for quality: Improved storage, longer life, male sterility,

4.3 Chloroplast transformation: vectors for chloroplast transformation, chloroplast transformation method, advantages, limitation of chloroplast transformation.

4.4 Plant secondary Metabolites: Mechanism, manipulation of phenyl propanoidpathway, lysosomal enzymes

Suggested Readings –

- H.S.Chawala: Biotechnology in crop improvement.
- R.J. Henry: Prectical application of plant molecular biology: Chapman & Hall.
- B.D. Singh: Biotechnology, Expanding Horizons.
- Kalyan Kumar De- Plant Tissue Culture.
- M.K. Ragdan: Introduction to Plant Tissue Culture.

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SEMESTER III

LABCOURSE I

Instrumentation:

1. The study of different instruments used in biotech lab: - pH meter, microscope, colorimeter, laminar flow, Hot air oven ,incubator , Deep freezer ,centrifuge .
2. The study of chromatographic method – ion exchange and molecular sieve chromatography.
3. Paper and gel electrophoresis.
4. Study of UV/ VIS spectrophotometer
5. Study of Atomic absorption spectrophotometer
6. Study of ELISA reader
7. Study of Auto analyzer
8. Study of Lyophilizer
9. Study of PCR and and Gel Doc system
10. Use of sonicator

Nano Biotechnology and Drug Designing

1. Synthesis of silvernanoparticles.
2. Synthesis of ironnanoparticles.
3. Synthesis of Zn/Cu/Ca or Mg nanoparticles.
4. Detection of nanoparticles in colloidal solutions using UV-Vis Absorption technique.
5. Functionalization of nanoparticles for biological application.
6. Functional group characterization by FTIR.

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LAB COURSE – I

Scheme of Marks Distribution

Duration –1days (8 hrs). **M.M. 100**

1.TwoExpts. based on Instrumentation, (Each carrying 20 marks)	40
2.TwoExpts. based on Nanobiotechnology& Drug designing (Each carrying15 marks)	30
3 .Viva	10
4.Sessional	20
Total	**100**marks

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SEMESTER III

LABCOURSE II

Genetic Engineering :

1. Isolation of plasmid DNA.
2. Restriction map of plasmid DNA.
3. Restriction mapping of Bacterial genomic DNA
4. DNA finger printing.
5. PCR based experiment.(AFLP. RAPD)
6. Ligation of DNA.
7. Gene expression in *E. coil* and analysis of gene product.
8. DNA end labeling
9. Random primer labeling
10. Gene amplification and Cloning of amplified product

Plant Biotechnology :

1. Media preparation.
2. Surface sterilization.
3. Organ culture.
4. Callus propagation, organogenesis, transfer of plants to soil.
5. Protoplast isolation and culture.
6. Anther culture, production of Haploids.
7. Cytological examination of regenerated plants.

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LAB COURSE II

Scheme of Marks distribution

Duration –1days (8 hrs). **M.M. 100**

1. TwoExpts. based on Genetic Engineering (Each carrying 20 marks)	40
2. Two experiments based on Plant Biotechnology (Each carrying 15 marks)	30
3. .Viva	10
4.Sessional	10
Total	**100**marks

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Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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