

**GOVERNMENT AUTONOMOUS COLLEGE,
RAJAMAHENDRAVARAM
NAAC “A” GRADE**



**DEPARTMENT OF MICROBIOLOGY
BOARD OF STUDIES
2019-2020
(2, 4 & 6 Semesters)**

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8B2: Sensory Evaluation and Food Packaging

8B3: Food Adulteration & Food Toxicology

16. 8 C1: Food processing and preservation

8 C2: Food Safety and Quality control

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Proceedings of the Principal, Government Autonomous College, Rajamahendravaram

Present: Dr.R.David Kumar Swamy, M.Sc, M.Phil, Ph.D

Re. No: Spl/Acad,Cell-GC[A]-RJY/BOS/2018-1, Dated: 17 April 2018

Sub:- Government Autonomous College, Rajamahendravaram – **Boards of Studies (BoS) –**
Nomination of Members - Orders Issued.

Ref:- UGC Guidelines for Autonomous Colleges - 2018.

ORDER:

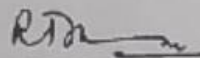
The Principal, Government Autonomous College, Rajamahendravaram is pleased to constitute **Board of studies in MICROBIOLOGY** for framing the syllabi in Microbiology subject for all semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name	Designation
1	Smt. D. Jayasree Lecturer In- Charge/HoD, Department of Microbiology, GC[A], Rajamahendravaram	Chairman
2	All Faculty members in the department	Member
3	Dr. K. Aruna HOD, Dept. of Microbiology, ASD College for Women (A), Kakinada	Subject Expert
4	Dr. Seni Sarika, HOD, Dept. of Microbiology, AL Amir UG&PG College, Rajamahendravaram	Subject Expert
5	Dr.D. Kalyani Dept. of Zoology, Adikavi Nannaya University	University Nominee
6	Sri N. Srinivas, Manager, Coca Cola, Sri Sarvaraya Sugars, Bheemadolu	Expert from Industry/Corporate Sector
7	Sri S. Sagar Dora,	Student Nominee

The above members are requested attend the BOS meetings and share their valuable views, suggestions on the following functionalities:

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and national requirement for consideration and approval of the Academic Council
- Suggest methodologies for innovate teaching and evaluation techniques
- Suggest panel of names to the Academic council for appointment of examiners
- Coordinate research, teaching, extension and other activities in the department of the college.

The term of the members will be Three years from the date of the nomination. The Chairman of the BoS (HoD/lecturer In-Charge of the department) is directed to coordinate with the Principal of the College and conduct BoS meetings as and when necessary, but at least twice a year.



PRINCIPAL

GOVERNMENT COLLEGE [A]
RAJAHMUNDRY

Copy to:

- The above individuals
- File

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**DEPARTMENT OF MICROBIOLOGY****BOARD OF STUDIES****MEETING MINUTES 2018-2019**

The Board of Studies meeting of 2, 4& 6 semesters for the academic year 2019-2020, held in the Department of Microbiology on 16/11/2019 at 10 pm with Smt: D.JAYASREE, Lecturer in-Charge, in the chair along with the following members.

1. **Chairman** : **Smt. D. JAYASREE**, Head of the Department of Microbiology, GC (A) – Rajamahendravaram.
2. **Faculty Member** : Smt.P. Suneeta, Lecturer in Microbiology
3. **Subject expert** : Dr.K.Aruna, Head-Dept of Microbiology ASD Govt.College (W), Kakinada.
4. **Subject expert** : Dr.M.Soni sarika, Head-Dept of Microbiology All-Ameer Degree & PG College, Rajahmundry
5. **University Nominee** : Dr.D.Kalyani, Asst.Professor, Department of Zoology, Adikavi Nannaya University
6. **Expert from Industry**: Sri. N.Srinivas, Manager, Coca-cola, Sri Sarvaraya Sugars, Bheemadolu.
7. **Student Nominee** : Mr. A. Hari Naga Papparao
8. **Student member** : Miss Nageswari

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM

Structure of MICROBIOLOGY under CBCS

Year	Semester	Paper	Course Title	Hours	Marks	Credits
I	II	2	Microbial Biochemistry & Metabolism	4	100	03
			Practicals	2	50	02
II	IV	4	Immunology and Medical microbiology	4	100	03
			Practicals	2	50	02
III M.Z.C	VI	7	E-1 Microbial biotechnology	3	100	03
			E-2 Advances in Microbiology	3	100	03
			Practicals	2	50	02
		8A1	<u>Cluster paper – A</u> Diagnostic microbiology	3	100	03
			Practicals	2	50	02
		8A2	Microbial instrumentation and Biotechniques	3	100	03
			Practicals	2	50	02
		8A3	Biofertilizers and Biopesticides	3	100	03
			.Practicals/project work	2	50	02
		8B1	<u>Cluster paper – B</u> Microbes in sustainable agriculture	3	100	03
			Practicals	2	50	02
		8B2	Mushroom cultivation	3	100	03
Practicals	2		50	02		
8B3	Management of Human microbial Diseases	3	100	03		
	Practicals/project work	2	50	02		
8C1	<u>Cluster paper – C</u> Biostatistics and Bioinformatics	3	100	03		
	Practicals	2	50	02		
8C2	Bio safety and Intellectual property rights	3	100	03		
	Practicals/project work	2	50	02		

		8C3	Drug design and Discovery Practicals/project work	3 2	100 50	03 02
Year	Semester	Paper	Course Title	Hours	Marks	Credits
III M.Z.C Food	VI	8A1	<u>Cluster paper – A</u> Microbial Quality Control in Food and Pharmaceutical Industries Practicals	3 2	100 50	03 02
		8A2	Food Microbiology and Biotechniques Practicals	3 2	100 50	03 02
		8A3	Food Microbiology Hygiene & Sanitation Project/Internship	3 2	100 50	03 02
		8B1	<u>Cluster paper – B</u> Post-Harvest Technology Practicals	3 2	100 50	03 02
		8B2	Sensory Evaluation and Food Packaging Practicals	3 2	100 50	03 02
		8B3	Food Adulteration & Food Toxicology Project/Internship	3 2	100 50	03 02
		8C1	<u>Cluster paper – C</u> Food processing and preservation Practicals	3 2	100 50	03 02
		8C2	Food Safety and Quality control Practicals	3 2	100 50	03 02
				8C3	Food Biotechnology Project/Internship	3 2

**GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
DEPARTMENT OF MICROBIOLOGY**

Minutes of Board of Studies

2019-2020

The Chairperson & members of the Board of Studies met on 16-11-2019 at 10 AM in the Department of Microbiology Room No. 72 and discussed the following agenda:

❖ **Agenda:**

The members present were discussed various aspects of the Syllabus, model question papers of both Theory and Practicals for three year B.Sc., Degree Programme in Microbiology and also various pedagogic methods that are to be implemented for the academic year 2019-2020 the following are the agenda points.

- i. Introduction of new courses and cluster papers for III year students
- ii. Model question papers & blue prints
- iii. Panel of paper setters
- iv. Continuation of old SEE: CIA evaluation
- v. Additional inputs in the curriculum
- vi. Proposal for extension activities benefit of the society / field trips/ industrial visits/ projects for the students
- vii. Study projects III B.Sc MZC / Internships for III B.Sc MZC-Food
- viii. Skill training for III B.Sc students
- ix. Any other proposal with the permission of the chair.

Resolutions:-

Agenda point 1: Introduction of 3 new cluster courses for III B.Sc MZC-Food program

Discussion: The members of BOS discussed the entire syllabus of 3 new courses introduced and given their valuable suggestions for cluster papers of III B.Sc MZC Food.

Resolution 1:

- It is resolved to approve introduction of 3 new courses for 3 cluster papers of III B.Sc MZC-Food program (admitted batch 2017-18)

Agenda point 2: Model question papers & blue prints

Discussion: The members of BOS discussed the Model question papers for both theory and Practicals.

Resolution 2:

- It is resolved to follow the old pattern of question paper model for II & III B.Sc students.

Agenda point 3: Panel of paper setters & examiners

Discussion: The members of BOS discussed Panel of paper setters & examiners

Resolution 3:

- It is resolved to approve the list of examiners & paper setters enclosed (Pg. No.09) for the year 2019-2020.

Agenda point 4: SEE: CIA evaluation

Discussion: The members present discussed the SEE: CIA evaluation and ratified the same.

Resolution 4:

- Ratification of old Pattern of 50:50 CIA &SEE evaluation for I year (admitted batch 2019-20).
- Resolved to follow the same old pattern of 60:40 SEE & CIA for II & III years.

Agenda point 5: Additional inputs in the curriculum

Discussion: The members present discussed the Additional inputs in the curriculum

Resolution 5: It is resolved to approve the additional inputs included in the curriculum

Agenda point 6: Proposal for extension activities - benefit of the society / field trips/ industrial visits/ projects for the students.

Discussion: The members present discussed about the extension activities - benefit of the society / field trips/ industrial visits/ projects for the students.

Resolution 6: It is resolved to approve the tentative plan of extension activities (Pg. No. 35) of the department

Agenda point 7: Student projectsfor III B.Sc MZC / Internships for for III B.Sc MZC Food

Discussion: The members present discussed about Internship of III year students.

Resolution 7: It is resolved and approved the same.

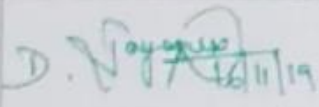
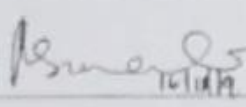
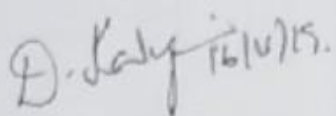
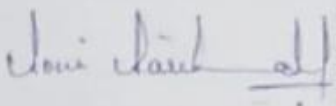

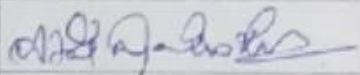
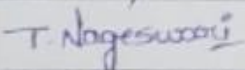
Agenda point 8: Skill training for III B.Sc students

Resolution 8: It is resolved and approved the same.

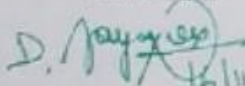
Agenda point 9: Ratification of CO/PO final attainment for 2016 – 19 academic batch

Resolution 9: it is resolved to ratify the CO – PO mapping (final attainment) for 2016 – 19 batch.

Agenda point 10: Any other proposal with the permission of the chairman

S.no	Name	signature
1.	Chairman : Smt.D.Jayasree Head of the Department of Microbiology, GC (A) – Rajamahendravaram.	 16/11/19
2.	Faculty member : Smt P.Suneeta Lecturer in Microbiology	 16/11/19
3.	Subject expert : Dr.K.Aruna Head-Dept of Microbiology ASD Govt.College (W), Kakinada.	
4.	University nominee : Dr.D.Kalyani department of Zoology, Adikavi Nannaya University	 16/11/19.
5.	Local nominee / Subject expert : Dr.M.Soni sarika Head-Dept of Microbiology All-Ameer Degree & PG College, Rajahmundry	 16/11/19
6.	Industrial nominee : Sri N.Srinivas Manager, Coca-cola, Sri sarvaraya Sugars, Bheemadolu.	
7.	Student nominee : Mr. A. Hari Naga Paparao	
8.	Student member : Miss Nageswari	 T. Nageswari

Rajahmundry
Date:

Chairman

16/11/19

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
DEPARTMENT OF MICROBIOLOGY
BOS MEETING 2019-20

List of Examiners/Paper Setters:

S.No	Name of theCollege	Place
1	DNR College	Bhimavaram
2	YN College	Narsapur
3	CRR College	Eluru
4	VS Laxmi College	Kakinada
5	St.Theresasa College	Eluru
6	KGRL College	Bhimavaram
7	PRG College	Kakinada
8	ASD Govt .college	Kakinada
9	Govt. College	Palakol

Members

Chairman

BOS

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**I BSC: MICROBIOLOGY (2019 – 20)****II Semester Syllabus****MBY – 112: MICROBIAL BIOCHEMISTRY & METABOLISM****UNIT-I:****No. of hours: 10 Hrs**

- Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).
- General characteristics of amino acids and proteins.
- Structure of nitrogenous bases, nucleotides, nucleic acids.
- Fatty acids (saturated and unsaturated)
- Lipids (spingolipds, sterols and phospholipids).

UNIT-II:**No. of hours: 8 Hrs**

- Principle and applications of Colorimerty, Chromatography (paper, thin-layer and column),Spectrophotometry(UV & visible), Centrifugation and Gel Electrophoresis.

UNIT-III:**No. of hours:10 Hrs**

- Properties and classification of Enzymes.
- Biocatalysis- induced fit and lock and key models.
- Coenzymes and Cofactors.
- Factors affecting catalytic activity.
- Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV:**No. of hours:10 Hrs**

- Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.
- Nutritional groups of microorganisms- autotrophs, heterotrophs, and mixotrophs.
- Growth media- synthetic, complex, selective, enrichment and differential media.
- Microbial Growth- different phases of growth in batch cultures, Synchronous, continuous, biphasic growth.
- Factors influencing microbial growth.
- Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT-V:**No. of hours:10 Hrs**

- Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation.
- Anaerobic respiration (Nitrate).
- Fermentation - Alcohol and lactic acid fermentations.
- Outlines of oxygenic and an oxygenic photosynthesis in bacteria.

Model Question Paper (Theory)**Semester II: Microbial Biochemistry & Metabolism (Mar/Apr 2020)****Time: 3Hrs****Max.Marks:50****Part-A**

Note: Answer ALL questions

4x10 = 40M

1. a) Outline classification and general characteristics of carbohydrates?
(or)
b) Explain the Structure of nitrogenous bases, nucleotides?
2. a) Write about Principle and applications of Chromatography (paper, thin-layer)
(or)
b) Write about Principle and applications of Colorimetry?
3. a) Explain in detailed about Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric?(or)

b) Write about Biocatalysis models - induced fit and lock and key models?
4. a) Write an essay on Nutritional groups of microorganisms- autotrophs, heterotrophs, and mixotrophs?
(or)

b) Give a detailed account on Outlines of oxygenic and an oxygenic photosynthesis in bacteria?

Part-B

Answer any TWO questions. All carry equal marks

2x5=10M

5. Saturated fatty acids
6. Centrifugation
7. Coenzymes.
8. Turbidometry.
9. TCA Cycle

PRACTICAL SYLLABUS
MBY – 112: MICROBIAL BIOCHEMISTRY & METABOLISM
SEMESTER – II PRACTICALS

1. Colorimetric estimation DNA by diphenylamine method
2. Colorimetric estimation of proteins by Biuret/Lowry method.
3. Paper chromatographic separation of sugars and amino acids.
4. Preparation of different media- Synthetic and Complex Media.
5. Setting and observation of Winogradsky column.
6. Estimation of CFU count by spread plate method/pour plate method.
7. Bacterial growth curve.
8. Factors affecting bacterial growth – PH.
9. Factors affecting bacterial growth – Temperature.
10. Factors affecting bacterial growth –Salts.

SUGGESTED READINGS

1. Berg JM, Tymoczko JL and Stryer L (2011) **Biochemistry**, W.H.Freeman and Company
2. Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.
3. Campbell, PN and Smith AD (2011) **Biochemistry Illustrated**, 4th ed., Published by Churchill Livingstone
4. Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2 nd Edition, Oxford University Press, U.S.A.
5. Gottschalk, G. (1986). **Bacterial Metabolism**, SpringerVerlag, New York.
6. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
7. Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.
8. Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, John Wiley, New York.
9. Nelson DL and Cox MM (2008) Lehninger **Principles of Biochemistry**, 5th Edition. W.H. Freeman and Company.
10. Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology**. 5th Edition, WCB Mc Graw Hill, New York.
11. Reddy, S.R. and Reddy, S.M. (2004). **Microbial Physiology**, Scientific Publishers, Jodhpur, India.
12. Sashidhara Rao, B.and Deshpande, V. (2007). **Experimental Biochemistry: A student Companion**. I.K. International Pvt. Ltd.
13. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed.Prentice Hall of India Pvt. Ltd., New Delhi.
14. Tymoczko JL, Berg JM and Stryer L (2012) **Biochemistry: A short course**, 2nd ed. W.H.Freeman
15. Voet, D. and Voet J.G (2004) **Biochemistry** 3rd edition, John Wiley and Sons

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM**I B.Sc: MICROBIOLOGY – SEMESTER- II****Practical Model Paper (2019-20)**

Time: 3 hrs

Max.Marks:50

1. Major Experiment	15 Marks
2. Minor Experiment	10 Marks
3. Spotting (5 Nos)	15 Marks
4. Record & Viva	10 Marks

Total	50 Marks

GOVT.COLLEGE (A), RAJAHMUNDRY
CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2019 – 20)
II B.Sc MICROBIAL BIOCHEMISTRY AND METABOLISM
BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	1	25
Unit III	2	1	15
Unit IV	1	1	15
Unit V	1	1	15
Total no. of questions	8	5	
Total marks including choice			95

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II BSC: MICROBIOLOGY Semester – 4, Syllabus (2019-20)****MBY 116: IMMUNOLOGY AND MEDICAL MICROBIOLOGY****UNIT – I:****No. of hours: 10**

- Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.
- Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes.
- Cells of immune system.
- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

UNIT – II:**No. of hours: 10**

- Antigens – types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity.
- Antibodies – basic structure, types, properties and functions of immunoglobulins.
- Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.
- Labeled antibody based techniques – ELISA, RIA and Immunofluorescence.
- Monoclonal antibodies – production and applications.
- Concept of hypersensitivity and Autoimmunity.

UNIT – III:**No. of hours:10**

- Normal flora of human body.
- Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection, General account on nosocomial infection.
- General principles of diagnostic microbiology- collection, transport and processing of clinical samples.
- General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT – IV:**No. of hours : 10**

- Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
- Antifungal agents – Amphotericin B, Griseofulvin
- Antiviral substances - Amantadine and Acyclovir
- Tests for antimicrobial susceptibility.
- Brief account on antibiotic resistance in bacteria - Methicillin-resistant *Staphylococcus aureus* (MRSA).
- Vaccines – Natural and recombinant

UNIT – V:**No. of hours : 10**

- General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control
- Bacterial diseases – Tuberculosis and Typhoid.
- Fungal diseases – Candidiasis.
- Protozoal diseases – Malaria.
- Viral Diseases - Hepatitis- A and AIDS.

Text and reference books:

- Abbas AK, Lichtman AH, Pillai S. (2007). **Cellular and Molecular Immunology**. 6th edition Saunders Publication, Philadelphia.
- Ananthanarayan R. and Paniker C.K.J. (2009) **Textbook of Microbiology**. 8th edition, University Press Publication
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Publication
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's **Essential Immunology**. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
- Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.
- Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II BSC; MICROBIOLOGY****Paper-II: Immunology and medical microbiology****4th Semester Model Question Paper (Mar/Apr-2020)****Time: 3hrs****Max Marks = 60****PART-A**

Answer FOUR of the following:

4x10=40 M

1. a. Explain types of immunity?
(or)
b. Write notes on cells of immune system and their functions?
2. a. Write in detail about types of antigens and factors effecting antigenicity?
(or)
b. Write notes on antigen and antibody interactions?
3. a. Discuss in detail about collection and transport of clinical samples?
(or)
b. Write In detail about methods of laboratory diagnosis of microbial infections?
4. a. Write in detail about mechanism of action of anti bacterial agents?
(or)
b. explain about the following.
 - i) Tuberculosis
 - ii) Hepatitis - A

PART-B

Answer any FIVE of the following:

5 X 4 = 20 Marks

5. Secondary organs of immune system.
6. Macrophage
7. ELISA
8. Monoclonal antibodies.
9. Autoimmunity.
10. Normal flora of human body.
11. Antiviral substances.
12. Vaccines.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II BSC; MICROBIOLOGY- SEMESTER-IV****PAPER-II: Immunology and medical microbiology****Practical Syllabus (2019-20)**

1. Identification of human blood groups.
2. Separate serum from blood sample (demonstration).
3. Estimation of blood hemoglobin.
4. Total leukocyte count of the given blood sample.
5. Differential Leukocyte Count of the given blood sample.
6. Immunodiffusion by Ouchterlony method.
7. Identify bacteria (E.coli, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests.
8. Isolation of bacterial flora of skin by swab method.
9. Antibacterial sensitivity by Kirby-Bauer method.
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, Chicken pox, HPV warts, Dermatomycoses (ring worms).
11. Study of various stages of malarial parasite in RBCs using permanent mounts.

REFERENCE BOOKS FOR LAB:

- Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' **Medical Microbiology**. 4th edition. Elsevier
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM**II B Sc: MICROBIOLOGY- SEMESTER - IV****Paper-II – Immunology and medical microbiology****Practical Model Paper (2019-20)**

Time: 3 hrs

Max.Marks:50

1. Major Experiment	15 Marks
2. Minor Experiment	10 Marks
3. Spotting (5 Nos)	15 Marks
4. Record & Viva	10 Marks

Total

50 Marks

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM (2019 – 20)

IMMUNOLOGY AND MEDICAL MICROBIOLOGY**BLUE PRINT FOR QUESTION PAPER SETTER**

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	2	30
Unit III	2	2	30
Unit IV	1	2	20
Unit V	1	1	15
Total no. of questions	8	8	
Total marks including choice			120

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****VI- SEMESTER -PAPER-VII (Elective – 1)****MBY - 127: MICROBIAL BIOTECHNOLOGY****CREDITS: 3****UNIT- I****No. of Hours: 10**

- Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.
- Genetically engineered microbes for industrial application: Bacteria and yeast

UNIT- II**No. of Hours: 10**

- Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine).
- Over view of production and applications of Microbial polysaccharides, Bioplastics and Microbial biosensors

UNIT- III**No. of Hours: 10**

- Microbial based transformation of steroids and sterols.
- Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.
- Immobilization methods and their application: Whole cell immobilization

UNIT- IV**No. of Hours: 7**

- Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass.
- Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics.
- Mineral recovery, removal of heavy metals from aqueous effluents.

UNIT- V**No. of Hours: 4**

- Outlines of Intellectual Property Rights: Patents, Copyrights, Trademarks

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**B.Sc MICROBIOLOGY (CBCS) SYLLABUS****MBY - 127: MICROBIAL BIOTECHNOLOGY****Model Question Paper****Time: 3Hrs****Section – A****Max.Marks:60****ANSWER ANY FIVE OF THE FOLLOWING****4 x 10=40 marks****Draw labeled diagrams wherever necessary**

1. a) Discuss applications of microbial biotechnology?
(or)
b) Industrial applications of genetically engineered microbes?
2. a) Write production process of recombinant Hepatitis B vaccine?
(or)
b) Explain production process and applications of microbial polysaccharides and bioplastics?
3. a) Describe immobilization methods and applications?
(or)
b) Explain microbial based transformation of steroids?
4. a) Explain in bio-diesel production?
(or)
b) Out lines of intellectual property rights for copyrights and trademarks?

Section B**Answer any five of the following****5x4=20 marks**

1. Biofertilizer
2. Streptokinase
3. Biosensors
4. Whole cell immobilization
5. Xenobiotics
6. Patents
7. Bio ethanol
8. Bioplastics

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**III BSC; MICROBIOLOGY- SEMESTER-V****MICROBIAL BIOTECHNOLOGY****Practical Syllabus (2019-20)****TOTAL HOURS: 36****CREDITS: 2**

1. Yeast cell immobilization in calcium alginate gels
2. Enzyme immobilization by sodium alginate method
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins

SUGGESTED READING

1. Crueger W, Crueger A (1990) **Biotechnology: A text Book of Industrial Microbiology** 2nd edition Sinauer associates, Inc.
2. Demain, A. L and Davies, J. E. (1999). **Manual of Industrial Microbiology and Biotechnology**, 2nd Edition, ASM Press.
3. Glazer AN and Nikaido H (2007) **Microbial Biotechnology**, 2nd edition, Cambridge University Press Glick BR, Pasternak JJ, and Patten CL (2010) **Molecular Biotechnology** 4th edition, ASM Press Gupta PK (2009) **Elements of Biotechnology** 2nd edition, Rastogi Publications
4. Prescott, Harley and Klein's **Microbiology** by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.
5. Ratledge, C and Kristiansen, B. (2001). **Basic Biotechnology**, 2nd Edition, Cambridge University Press.
6. Stanbury PF, Whitaker A, Hall SJ (1995) **Principles of Fermentation Technology** 2nd edition., Elsevier Science
7. Swartz, J. R. (2001). **Advances in Escherichia coli production of therapeutic proteins. CurrentOpinion in Biotechnology**, 12, 195–201.

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM**III B Sc: MICROBIOLOGY (2019-20)****Practical Model Paper (Elective)**

Time : 3 hrs

Max.Marks:50

1. Major Experiment	15 Marks
2. Minor Experiment	10 Marks
3. Spotting (5 Nos)	15 Marks
4. Record & Viva	10 Marks

Total

50 Marks

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

ELECTIVE-MICROBIAL BIOTECHNOLOGY**BLUE PRINT FOR QUESTION PAPER SETTER**

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	2	30
Unit III	2	2	30
Unit IV	1	2	20
Unit V	1	1	15
Total no. of questions	8	8	
Total marks including choice			110

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
VI- SEMESTER – PAPER-VII (Elective – 2)
MBY – 128: ADVANCES IN MICROBIOLOGY

TOTAL HOURS: 36

CREDITS:3

UNIT- I

No. of Hours:8

- Salient features of sequenced microbial genomes, core genome pool, flexible Genome pool and concept of Pangenome. Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics.

UNIT- II

No. of Hours: 8

- Brief history and development of Metagenomics. Understanding bacterial Diversity using Metagenomics approach. Prospecting genes of biotechnological Importance using Metagenomics. Basic knowledge of viral metagenome, Metatranscriptomics, metaproteomics and metabolomics

UNIT- III

No. of Hours: 8

- Epiphytic fitness and its mechanism in plant pathogens. Hypersensitive Response (HR) to plant pathogens and its mechanism. Type three secretion Systems (TTSS) of plant and animal pathogens.

UNIT - IV

No. of Hours: 5

- Biofilms: Types of microorganisms, molecular aspects and significance in Environment, health care, virulence and antimicrobial resistance

UNIT.V

No. of Hours: 7

- Networking in biological systems, Quorum sensing in bacteria. Co-ordinated Regulation of bacterial virulence factors. Basics of synthesis of poliovirus in Laboratory. Future implications of synthetic biology with respect to bacteria And viruses.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**B.Sc MICROBIOLOGY (CBCS) SYLLABUS****MBY – 128: ADVANCES IN MICROBIOLOGY****Model Question Paper**

Time: 3 hours

Maximum: 60marks

SECTION - A

Answer ALL of the following questions

4 x 10 = 40marks

Draw neat and labeled diagrams wherever necessary

1. a) Discuss about Salient features of Sequenced microbial genomes.

(or)

b) Write about the Characteristics of Genomic islands and Pathogenicity islands.

2. a) Describe Brief history and development of Metagenomics.

(or)

b) Give an account on basic knowledge of metatranscriptomics and metaproteomics.

3. a) What is Epiphytic fitness and Discuss its mechanism in plant pathogens.

(or)

b) Explain the mechanism of Hypersensitive response to plant pathogens.

4. a) Write about the Significance of Biofilms in environment.

(or)

b) Discuss about Basics of Synthesis of poliovirus in laboratory.

SECTION - B

Answer any FIVE of the following questions

5 x 4 = 20marks

Draw neat and labeled diagrams wherever necessary

1. Quorum Sensing

2. Viral metagenome

3. TTSS

4. Virulence

5. Biofilms

6. Pangenome

7. Metabolomics

8. Antimicrobial resistance

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III BSC; MICROBIOLOGY- SEMESTER-VI

MBY – 128: ADVANCES IN MICROBIOLOGY

Practical Syllabus (2019-20)

TOTALHOURS:36

CREDITS:2

1. Extraction of metagenomic DNA from soil
2. To understand the impediments in extracting metagenomic DNA from soil
3. PCR amplification of metagenomic DNA using universal 16s ribosomal gene primers
4. Case study to understand how the poliovirus genome was synthesized in the laboratory
5. S. Case study to understand how networking of metabolic pathways in bacteria takes place

SUGGESTED READING :

1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press
2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004, ASM Press
3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press.
4. Sangdun C. Introduction to Systems Biology, 2007, Humana Press
5. Klipp E, Liebermeister W. Systems Biology - A Textbook, 2009, Wiley - VCH Verlag
6. Caetano-Anolles G. Evolutionary Genomics and Systems Biology, 2010, John Wiley and Sons
7. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms, 14th edition, Pearson-Benjamin Cummings
8. Wilson BA, Salyers AA, Whitt DD and Winkler ME (2011) Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,
9. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International.
9. Voit Eo (2012) A First Course in Systems Biology, 1st edition, Garland Science

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

VI – SEMESTER, CLUSTER PAPERS UNDER ELECTIVE (8A1, 8A2 & 8A3)

MBY -119: 8A1 - DIAGNOSTIC MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of hours: 8

- Study of Bacteria (Tuberculosis and Typhoid) Viral (Influenza and HIV) Fungal (Aspergillosis and Candidiasis) and Protozoan Malaria and Amebiasis) Diseases affecting humans.

UNIT- II

No. of hours: 8

- Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and faeces) and precautions required.
- Method of transport of clinical samples to laboratory and storage.

UNIT- III

No. of hours: 8

- Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria
- Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, distinct colony properties of various bacterial pathogens.

UNIT- IV

No. of hours: 6

- Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.
- Typhoid, Dengue and HIV, Swine flu.

UNIT- V

No. of hours: 6

- Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

THIRD YEAR – VI SEMESTER

8A1 - DIAGNOSTIC MICROBIOLOGY

Model Question Paper

Time: 3Hrs

Section – A

Max.Marks: 60

Answer Any Five of The Following

4 x 10=40 marks

Draw labeled diagrams wherever necessary

1. a) What is tuberculosis? Describe the characters of the causal agent and discuss the pathogenesis of the disease?
(or)
b) Describe the causal agent, laboratory diagnosis, and prevention and treatment of influenza?
2. a) Describe the various methods used to collect samples?
(or)
b) Describe various methods of transport of clinical samples to laboratory and storage?
3. a) Write Grams staining and Giemsa-staining techniques for examination of clinical samples
(or)
b) Write composition and preparation of culture media for identification of pathogens?
4. a) Explain serological methods for identification of pathogens?
(or)
b) Give a concise account of disk diffusion tests for antimicrobial drug susceptibility?

Section B

Answer any five of the following

5x4=20 marks

1. Aspergillosis
2. Malaria
3. Transport media
4. Ziehl-Neelson staining
5. Lowenstein-Jensen media
6. ELISA
7. Dengue
8. MIC

**MBY -119: 8A1 - DIAGNOSTIC MICROBIOLOGY
PRACTICALS**

TOTAL HOURS: 36 CREDITS: 2

1. Collection transport and processing of any one of the following clinical specimens (Blood/ Urine/ Stool/Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
2. Isolation of bacteria in pure culture and Antibiotic sensitivity.
3. Identification of common bacteria (E.coli, Staphylococcus aureus and Streptococcus sps) by studying their morphology, cultural character, Biochemical reactions, and other tests.
4. Maintenance and preservation of stock culture.

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009) **Textbook of Microbiology**, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Publication
3. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney **Practical Medical Microbiology**, 14th edition, Elsevier.
4. Randhawa, VS, Mehta G and Sharma KB (2009) **Practicals and Viva in Medical Microbiology** 2nd edition, Elsevier India Pvt Ltd
5. Tille P (2013) Bailey's and Scott's **Diagnostic Microbiology**, 13th edition, Mosby

GOVT.COLLEGE (A), RAJAHMUNDRY
CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

CLUSTER A1: DIAGNOSTIC MICROBIOLOGY

BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	1	25
Unit III	2	1	25
Unit IV	1	1	15
Unit V	1	1	15
Total no. of questions	8	5	
Total marks including choice			105

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****6th - SEMESTER****8A2- INSTRUMENTATION AND BIOTECHNIQUES****TOTAL HOURS: 36****CREDITS: 3****UNIT-I****No. of Hours: 6**

- Bright field and dark field microscopy. Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy and Micrometry

UNIT – II**No. of Hours: 8**

- Principles and applications of paper chromatography (including Descending and 2D), Column packing and fraction collection. Gel filtration
- chromatography, ion-exchange chromatography' GLC and HPLC'

UNIT-III**No. of Hours: 8**

- Principle and applications of native polyacrylamide gel electrophoresis, SDS polyacrylamide gel electrophoresis, 2D gel electrophoresis and Iso electric focusing.

UNIT- IV**No. ofHours:5**

- Principle and applications of study of absorption Spectra of bimolecular.
- Analysis of bimolecular using UV and visible range Turbidometry.

UNIT- V**No. of Hours: 8**

- Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation'

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – 6th SEMESTER
8A2: INSTRUMENTATION AND BIOTECHNIQUES

Model Question Paper

Time: 3 Hrs

Maximum: 60 Marks

Section - A

Answer Any Five of the Following (4 x 10 = 40marks)

Draw neat and labeled diagrams wherever necessary

1. a) Write an essay on phase contrast microscopy.
(or)
b) Explain Micrometry.
2. a) Write about principles and applications of paper Chromatography.
(or)
b) Describe Gel filtration chromatography and ion exchange chromatography.
3. a) Explain details about SDS-PAGE.
(or)
b) Write about principle and applications of native polyacrylamide gel Electrophoresis.
4. a) Write principle and applications of study of absorption spectra of biomolecules.
(or)
b) Discuss about Ultracentrifugation and density gradient centrifugation.

Section - B

Answer any FIVE of the following questions (5 x 4 = 20marks)

1. 2D gel Electrophoresis
2. Immunofluorescence
3. GLC
4. Confocal microscopy
5. RCF
6. Isoelectric focusing
7. Turbidometry
8. HPLC

8A2 - INSTRUMENTATION AND BIOTECHNIQUES PRACTICALS

TOTAL HOURS: 36 CREDITS:2

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Ray diagrams of phase contrast microscopy and Electron microscopy.
3. Separation of mixtures by paper / thin layer chromatograph.
4. Demonstration of column packing in any form of column chromatography.
5. Separation of protein mixtures by any form of chromatography.
6. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis(PAGE).
7. Determination of lambda max for an unknown sample and calculation of extinction coefficient.
8. Separation of components of a given mixture using a laboratory scale centrifuge.
9. Understanding density gradient centrifugation with the help of pictures.

SUGGESTED READING

1. Nelson DL and Cox MM' (2008). Lehninger Principles of Biochemistry, 5e Ed., W.H. Freeman and Company'
1. Willey MJ, Sherwood LM & Woolverton C J' (2013)' Prescott' Harley and Klein's Microbiology 8th Ed' McGraw Hill'
2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments' 6th edition. John Wiley & Sons' Inc'
3. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology 8th edition. Lipincott Williams and Wilkins, Philadelphia.
4. Cooper G.M. and Hausman R'E' (2009)' The Cell: A Molecular Approach' 8th Edition. ASM Press Associates, MA. & Sunderland, Washington D'C', Sinauer

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

CLUSTER A2: MICROBIAL INSTRUMENTATION AND BIOTECHNIQUES

BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	1	25
Unit III	2	1	25
Unit IV	1	1	15
Unit V	1	1	15
Total no. of questions	8	5	
Total marks including choice			105

Note:
The question paper setters are requested

d to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****VI - SEMESTER PAPER****MBY -121: 8A3 -BIOFERTILIZERS AND BIOPESTICIDES****TOTAL HOURS: 36****CREDITS: 3****UNIT – I****No of Hours: 10**

- General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.
- Symbiotic N₂ fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants
- Frankia from non-legumes and characterization.
- Cyanobacteria and Azolla, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

UNIT – II**No of Hours: 6**

- Free living Azospirillum, Azotobacter - isolation, characteristics, mass inoculum production and field application.

UNIT – III**No of Hours: 6**

- Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application

UNIT – IV**No of Hours: 7**

- Importance of mycorrhizal inoculum, types of Mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

UNIT – V**No of Hours: 7**

- General account of microbes used as bioinsecticides and their advantages over synthetic pesticides. Bacillusthuringiensis- production, Field applications.
- Viruses – NPV cultivation and field applications.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY VI -SEMESTER (CBCS) SYLLABUS

8A3 -BIOFERTILIZERS AND BIOPESTICIDES

Model Question Paper

Time: 3Hrs

Section – A

Max.Marks: 60

Answer Any Five of The Following

4 x 10=40 marks

Draw labeled diagrams wherever necessary

1. a) Write an account on microbes used as biofertilizers for various crops and their advantages over chemical fertilizers?
(or)
- b) Describe mass multiplication of cyanobacteria and field application in rice cultivation?
2. a) Explain Isolation mass multiplication of *Azospirillum* and field application?
(or)
- b) Describe isolation, mass multiplication field application of Azatobacter?
3. a) Describe isolation, mass multiplication field application of phosphate solubilizing microbes?(or)
- b) List out various phosphate solubilizing microbes and its importance?
- 4.a) Explain various types of mycorrhizae?
 (or)
- b) How NPV cultivated and its applications in field?

Section B

Answer any five of the following

5x4=20marks

1. Rhizobium
2. Frankia
3. Azolla
4. Bioinsecticides
5. Ectomycorrhizae
6. Biofertilizers
7. Sedarophores
8. Cyanobacteria

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

CLUSTER A3: BIOFERTILIZERS AND BIOPESTICIDES

BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	1	25
Unit II	2	1	25
Unit III	2	1	25
Unit IV	1	1	15
Unit V	1	1	15
Total no. of questions	8	5	
Total marks including choice			105

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

6th- SEMESTER CLUSTER B (8B1, 8B2 & 8B3)

MBY -120: 8B1 - Microbes in Sustainable Agriculture

TOTALHOURS: 36

CREDITS: 3

UNIT – I:

No of Hours 8

- Soil as Microbial Habitat, soil properties. Diversity and distribution of Microorganisms in soil. Mineralization of cellulose, hemicelluloses, lignin, Phosphate, nitrate.

UNIT - II:

No of Hours 6

- Carbon dioxide, methane, nitrous oxide, nitric oxide -production and control

UNIT – III:

No of hours 6

- Biocontrol mechanisms - Microorganisms used as Biocontrol agents against Microbial plant pathogens, Insects, Weeds.

UNIT - IV:

No of Hours: 8

- plant growth promoting bacteria, biofertilizers - symbiotic (Bradirhizobium, Rhizobium, Frankia), Non symbiotic (Azospirillum, Azotobacter, Mycorrhizae, MHBs, phosphate solubilizers, algae).
- Novel combination of microbes as biofertilizers, PGPRs

UNIT – V:

No of Hours: 8

- Biotech feed, silage, Biomanure, biogas, biofuels - advantages and processing parameters. Advantages,
- Social and environmental aspects of GM crops, BT crops, golden rice, transgenic animals.

**8B1 - MICROBES IN SUSTAINABLE AGRICULTURE
PRACTICALS**

TOTALHOURS: 36

CREDITS: 2

1. Study of soil Profile.
2. Study of micro flora of different types of soils.
3. Rhizobium as soil inoculants characteristics and field application.
4. Azotobacter as soil inoculants characteristics and field application.
5. Design and functioning of a biogas plant.
6. Isolation of cellulose degrading organisms.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
VI – SEMESTER – PAPER 8B
MBY – 129: 8B2 - MUSHROOM CULTTIVATION

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No of Hours: 8

- History and scope of mushroom cultivation. Types of edible mushrooms available in India. Mushroom morphology. Different parts of a typical Mushroom & variations in mushroom morphology. Button, Paddy straw & Oyster- General Morphology, distinguishing characteristics.

UNIT - II

No of Hours: 6

- Classification Based on occurrence, natural habitats, color of spores, Morphology of fruiting layers, Structure and texture of fruiting bodies. Key to Differentiate edible from Poisonous mushrooms. Economic importance of edible Mushrooms.

UNIT - III

No of Hours: 10

- Cultivation of Button, Oyster and Paddy straw Mushrooms: Collection of raw Materials, compost & composting, spawn & spawning, casing & case run, Cropping, picking & packing, marketing.

UNIT – IV

No of Hours: 6

- Nutritional profile of mushrooms, health benefits of mushrooms. Mushroom Toxins and illness, mushroom recipes.

UNIT - V

No of Hours: 6

- Effect of physical and chemical factors on the growth of mushrooms. Crop Management during spawn running, casing to mushroom period, the cropping Period. Post harvest management.

8B2 - MUSHROOM CULTIVATION**PRACTICALS****TOTAL HOURS: 36****CREDITS: 2**

1. Microscopic and anatomical observations of different mushroom species. .
2. Preparation of spawn under controlled conditions (preparation of mother Spawn in saline bottle and polypropylene bag and their multiplication
3. Types of Compost preparation and sterilization.
4. Mushroom bed preparation - paddy straw, sugarcane trash, maize Straw, banana leaves/waste.
5. Spawning, casing, Cropping and harvesting.
6. Substrate preparation, bed preparation, spawning and cropping.
7. Diseases of mushrooms (photographs).
8. Visit to relevant Labs/Field Visits

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
MBY – 131: 8B3: MANAGEMENT OF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No.of hours:7

- Introduction to human microbial diseases caused by bacteria, virus, fungi and protozoa. Definition and concept of health, disease, infection, and pathogen. Types of human microbial diseases and their transmission, causative agents and symptoms of human microbial diseases.

UNIT – II

- General account of epidemiology: principles of epidemiology, current epidemics (AIDS, nosocomial, acute respiratory syndromes). Measures for prevention of epidemic – global health consideration, emerging and re-emerging infectious diseases. Biological warfare and Biological weapons.

UNIT – III

- Over view of diseases caused by virus – AIDS, Hepatitis, Influenza, Rabies, Chikengunya and Polio, poxvirus, herpes virus, chicken pox virus – history, causative agent, pathogenesis, diagnosis, drugs and inhibitors.

UNIT – IV

- Harmful microbial interaction: human entry of pathogens into the host, types of bacterial pathogens, mechanism of bacterial pathogenicity, colonization and growth, virulence, virulence factors, exotoxins, enterotoxins, endotoxins, neurotoxins – avoidance of host defense mechanisms, damage to host cell, host factors for infection & innate resistance to infection.

UNIT – V

- Laboratory diagnosis of Common infective syndromes and parasitic manifestations; Methods of transmission and role of vectors- biology of vectors. (1) House fly (2) Mosquitoes (3) sand fly. Need and significance of epidemiological studies.

Epidemiological investigations to identify a disease, Problems of drug resistance and drug sensitivity. Drug resistance in bacteria.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

6th - SEMESTER PAPER

MBY- 132 - 8C1 Biostatistics and Bioinformatics

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No.of hours: 7

- Definition, nature and scope of bioinformatics. Bioinformatics versus computational biology. Branches of bioinformatics. Basic concepts in bioinformatics.

UNIT – II

No.of hours: 7

- Biostatistics: probability and distribution. Poisson and binomial distributions. Measurement of central tendency (mean, mode and range) and dispersion (standard error and standard deviation).

UNIT – III

No.of hours: 7

- Computational phylogenetics – various applications. Phylip software. Microarray, Bioinformatics – Experimental design & Over view of data analysis.

UNIT – IV

No.of hours: 8

- Basic concepts of system biology. Over view of computer aided drug design. Searching sequence database using BLAST. Concept of genomics and proteomics.

UNIT – V

No.of hours: 7

- Population and sampling test of significance. Student t-test for small samples. Chi² test for analysis, correlation and regression. Computer applications in Biotechnology.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY****Practical Model Paper****TOTAL HOURS: 36****CREDITS: 2**

1. Isolation of plasmid DNA from *E.coli* cells
2. Quantitative and qualitative analysis of proteins / DNA by using spectrophotometer.
3. Demonstration of Southern hybridization
4. Demonstration of amplification DNA by PCR.
5. Use of software for sequence analysis of nucleotides and proteins.
6. Problem related to t – test and χ^2 test.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****6th - SEMESTER PAPER****MBY – 133 - 8C 2 Bio safety and Intellectual property right****TOTAL HOURS: 36****CREDITS: 3****UNIT – I****No.of hours: 7**

- Introduction: general introduction to IPR (parent, plant breeder's right). Trademarks, industrial design, trade secrets (or) undisclosed information integrated circuit designs.

UNIT – II**No.of hours: 7**

- Patenting principle, international – standards and patent validity (neem and relaxins), recent developments in patent system and patentability of biotechnology, invention IPR issues of the Indian context.

UNIT – III**No.of hours: 7**

- Biotechnology and hunger: challenges for the Indian biotechnological research and industries. Bio safety: the Cartagena protocol on bio safety.

UNIT – IV**No.of hours: 7**

- Bio safety management: key to the environmentally responsible use of biotechnology, ethical implications of biotechnology product techniques, social and ethical implications of biological weapons

UNIT – V**No.of hours: 7**

- Copy right and rights related to copy right, patent claims, the legal decision – making process.
- International standards as per WHO, ISI, bio safety and validation. International organization agencies and treaties.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY

Practical Syllabus

TOTAL HOURS: 36

CREDITS: 2

1. Study of components and design of a BSL – III laboratory
2. Filing applications for approval from bio safety committee
3. Filing primary applications for patents
4. Study of steps of patenting process
5. A case study of patent.
6. Study of bio safety measures in pharmaceutical industry.
7. Study on QA & QC parameters followed in R&D laboratory.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****6th - SEMESTER PAPER****MBT- 134 - 8C3 DRUG DESIGN AND DISCOVERY****TOTAL HOURS: 36****CREDITS: 3****Unit – I****No.of Hours: 7**

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products of microbial origin (antibiotics) animal origin (sex hormones), plant origin (Alkaloids & Morphine).

Unit – II**No.of Hours: 7**

Sources of Drugs- Microbial drugs, Plants as a source of drugs, E. coli as a source of recombinant therapeutic proteins. Expression of recombinant proteins in yeasts, animal cell culture systems.. Rational drug design and Combinatorial approaches to drug discovery

Unit – III**No.of Hours: 7**

Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics. Drug manufacturing process- Guides to good manufacturing practice.

Unit – IV**No.of Hours: 8**

Vaccines and adjuvant- Traditional vaccine preparations, attenuated, dead or inactivated bacteria, Attenuated and inactivated viral vaccines, Toxoids, antigen-based and other vaccine preparations. Impact of genetic engineering on vaccine technology. Peptide vaccines and vaccine vectors. Adjuvant technology: Adjuvant mode of action.

Unit – V**No.of Hours: 7**

Nucleic acid as drugs- Gene therapy: Basic approach to gene therapy, Vectors used in gene therapy -Retroviral vectors, Additional viral-based vectors, Manufacture of viral vectors, Non-viral vectors. Gene therapy and genetic disease, cancer, Gene therapy and AIDS. Genebased vaccines.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY 6th - SEMESTER (CBCS) SYLLABUS

MBY -122: 8A1 - Microbial Quality Control in Food and Pharmaceutical Industries

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No of Hours: 8

- Good laboratory practices - Good microbiological practices.
- Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.
- Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

UNIT – II

No. of Hours: 8

- Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts,
- Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products

UNIT – III

No. of Hours: 8

- Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

UNIT – IV

No. of Hours: 8

- Enrichment culture technique, Detection of specific microorganisms - on XLD agar, SalmonellaShigellaAgar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar
- Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).

UNIT – V

No. of Hours: 4

- Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations.
- Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.

References:

1. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer
2. Pharmaceutical Microbiology – W.B. Hugo
3. . Frazier, W.C. 1978. Food Microbiology.McGraw Hill.

8A1 -Microbial Quality Control in Food and Pharmaceutical Industries

COURSE OUTCOMES

General objective:

- To create a thorough understanding of important QC QA.
- To create experts in the field of Quality control & Quality Assurance.
- To encourage continuous learning and development in QC QA.
- To clear the basic fundamentals of Quality concepts.
- To update knowledge of existing QC QA professionals.

Learning outcome

- Understand Pharmaceutical Quality related Concepts
- Able to write and review Quality Documents like SOPs, BMR etc
- In process Quality Control
- Establish QC/QA Labs
- Preparation for audits and inspections
- Manufacturing Control

Career Opportunities

- A career in Quality Control/Quality Assurance is a highly challenging career. QC/QA departments are the 2 backbones of any pharmaceutical company, the company cannot stand in domestic or international market without them.
- All regulatory agencies focus on Quality as a main issue in any facility and guidelines for the same are always updated.
- The Pharma industry is growing at a rapid pace and there is a rising concern over quality of pharmaceutical and medical device products. With the increasing number of pharma companies the demand for QC /QA professionals is always on the rise.

Employability

- Quality Control Analyst
- Quality Control officer
- Quality Control head/ Director
- Quality Assurance officer
- Quality Assurance head
- In Process Quality Control Officer
- In process Quality Assurance Officer

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

B.Sc MICROBIOLOGY (CBCS) SYLLABUS, 6th SEMESTER

8A1 -Microbial Quality Control in Food and Pharmaceutical Industries

Model Question Paper

Time: 3Hrs

Section – A

Max.Marks:60

Answer Any Four of the Following

4 x 10=40 marks

Draw labeled diagrams wherever necessary

1. a) Discuss Biosafety in microbiology and biomedical laboratories? (or)
b) How to discard biohazardous waste?

2. a) Describe the various culture and microscopic methods to enumerate the microorganisms? (or)
b) Write Biochemical methods for endotoxin and sterility tests for pharmaceutical products?

3. a) What are nucleic acid probes and what are they used for?
(or)
b) Define PCR? Write methodology for detection and diagnosis of infectious diseases?

- 4.a) Write enrichment culture techniques??
(or)
b) Discuss rapid detection methods of microbiological quality of milk?

Section B

Answer any five of the following

5x4=20 marks

5. Incineration
6. Gel diffusion
7. Biosensors
8. SDA
9. MBRT
10. EMB agar
11. HACCP
12. Mac Conkey agar

8A1 - Microbial Quality Control in Food and Pharmaceutical Industries

PRACTICALS

TOTAL HOURS: 36

CREDITS: 2

1. Microbiological laboratory safety- General rules & Regulations.
2. Sterility tests for Instruments – Autoclave & Hot Air Oven
3. Disinfection of selected instruments & Equipments
4. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
5. Sterility testing of Microbiological media
6. Sterility testing of any one Pharmaceutical product
7. Standard qualitative analysis of water.
8. Microbiological analysis of homogenized food samples by direct microscopic count

SUGGESTED READING

1. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
4. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer
5. Laboratory Exercises in Microbiology, George.A.Wistreich&Max.D.Lechtman, 3rd Ed, Glencoe press, London.
6. Manual of diagnostic microbiology, Dr.B.J.Wadher&Dr.G.L.Bhoosreddy, Firs.Ed., Himalaya publishing house, Nagpur.
7. Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education Pharmaceutical Microbiology – Purohit
8. Pharmaceutical Microbiology – W.B. Hugo

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GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

FMZC CLUSTER A1: MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	2	30
Unit II	2	2	30
Unit III	2	1	25
Unit IV	1	2	20
Unit V	1	1	15
Total no. of questions	8	8	
Total marks including choice			120

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) 6th - SEMESTER SYLLABUS

8A2 - FOOD MICROBIOLOGY AND BIOTECHNIQUES

UNIT - I: Food Biochemistry:

- Carbohydrate metabolism: Oxidation of glucose by glycolysis, TCA cycle, HMP path way, Glycogenolysis.
- Protein metabolism: Urea cycle, Biosynthesis of nucleic acids, protein biosynthesis.

UNIT -II: Food Microbiology:

- Factors associated with food spoilage: Micro-organisms, contamination during processing and handling.
- Fundamentals of control of microorganism in foods; use of high and low temp., dehydration, freezing, freeze-drying, irradiation and preservatives in food preservation.
- Microorganisms important in food preservation: Moulds, yeast, bacteria, characteristics and identification.

Unit III: Food Intoxication:

- Food borne disease-Toxins produced by Staphylococcus, Cholera, Clostridium, Aspergillus;
- Bacterial pathogens- Salmonella, Shigella, Bacillus, Escherichia coli, Campylobacter;

Unit IV:

- PCR- Mechanism and application, and DNA finger printing in microbial detection in foods.
- SDS polyacrylamide gel electrophoresis

Unit V:

- Principles of Microscopy: Bright field and dark field microscopy. Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron microscopy and Micrometry

REFERENCE:

1. Satyanarayana, U., Bio-chemistry, Books and allied (Pvt), 8/1-Chinthamani das line Calcutta 2001.
2. Thalwar GP Text book of biochemistry and human biology. Second edition, prentice Hall of India-pvt 1989.
3. Deb AC. Fundamentals of bio-chemistry. Seventh Edition New Book house (P)Ltd, 1998.
4. Frazier, W.C. 1978. Food Microbiology. McGraw Hill.
5. Industrial Microbiology by Samuel C. Prescott
6. Parihar and Parihar Dairy Microbiology, Saraswati Purohit, Jodhpur India, 2007
7. Prajapati J. B. (1995), Fundamentals of Dairy Microbiology.

COURSE OUTCOMES

8A2 - FOOD MICROBIOLOGY AND BIOTECHNIQUES

OBJECTIVES

1. To impart through knowledge on the technical skills in various aspects of food processing and preservation.
2. To inculcate the students to work in a hygienic way.
3. To provide an employment potential in food processing and preservation /self-employment.

COURSE OUTCOMES

1. Handling of preservation equipment for large scale.
2. Working in hygienic manner.
3. Maintaining sanitation.
4. Preparation of preserved products
5. Identification of spoilage and apply remedial measure.

EMPLOYMENT OPPORTUNITIES

1. Wage Employment
 - a. As a Technical Specialist In Food Industry
 - b. Bottling
2. Self Employment
 - a. Establishing a Home Scale Unit of Food Preservation

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

6th - SEMESTER PAPER

8A2 - FOOD MICROBIOLOGY AND BIOTECHNIQUES

PRACTICALS

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Ray diagrams of phase contrast microscopy and Electron microscopy.
3. Preparation of bacterial smears, simple staining, differential staining, spore staining, staining of molds and yeasts.
4. Preparation of common laboratory media for cultivation of bacteria, yeast and molds.
5. Isolation of micro-organisms by standard plate count method.
6. Sampling of air, water, dust, soil, food handlers to study the various sources of transmission of microorganism in foods.
7. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
8. Industrial visit on molecular methods

REFERENCES

1. Biophysical Chemistry Principles and Techniques- Upadhyay, Nath.
2. Practical Biochemistry” Principles and Techniques - Ed Keith Wilson and John Walker Cambridge University press, Cambridge , U K.
3. Frazier, W.C. and Westhoff , D.C. (1988): Fourth Edition, Food Microbiology, McGraw Hill Inc. Jay
- James, M. (1986): Third Edition, Modern Food Microbiology, Van Nostrand Reinhold Company inc.
4. Pelezar, M.I. and Reid, R.D. (1978): Microbiology, IYlcGraw Hill Book Company, New York. Benson Harold, J. (1990):
5. Microbiological applications, Wn. C. Brown Publishers, U.S.A. Collins, C.H. and Lyne, P.M. (1976).
6. Microbiological Methods, Buttersworth, London.

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

FMZC CLUSTER A2 FOOD MICROBIOLOGY AND BIOTECHNIQUES**BLUE PRINT FOR QUESTION PAPER SETTER**

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	2	30
Unit II	2	2	30
Unit III	1	1	25
Unit IV	2	2	20
Unit V	1	1	15
Total no. of questions	8	8	
Total marks including choice			120

Note: The question paper setters are requested to kindly adhere to the format given above

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

6th - SEMESTER PAPER

8A3 –Food Microbiology Hygiene & Sanitation

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

- Brief history of food microbiology and introduction to important microorganisms in foods. Primary sources of microorganisms in foods
- Fermented foods and their benefits. Indices of food, milk and water sanitary quality
- Microbiological criteria (Bacteriological analysis) of foods, water and milk testing

UNIT- II

- **Public health hazards due to contaminated foods:** food borne infections and intoxications - symptoms, mode and sources of transmission and methods of prevention. Investigation and detection of food borne disease out-break.

UNIT- III

- **Hygiene & Sanitation :** Hygiene and sanitation in food sector - pest control measures, Garbage and Sewage disposal, Water - Sources, purification; Principles of Hazards Analysis & Critical Control Point (HACCP)
- **Food Packaging:** Types & functions of packaging materials used in foods.
- Packaging material as a threat, impact on health and controlling measures.

UNIT- IV

- General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.
- Symbiotic N₂ fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants: Frankia from non-legumes and characterization.
- Cyanobacteria and Azolla, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

UNIT- V

- Outlines of Intellectual Property Rights: Patents, Copyrights, Trademarks; Public perception of GM foods. IPR – GMO Act – 2004.

REFERENCES:

1. Frazier, W.C. 1978. Food Microbiology.McGraw Hill.
2. Parihar and Parihar Dairy Microbiology, SaraswatiPurohit, Jodhpur India, 2007
3. Prajapati J. B. (1995), Fundamentals of Dairy Microbiology.
4. Food science and nutrition by Sunetra roday, 2nd edition, Oxford university press.
5. Food preservation technology with processing book, B.Siva Shankar, KINDLE EDITION, 2002
6. Text book of food science and technology, Arantina sharma3rd edition, 2017
7. Food safety management, Yasminematargemi, 1st edition,2013

Course outcomes

8A3: Food Microbiology Hygiene & Sanitation

General objective:

- To impart knowledge and skills on processing and preservation methods for wholesome food products.

Specific objectives:

- a) To impart knowledge on the causes of food spoilage and methods of processing and preserving food
- b) To identify & select processing equipment and preservation methods appropriate for specific foods

To describe the effects of preservation methods

Employability:

- **Food Safety Officers**
- Lab technicians
- Assistant Quality controller
- Internships in labs
- Quality Analyst in food industries

GOVT.COLLEGE (A), RAJAHMUNDRY

CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM 2017 – 18)

FMZC CLUSTER A3: FOOD MICROBIOLOGY HYGIENE AND SANITATION

BLUE PRINT FOR QUESTION PAPER SETTER

Time: 2 ½ Hours.

Marks: 60M

Unit	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTTED TO THE UNIT
Unit I	2	2	30
Unit II	1	2	30
Unit III	2	0	20
Unit IV	2	2	20
Unit V	1	2	20
Total no. of questions	8	8	
Total marks including choice			120

Note: The question paper setters are requested to kindly adhere to the format given above