

# DEPARTMENT OF MICROBIOLOGY

## COURSE CURRICULUM & MARKING SCHEME

# M.Sc. MICROBIOLOGY

## Semester - II

SESSION : 2022-23



ESTD: 1958

## GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A<sup>+</sup>, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - [www.govtsciencecollegedurg.ac.in](http://www.govtsciencecollegedurg.ac.in), Email – [autonomousandurg2013@gmail.com](mailto:autonomousandurg2013@gmail.com)



## Department of Microbiology

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

Session 2022-23; 2023-24

### Learning Outcome Based curriculum for M.Sc. Microbiology

#### Program Specific Outcome (PSO): M.Sc. Microbiology

The program enables the students –

- To give comprehensive understanding about the diversity of microbes, their organizational units and response towards other life entities
- To inculcate the students to the behavior of microorganisms in terms of physiology, molecular characters and genetic performance
- To make the hypothetical assumptions about the life forms and establish the facts with data interpretation and develop capability of handling of instruments and to build inference for scientific conclusions
- To create employable skills in the field of medical, food, Dairy and industrial microbiology and build the competency in relation with environment consciousness, ethical values and socio-economical aspects
- To be able to analyze problems involving microbes, articulate this with peers/ team members/ other stake holders, and undertake remedial measures

#### Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni	Pragya Kulkarni 25/7/22	Student Nominee – Ms. Yogita Lokhande	Yogita Lokhande 25/9/22
Subject Expert - Dr. Anita Mahiswar	Anita Mahiswar	Departmental members	
Subject Expert - Dr. Sonal Mishra	Sonal Mishra	1. Mrs. Rekha Gupta	Rekha Gupta 25/7/22
VC Nominee – Dr. Prakash Saluja	Prakash Saluja	2. Mrs. Neetu Das	Neetu Das 25/07/22
Industrial Representative- Shri Amitesh Mishra	Amitesh Mishra	3. Ms. Anamika Sharma	Anamika Sharma 25/07/22
Member of Other Department- Dr. Ranjana Shrivastava	Ranjana Shrivastava		

The Syllabus for M.Sc. Microbiology is hereby approved for the sessions 2022-23 and 2023-24

**Semester I**

<b>Paper I: Bacteriology and Virology</b>	<b>Paper II: Phycology and Mycology</b>
<b>Paper III: Biochemistry</b>	<b>Paper IV: Fundamentals of Immunology</b>
<b>Lab Course I: Based on Paper I and II</b>	<b>Lab Course II: Based on Paper III and IV</b>

**Semester II**

<b>Paper I: Cell and Molecular Biology</b>	<b>Paper II: Microbial Genetics</b>
<b>Paper III: Microbial Physiology and Metabolism</b>	<b>Paper IV: Biostatistics and Computers</b>
<b>Lab Course I: based on paper I and II</b>	<b>Lab Course II: Based on paper III and IV</b>

**Semester III:**

<b>Paper I: Biophysical Technique, Instrumentation and Bioinformatics</b>	<b>Paper II: Medical Microbiology</b>
<b>Paper III A: Food and Dairy Microbiology (Elective)</b>	<b>Paper III B: Agriculture Microbiology (Elective)</b>
<b>Lab Course I: Based on Paper I</b>	<b>Lab Course II: Based on Paper II and III</b>

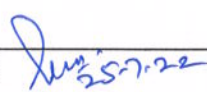
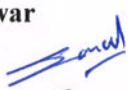


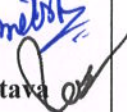
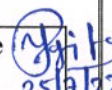
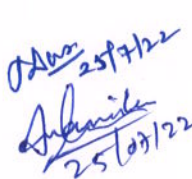
**Semester IV:**

<b>Paper I: Environmental Microbiology</b>	<b>Paper II: Industrial Microbiology and Fermentation Technology</b>
<b>Paper III A: Microbial Biotechnology (Elective)</b>	<b>Paper III B: Microbial Genomics and Proteomics (Elective)</b>
<b>Lab Course I: Based on Paper I and II</b>	<b>Lab Course II: Based on Paper III</b>
<b>Any one elective course to be selected as paper III</b>	<b>Project Work of 3 months duration</b>

**\*Project Work:** A project work shall be initiated at the beginning of semester III for the duration of three months (i.e. June to August) and undertaken in any reputed Institute/ Industry/P.G. departments of University or College.

**Evaluation of Project work:** The project report duly signed by the supervisor and the Head of the institution where the project is completed shall be submitted to the department on or before 31<sup>st</sup> March. Evaluation of the projects shall be done by external examiner.

**Name and Signatures**

<p><b>Chairperson/ HOD- Dr. Pragya Kulkarni</b> </p> <p><b>Subject Expert - Dr. Anita Mahiswar</b></p> <p><b>Subject Expert - Dr. Sonal Mishra</b> </p> <p><b>VC Nominee – Dr. Prakash Saluja</b> </p> <p><b>Industrial Representative- Shri Amitesh Mishra</b> </p> <p><b>Member of Other Department- Dr. Ranjana Shrivastava</b> </p>	<p><b>Student Nominee – Ms. Yogita Lokhande</b> </p> <p><b>Departmental members</b></p> <ol style="list-style-type: none"> <li><b>Mrs. Rekha Gupta</b></li> <li><b>Mrs. Neetu Das</b></li> <li><b>Ms. Anamika Sharma</b> </li> </ol>
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## GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessment separately.
2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semester examination.
3. The internal assessment shall include class test, home assignment and seminar presentation.
4. A. In internal assessment, the marks taken into consideration will be the average of class test and home assignment  
B. The seminar shall be in lieu of home assignment from any one of the theory paper and shall be of 20 marks.  
C. There shall be one seminar in each semester.

## EVALUATION PATTERN

### ➤ Theory 80 marks = 04 Credits

1. The question paper will be of 80 marks.
2. Questions will be asked Unit wise in each paper.
3. The marking scheme for each unit will be as follows –
  - a. Very short answer type question (in one or two sentences) – Two from each unit
  - b. Short answer type question (in 200-250 words) – One from each unit
  - c. Long answer type question (in 400-450 words) – One from each unit

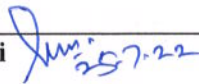
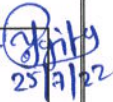

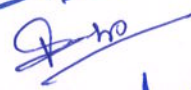
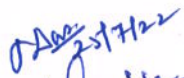
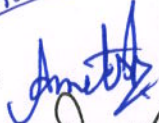

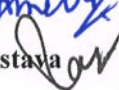
### ➤ Internal Assessment 20 marks = 01 credit

- Unit test – One class test in each theory paper comprising 20 marks. ( containing two short answer type questions of 05 marks each and 05 objective type questions of 02 marks each)
- Home assignments – Two long answer type questions from theory paper containing 10 marks each. The answer should be prepared with the help of standard reference books. (The titles of those books, authors, year of publication and publishers details should be mentioned in an appropriate way, at the end of each assignment).
- Seminar presentations (Power point) – Comprising 20 marks. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentation and open discussion (10 marks).

## Marking Scheme

Type of Question	Unit -I	Unit - II	Unit – III	Unit - IV
A Very short (2 questions)	2 X 2 = 4 marks	2 X 2 = 4 marks	2 X 2 = 4 marks	2 X 2 = 4 marks
B Short ( 1 question)	1 X 4 = 4 marks	1 X 4 = 4 marks	1 X 4 = 4 marks	1 X 4 = 4 marks
C Long (1 question)	1 X 12 = 12 marks	1 X 12 = 12 marks	1 X 12 = 12 marks	1 X 12 = 12 marks

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**DEPARTMENT OF MICROBIOLOGY**  
**GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG**

**M.Sc. MICROBIOLOGY**

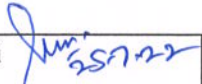



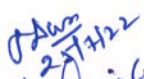


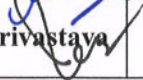
**SYALLABUS AND MARKING SCHEME**

**SECOND SEMESTER**

**Session: 2022-2023**

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	CELL AND MOLECULAR BIOLOGY	80	16	20	04	05
II	MICROBIAL GENETICS	80	16	20	04	05
III	MICROBIAL PHYSIOLOGY AND METABOLOISM	80	16	20	04	05
IV	BIOSTATISTICS AND COMPUTER APPLICATION	80	16	20	04	05
V	LAB COURSE I Based on Paper I and II	100	33			04
IV	LAB COURSE II Based on Paper III and IV	100	33			04
	<b>Total</b>	<b>520</b>		<b>80</b>		<b>28</b>

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Session :2022 -23  
M.Sc. – MICROBIOLOGY  
SEMESTER II  
PAPER – I  
MMB 201 CELL AND MOLECULAR BIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- ❖ To get an in depth understanding of DNA replication and inhibitors of DNA replication
- ❖ To understand the significance of central dogma of gene action and understand the molecular mechanisms involved in transcription and processing of RNA
- ❖ To gain knowledge of genetic code and molecular mechanisms in Protein synthesis
- ❖ To study and compare the regulation of gene expression in both prokaryotes and eukaryotes

**Unit – I**

- DNA replication: general principles, various modes of replication, Types and properties of DNA polymerases, Proof reading, Continuous and discontinuous synthesis, Exonuclease activity in eukaryotic DNA polymerases, Superhelicity in DNA, Linking number, Topological properties, Mechanism of action of topoisomerases
- Retroviruses and their unique modes of DNA synthesis

**Unit – II**

- Inhibitors of DNA replication: Blocking precursor synthesis, nucleotides polymerization, altering DNA structures
- Cell Cycle; Relationship between replication and cell cycle; Cell cycle regulation
- Apoptosis

**Unit – III**

- Transcription: general principles, basic apparatus, steps (initiation, elongation and termination), Types of RNA polymerases, Inhibitors of RNA synthesis
- Polycistronic and monocistronic RNAs, Maturation and processing of RNA: Methylation, Cutting and trimming of rRNA, Capping, Polyadenylation and splicing of mRNA (Cutting and modification of tRNA degradation system, Catalytic RNA, group I and group II intron splicing, RNase P)
- Basic features of genetic code
- Protein synthesis: steps, details of initiation, elongation, termination, roles of various factors in above steps, Inhibitors of proteins synthesis, Synthesis of exported proteins on membrane bound ribosomes

**Unit – IV**

- Regulation of genes expression: Operon concept, catabolite repression instability of bacterial RNA
- Gene regulation: Inducers and co repressors, Negative regulation (E. coli lac operon), Positive regulation (E. coli), regulation by attenuation
- DNA binding proteins, enhancer sequences and controls of transcription by interaction between RNA polymerases and promoter regions, Use of alternate sigma factors, protein binding sites on DNA

**Name and Signatures:**

Chairperson/ HOD

Industrial Representative

Departmental members:

Subject Expert

Member of Other Department

Subject Expert

VC Nominee

Student Nominee

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25/7/22

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25/07/22

**Recommended Books:**

1. Molecular biology of gene, Watson, Baker, Bell, Gann, Levine, Personal Education LPE
2. Principles and Techniques of Biochemistry and Molecular Biology, K. Wilson and J. Walker, Cambridge low price Edition.
3. Mol Bio- Fundamentals of Molecular Biology, A. Upadhyay, Himalaya Pub.
4. Molecular Biology, A.V.S.S. Sambamurthy, Narosa Pub.
5. Essentials of Molecular Biology, Malacinski, M.GeorgeandDavidFreidfelder, Narosa Pub.
6. Biochemistry, C.B. Powar and Chatwal, Himalaya Pub.
7. Principles of Biochemistry, Nelson and Cox

**Session: 2022 -23**  
**M.Sc. – MICROBIOLOGY**  
**SEMESTER II**  
**PAPER – II**  
**MMB 202 MICROBIAL GENETICS**

**Max. M. – 80; Min. M. – 16**

Upon successful completion of the course students will be able –

- ❖ To understand the mechanism of damage and repair of DNA in living system
- ❖ To gain the knowledge of causes and consequences of modifications in DNA structures
- ❖ To study the different ways of gene transfer in microorganisms
- ❖ To get an idea about the tools used in genetic construction and analysis

**Unit – I**

- DNA damages: Biological indications of damage to DNA
- Types of DNA damage (deamination, oxidative damage, alkylation, pyrimidindimers)
- Evidences to repair system
- Repair pathways (methyl directed mismatch repair, very short patch repairs, nucleotide excision repairs, base excision repairs, recombination repairs, and SOS system)

**Unit – II**

- Gene as a unit of Mutation, Biochemical basis of Mutation
- Types of mutations and their origin
- Mutagenesis: Reversion and Suppression
- Gene as a unit of recombination, Molecular nature of recombination

**Unit – III**

- Gene transfer mechanism: Transformation, Transduction, Conjugation, Transfection
- Lysogeny and their applications
- Genetic analysis of Bacteria and Yeast
- Plasmids, types and their uses in genetic analysis, as vector for gene cloning, Replication of selected plasmids, compatibility
- Transposons and their uses in genetic analysis

**Unit – IV**

- Construction of bacterial strains: Isolation of Mutants, Selection of Autotrophic mutants, Strain construction methods
- Molecular methods for detection of Mutations; Genotyping of Bacteria and Viruses, DNA sequencing, AFLP, RFLP and RAPD methods
- C Value Paradox

**Name and Signatures:**

  
Chairperson/ HOD

  
Subject Expert

  
Subject Expert

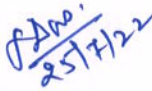
  
VC Nominee


  
Industrial Representative

  
Member of Other Department

  
Student Nominee

**Departmental members:**

  
25/7/22

  
25/07/22



**Recommended Books:**

1. Microbial Genetics – Maloy et al. 1994, Jones and Bartlett publishers.
2. Modern microbial genetics –Streips and Yasbin ,1991, Niley Ltd.
3. Microbial genetics – S.R. Maloy, J.E. Cronan, and David Freifelder, Iind edition 2006, Narosa publishing house, New Delhi.
4. Microbial Genetics – C.B. Powar, Vol I&II, Himalaya Pub.
5. Genetics – P.K. Gupta, Rastogi Pub.
6. Biotechnology and Genetics – R. Shetty
7. Genetics – W. Monroe
8. Genetics – N.W. Strickberger 3<sup>rd</sup> edition
9. Fundamentals of Genetics – B.D. Singh, Kalyani Pub.
10. Fundamental Principles of Bacteriology – A.J. Salle, TMH Edition, New Delhi

Session :2022-23

M.Sc. – MICROBIOLOGY  
SEMESTER II  
PAPER – III

MMB 203 MICROBIAL PHYSIOLOGY AND METABOLOISM

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- ❖ To get an overview of bioenergetics
- ❖ To understand the mechanism of anabolism and catabolism in microorganisms
- ❖ To be acquainted with respiratory metabolic pathway, Pasture effect and fermentation of carbohydrates
- ❖ To distinguish nitrogen metabolism and biosynthesis of polysaccharides

Unit – I

- Basic aspects of bioenergetics: entropy, enthalpy, electrons carrier, artificial electron donors, inhibitors, uncouplers, energy bond, phosphorylation.
- Global regulatory responses: Heat shocks response, stringent response and regulation by small molecules such as ppGpp and cAMP, signal hypothesis
- Brief account of photosynthetic and accessory pigments: chlorophyll, bacteriochlorophyll, rhodopsin, carotenoids, phycobiliproteins

Unit –II

- Autotrophy: Carbohydrate anabolism, Oxygenic and an-oxygenic photosynthesis
- Autotrophic generation of ATP, fixation of CO<sub>2</sub>, Calvin cycles, C<sub>3</sub>-C<sub>4</sub> pathway,
- Chemolithotrophism, Sulphur, iron, hydrogen, nitrogen oxidation
- Methanogenesis
- Luminescence

Unit – III

- Respiratory metabolism: Embden Mayer Hoff Parnas pathway, EntnerDoudroff pathway, Glyoxalate pathway
- Krebs cycle, Reverse TCA cycle, Oxidative and substrate level phosphorylation
- Gluconeogenesis, Pasteur effects
- Fermentation of carbohydrates: homo and heterolactic fermentation

Unit – IV

- Nitrogen metabolism
- Synthesis of major amino acids: polyamines
- Synthesis of polysaccharides: peptidoglycan, biopolymers as cell components.

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

*Aswani*  
25/7/22

*Subinik*  
25/07/22



**Recommended Books:**

1. A text book of Microbiology – P.Chakraborty , New central book agency(P) Ltd. Kolkata.
2. General Microbiology I & II - C.B. Powar and H. F. Dagainawala , Himalaya Publishing House Bombay.
3. Microbiology – B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsberg, Harper and Row, Publishers Philadelphia.
4. Biology of Microorganisms – T.D. Brock and M.T. Madigan, Prentice Hall Int. Inc
5. General Microbiology – R.Y. Stainer, J.L. Wheelis and P.R. Painter, Macmillan Educational Ltd. London.
6. Modern Microbiology – E.A. Brige, W.M.C. Brown, Oxford, England
7. Microbial Physiology and Metabolism – D.R. Coldwell, Brown Publisher
8. Microbial Physiology – A.G. Moat and J.W. Foster, Wiley Pub.

**Session :2022-23**  
**M.Sc. MICROBIOLOGY**  
**SEMESTER II**  
**PAPER IV**  
**MMB 204 BIOSTATISTICS AND COMPUTER APPLICATION**

**Max. M. – 80; Min. M. – 16**

Upon successful completion of the course students will be able –

- ❖ To get the concept of biostatistics in microbiology and learn the basic measures to compile, analyze and make inference from observations
- ❖ To understand the correlation of obtained data and able to explain the significance of observations and discrepancy in results during scientific experiments
- ❖ To design an experiment and to visualize the controlling factors
- ❖ To understand and practice the tools of computers

**Unit – I**

- Introduction: Definition, Basic concepts,
- The sample and population Measurement scales, Statistical inference and parameters
- Classification of Data : Objective of Classification, Types of data
- Presentation of data: Tabulation, Frequency distribution, Graphical presentation of data and interpretation
- Measures of central tendencies (mean, mode, median)

**Unit – II**

- Measures of dispersion (range, mean deviation, standard deviation and error)
- Probability : Basic Concepts, Types, Applications, Calculation of Probability
- Correlation: Types and Methods, Correlation coefficient and its significance
- Regression analysis: linear regression, regression coefficient, uses of regression analysis, difference between correlation and regression.

**Unit – III**

- Tests of significance: Chi-Square, characteristics, applications
- Student's t Test: Properties and Applications
- Variance – Ratio test 'F' test
- Analysis of Variance (ANOVA): Introduction, procedure, multiple comparisons
- Experimental designs: Basic concepts and principles, types, significance.
- Statistical quality control: Introduction, types, advantages.

**Unit – IV**

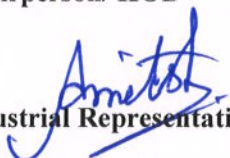
- Introduction to MS-Office Software: MS Word, MS-Excel, MS Power point, Publisher
- Basics of Internet and its applications, emailing
- Search engines: Google Scholar, Web of Science, Pub med, Scopus
- Plagiarism: types and examples, techniques to avoid plagiarism

**Name and Signatures:**

  
Chairperson/ HOD

  
Subject Expert

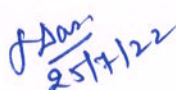
  
VC Nominee

  
Industrial Representative

  
Member of Other Department

  
Student Nominee

**Departmental members:**

  
25/7/22

  
25/07/22



**Recommended books:**

1. Statistics in Biology – C.I.K. Bliss, Vol.1, McGraw Hill, New York
2. Statistics for Biologists – R.C. Campbell, Cambridge Uni. Press, Cambridge.
3. Microbiological Assay – W. Hewitt, Academic Press, New York.
4. Hand Book for experimental immunology – D.M. Weir, (W. Lutz), Blackwell Pub.Ltd. Oxford.
5. Practical Statistics for experimental Biologists –A.C. Wardlaw, John wiley and Sons, New York.
6. Biostatistics, A foundation for analysis in the health science, Wayme W. Daniel, Wiley India Edition
7. A text book of Biostatistics, B. Annadurai
8. Research Methodology, Methods and Techniques, C.R. Kothari, New Age International Pub.
9. Biostatistical analysis – J.H. Zar
10. Introduction to Biostatistics – R.R. Sokal and F.J. Rohaf
11. Fundamentals of Biostatistics – Khan and Khanum, Ukaaz Pub. Hyderabad.
12. Biostatistics – P. Ramakrishnan, SarasPbu. Kanyakumari.

Session : 2022-23  
M.Sc. MICROBIOLOGY  
SEMESTER –II  
LAB COURSE: I  
MMBL 03 CELL AND MOLECULAR BIOLOGY AND MICROBIAL GENETICS  
List of Practical Exercises

M.M. - 100

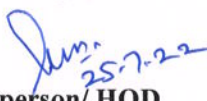
**I – Cell and Molecular Biology**

1. Study the cell division stages of mitosis through onion root tips.
2. Isolation of DNA from plant (Cauliflower/Onion/ Spinach Leaf).
3. Isolation of Genomic DNA from Bacteria (Gram positive/Gram negative).
4. Estimation of total DNA from given sample by DAP method.
5. Estimation of RNA From yeast.
6. Isolation and purification of Plasmid DNA from bacteria.
7. Extraction of total protein and protein profile study.

**II –Microbial Genetics**


1. Determination of antibiotic sensitivity by Well Diffusion method.
2. Determination of MIC for different antibiotics.
3. Isolation of antibiotic resistant bacterial population by Gradient plate method.
4. Isolation of UV induced Auxotrophic mutants by Replica Plating technique.
5. Study of bacterial Transformation.
6. Study of bacterial Transduction.

**Name and Signatures:**

  
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Subject Expert

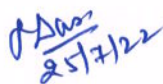
  
VC Nominee

  
Industrial Representative

  
Member of Other Department

  
Student Nominee

**Departmental members:**

  
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**Session: 2022-23**  
**M.Sc. MICROBIOLOGY**  
**SEMESTER –II**  
**LAB COURSE: II**  
**MMBL 04 MICROBIAL PHYSIOLOGY AND METABOLISM AND BIostatISTICS AND**  
**COMPUTER APPLICATION**  
**List of Practical Exercises**

**M.M. - 100**

**III – Microbial Physiology and Metabolism**

1. Effect of light on growth and sporulation of fungi.
2. Effect of temperature on growth of bacteria and determination TDP & TDT.
3. Effect of pH on growth of microorganism.
4. Study the fermentation of carbohydrates (glucose, sucrose & lactose).
5. Effect of salt concentration on growth of microorganism.
6. Effect of molecular oxygen on growth of microorganism.
7. Effect of heavy metal on growth of microorganism.

**IV – Biostatistics and Computer Application**

1. Construction of frequency tables by given sample data using MS word
2. Construction of Bar diagram, Pie chart and Histograms by given sample data using MS word and MS Excel
3. Compare the measures of central tendency from a common data table.
4. Prove that the frequency distributions with equal means have different amount of dispersion.
5. Calculate the standard deviation of the given data mean with MS Excel
6. Compare the sample mean with the population mean by t Test.
7. Determine whether the observed frequencies are similar to expected frequencies by  $\chi^2$  test.
8. Estimate and test the given hypothesis about population mean by ANOVA.
9. Computation of correlation coefficient.
10. Prepare a Presentation by applying formatting tools

**Name and Signatures:**

  
**Chairperson/ HOD**

  
**Subject Expert**

  
**Subject Expert**

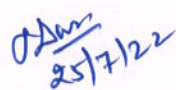
  
**VC Nominee**

  
**Industrial Representative**

  
**Member of Other Department**

  
**Student Nominee**

**Departmental members:**

  
25/7/22

  
25/07/22