



Estd. 1962
NAAC 'A' Grade

SHIVAJI UNIVERSITY, KOLHAPUR-416 004. MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर – 416004.

दुरध्वनी (ईपीएबीएक्स) २६०९०००० (अभ्यास मंडळे विभाग— २६०९०९४)

फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

SU/BOS/Science/ 7153

Date: 16/07/2018

To,

The Principal,
Sadguru Gadage Maharaj,
College, Karad.

Subject: Regarding syllabi of M.Sc. Part- II Microbiology degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of question paper and equivalence of M.Sc. Part- II Microbiology under the Faculty of Science and Technology.

1)	M.Sc. Part- II Microbiology (Sem. III & IV)
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This syllabi and equivalence shall be implemented from the academic year 2018-2019 (i.e. from June 2018) onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (Online Syllabus)

The question papers on the pre-revised syllabi of above mentioned course will be set for the examinations to be held in October /November 2018 & March/April 2019. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A' Grade

CHOICE BASED CREDIT SYSTEM

Syllabus For

M.Sc. Part - II Industrial Microbiology

SEMESTER III AND IV

(Syllabus to be implemented from June, 2018 onwards.)

Syllabus for M.Sc. - II (Industrial Microbiology)

To be implemented from June 2018

Titles of theory and practical courses

SEMESTER – III

IM-301- Microbial Technology

IM-302- Fermentation Technology - I

IM-303- Enzymology and Enzyme Technology

IM-304- Entrepreneurship Development and Modern Management Practices

IM-305- Practical Course – V

IM-306- Practical Course – VI

SEMESTER – IV

IM-401- Fermentation Technology -II

IM-402- Food and Dairy Microbiology

IM-403- Quality Assurance and Industrial Laws

IM-404- Industrial waste management

IM-405- Practical Course – VII

IM-406- Practical Course – VIII

Semester – III

IM – 301: MICROBIAL TECHNOLOGY

UNIT – I (12)

1. Fermentation equipment and its use:
 - 1.1 Basic functions of a fermenter, body construction, aeration, Agitation, baffles, etc.
 - 1.2 Design of other fermentation vessels: Airlift fermenter, tower fermenter Continuous fermenter, fed batch fermenter, Waldhof type fermenter
 - 1.3 Sterilization of fermentation equipment, air and media
 - 1.4 Fermentation broth rheology and power requirements, concepts of Newtonian and non-Newtonian fluids, plastic fluids, effect of rheology on heat and oxygen transfer, Reynold's number, power number, aeration number and apparent viscosity
2. Development of industrial fermentation processes
 - 2.1 Screening
 - 2.2 Stock culture maintenance
 - 2.3 Inoculum development for yeast process, bacterial processes and mycelial process
 - 2.4 Scale up of fermentation
3. Contamination problems in fermentation industry

UNIT – II (12)

1. Environmental control of metabolic pathways
2. Genetic Control of Metabolic pathways
3. Growth and product formation: Concept of primary and secondary metabolites and their control, kinetics of growth and product formation (growth rate, yield coefficient, efficiency), economics
4. Computer applications in fermentation technology- General applications and specific applications
- 5.

UNIT – III (12)

1. Fermentation media- Types of fermentation media, sources of carbon, nitrogen trace elements, growth factors, precursors, buffers, antifoam agents, sterilization of media, screening for Fermentation media.
2. Saccharification and utilization of cellulosic wastes.
3. Patents – Introduction, composition of patent, background, patent practice and problems

UNIT – IV (12)

1. Product recovery and purification – Precipitation, filtration, centrifugation, solvent recovery, chromatography, ultrafiltration, crystallization and whole broth processing
2. Fermentation economics – A case study, market potential for product and fermentation, product recovery cost, Entrepreneurship, plan for industry, product selection process, site selection, finance, feasibility, excise and legal aspects

REFERENCE BOOKS

1. Industrial Microbiology by L. E. Casida, John Wiley and Sons INC
2. Annual Reports on Fermentation processes Vol. I and II by D. Perlman, Academic press INC
3. Prescott and Dunn's Industrial Microbiology, 4th edition (1982) by Gerald Reed
4. Food processing: Biotechnological applications by S. S. Marwaha and J. K. Arora (2000), Asiatic publishers INC
5. Microbial technology Vol. I and II by H. J. Peppler and D. Perlman Academic Press INC
6. Principals of Fermentation Technology by P. Stanbury and A. Whitaker, Pergamon Press
7. Essays in Applied Microbiology by J. R. Norris and M. H. Richmond, John Wiley and Sons, Chicester, New York
8. Biology of Industrial Microorganisms by A. Demain and N. Solomon Butterworths Biotechnology Series
9. Overproduction of Microbial Metabolites: Strain Improvement and Process Control strategies by Z. Vanek and Z. Hostalek Butterworths Biotechnology Series
10. Fermentation Microbiology and Biotechnology by E. M. T. El-Mansi and C. F. A. Bryce Taylor and Francis Ltd. London
11. Legal protection for Microbiological and Genetic Engineering Inventions by R. Saliwanchik Butterworths Biotechnology Series.

IM – 302: FERMENTATION TECHNOLOGY- I

UNIT – I (12)

1. Production of single cell protein (SCP) - Microorganisms and substrates used, techniques of production, nutritional value of SCP, economics of production, merits and demerits
2. Microbial insecticides- Candidates for development into microbial insecticides, production of insecticides, evaluating potential hazards to man and environment, effectiveness, safety, economics, advantages and disadvantages

UNIT – II (12)

1. Typical Fermentation processes – industrial production of:
 - 1.1 Lactic starter culture for food fermentations
 - 1.2 Bacitracin
 - 1.3 Streptomycin
 - 1.4 β -carotene pigments
2. Typical Fermentation processes – industrial production of:
 - 2.1 Riboflavin
 - 2.2 Gluconic acid
 - 2.3 Gibberellin
 - 2.4 Itaconic acid

UNIT – III (12)

1. Production and applications of microbial polysaccharides- Xanthan gum and Dextran.
2. Production of mushrooms – Production steps, harvesting and preservation and nutritive value
3. Production of bacterial vaccines and antisera

UNIT – IV (12)

1. Industrial production of distilled alcoholic beverages – Whisky and Brandy
2. Microbial production of nucleosides and nucleotides
 - a. Introduction
 - b. Classification of methods for production of 5' IMP and 5'GMP
 - c. Production of 5'IMP and 5'GMP by fermentation.
3. Microbial transformations of antibiotics and steroids

REFERENCE BOOKS

1. Industrial Microbiology by L. E. Casida, John Wiley and Sons INC.
2. Annual reports on Fermentation Process Vol. I and II, by D. Perlman, Academic Press INC.
3. Prescott and Dunn's Industrial Microbiology, 4th edition (1982) by Gerald Reed.
4. Food processing: Biotechnological applications by S. S. Marwaha and J. K. Arora (2000), Asiatech publishers INC.
5. Microbial technology vol. I and II by H. J. Peppler and D. Perlman. Academic Press INC.
6. Methods in Industrial Microbiology by B. Sikyta, Ellis Horwood Ltd. Chichester (1983)
7. Industrial Microbiology by A. H. Patel, MacMillan India Ltd.
8. Principals of fermentation technology by P. Stanbury and A. Whitaker, Pergamon Press

9. *Advances in Applied Microbiology* Vols. 9 and 13, by W. W. Umbreit, Academic Press, New York
10. *Essays in Applied Microbiology* by J. R. Norris and M. H. Richmond, John Wiley and Sons, Chicester, New York
11. *Annual reports on fermentation process* vol. I and II by D. Perlman, Academic Press

IM – 303: ENZYMOLOGY AND ENZYME TECHNOLOGY

UNIT – I (12)

1. History and special properties of enzymes as catalysts
2. IUB system of nomenclature and classification of enzymes
3. Specificity of enzymes:
 - 3.1 Types: substrate and product, group or relative, absolute – stereochemical and spatial specificity
 - 3.2 Theories to explain specificity – Lock and Key and Induced Fit hypotheses
4. Structure of enzymes: monomeric and oligomeric enzymes, Ogsten's experiment and the concept of the Active Site
5. Methods employed to identify functional groups in the active site – trapping of the intermediate, use of substrate analogues, modification of amino acid side chains, some common functional groups and amino acids, chemistry of the active site
6. Co-factors in enzyme action:
 - 6.1 Organic – prosthetic groups, coenzymes and cosubstrates
 - 6.2 Inorganic – metal ions in enzyme function, metal activated enzymes and metallo-enzymes, ternary complexes

UNIT – II (12)

1. Kinetics of single-substrate enzyme catalysed reactions – Wilhelmy's and Brown's work, Henri and Michaelis-Menten relationships, Briggs and Haldane assumption and derivation, Lineweaver-Burk, Eadie-Hofstee, Hanes and Eisenthal and Cornish-Bowden modifications of the M-M equation to derive K_M , Significance of the M-M equation and K_M
2. Kinetics of multisubstrate reactions
3. Haldane's relationship for reversible reactions
4. Sigmoid kinetics – Hill and Adair equations for cooperativity
5. Enzyme inhibition: basic concepts, kinetics, examples and significance of reversible and irreversible inhibition
- 6.

UNIT – III (12)

1. Covalent modification of enzyme structure – irreversible and reversible modification
2. Ligand induced conformational changes – basic concepts of allosterism and allosteric enzymes, models proposed to explain the mechanism of functioning (MWC and KNF); structural aspects of aspartate carbamoyltransferase, role of allosteric enzymes in metabolic regulation – feedback inhibition
3. Multienzyme systems – basic concepts, types with examples, structural and functional aspects of pyruvate dehydrogenase, fatty acid synthetase, 'Arom' complex and tryptophan synthetase
4. Membrane bound enzymes in metabolic regulation
5. Isoenzymes – basic concepts, method of detection, examples and their metabolic significance

UNIT – IV (12)

1. Applications of enzymes in medicine:
 - 1.1 In diagnosis – general principles and use of alanine amino transferase, aspartate amino transferase, lactate dehydrogenase, creatine kinase, acid and alkaline phosphatase
 - 1.2 In therapy – specific applications of few selected enzymes, prodrug activation with examples, enzyme replacement therapy

2. Industrial applications of enzymes – catalysts in the manufacturing and other conversion processes
 - 2.1 Enzymes as analytical tools
 - 2.2 Immobilisation of enzymes: basic concepts, methods used, properties of IME and their applications in industry, medicine, enzyme electrodes
 - 2.3 Newer approaches to the application of enzymes – reactions in organic solvents

REFERENCE BOOKS

1. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry by T. Palmer
Affiliated East-West Press Pvt. Ltd. New Delhi
2. Fundamentals of Enzymology – N. C. Price and L. Stevens, Oxford University Press
3. Nature of Enzymology – R. L. Foster, Croom Helm Applied Biology Series, London
4. Enzyme Technology – Pandey, Webb, Soccol and Larroche. Asiatech Publishers, INC New Delhi
5. Enzyme Nomenclature by IUBMB Academic Press Inc.
6. Enzyme structure and function – A. Fuerst, Freeman, USA
7. Immobilised Enzymes – M. D. Trevan
8. Enzymes – Boyer, Academic Press
9. Advances in Enzymology – Series edited by N. O. Kaplan, Academic Press
10. Enzyme Biotechnology by G. Tripathi, Technoscience Publications
11. Enzyme Reaction Engineering by T. P. Jayadev Reddy, Biotech Books, Delhi
12. Enzymes and Immobilised Cells in Biotechnology by A. Laskin Butterworths Biotechnology Series

IM- 304: ENTREPRENEURSHIP DEVELOPMENT AND MODERN MANAGEMENT PRACTICES

UNIT – I (12)

Entrepreneur

1. Concept-classification–Functions-Qualities of successful Entrepreneur– Concept of Intrapreneur and Netpreneur, challenges before entrepreneurs in modern Era.
2. Concept- Importance, Theories of Entrepreneurship (Joseph Schumpeter's Innovation Theory, McClelland's Theory of need of Achievement, Hegan's Theory of status withdrawal) Entrepreneurship in service Industry- factors stimulating Entrepreneurship obstacles in Entrepreneurial growth.

UNIT – II (12)

Entrepreneurship Development

1. Concept-objective-Process-Problems and measures in Entrepreneurship development– Institutional support for Entrepreneurship Development Entrepreneurship Development Institute of India (EDI) Ahmadabad, National Institutes of Entrepreneurship and small Business Development (NIESBUD), New Delhi, National Institutes of small Industry Extension Training (NISIET), Hyderabad, small Industries Development organizations (SIDO), small Industry Development Bank of India (SIDBI), Technical consultancy organization (TCOs), District Industry centres(DIC).
2. Concept of project-classification of project-stages of project management – Reasons for failure for project. Project for call centre, Retail stores, Hotel, Hospital, Dairy.

UNIT – III (12)

1. Introduction to modern management practices and Quality Management

1. Concept and characteristics of modern management –Importance of modern management in changing environment.

2. International Management

- a. International Management and Multinational Corporations--- Nature and purpose of International Business
- b. Multinational Companies (MNCs)—Advantages and challenges
- c. Japanese Management and Theory 'Z'
- d. Role of Global Managers.

UNIT – IV (12)

Risk Management and Legal Aspects of Business

1. Introduction: concept and types of risks – Risk management, concept, objectives- Risk Management Information system – Enterprise Risk management.
2. Legal Aspects of Business
 - a. Law of contract 1872 –Definition of contract, essentials of valid contract, Types of contract, performance of contract, Discharge of contract and Break of contract.
 - b. Information Technology Act 2000 – Introduction, Internet, e-commerce, digital signature
 - c. cyber crimes and legal provisions.

- d. The company Law 1956: Definition of company, types of company, Incorporation of company.

REFERENCE BOOKS

1. Dynamics of Entrepreneurship Development & Management –By Vasant Desai
2. Entrepreneurship Development in India –By C.B.Gupta and N.P.Srinivasan
3. Entrepreneurial Development –By S. S. Khanka
4. Entrepreneurial Development –By Godron E.and Natarajan K.
5. Udyojakata- By Prabhakar Deshmukh.
6. Project Preparation Appraisal, Implementation- By Prasanna Chandra.
7. Entrepreneurship Development –By S.C. Gupta & Arun Mittal.
8. The Practice of Management – Peter Drucker
9. Organization and management – Dr.C.B.Gupta
10. Business organization and management – M.C.Shukla
11. Business Policy-Dr.Azhar Kazmi
12. Insurance and Risk Management –Dr.P.K.Gupta, Himalaya Publishers.
13. Mercantile law- N.D.Kapoor (Sultan Chand Publications)
14. Corporate Law- Bharat Law House, New Delhi
15. Business Law-M.C. Kuchal, Vikas Publisher Houses, New Delhi
16. Bare Act-Cyber Act

IM - 305: PRACTICAL COURSE – V

Unit - I

1. Quantitative estimation and determination of specific activity of α -amylase
2. Salt (ammonium sulphate) precipitation of α -amylase
3. Study of the effect of Substrate concentration [S₀] on α -amylase and determination of V_{max} and K_M
4. Study of the effect of Hydrogen Ion concentration (pH) and determination of optimum pH for activity of α -amylase
5. Study of the effect of Temperature – determination of optimum temperature for activity of α -amylase
6. Study of the effect of Metal ions on α -amylase
7. Immobilisation of α -amylase by entrapment in alginate gel and determination of loading efficiency
8. Assay of Invertase, Protease and Lipase

UNIT - II

1. Screening of antibiotic producers – Crowded plate technique
2. Screening of organic acid producers and amine producers
3. Screening of amylase producers and protease producers
4. Screening of vitamin producers
5. Enrichment and isolation of sulfate reducing bacteria
6. Enrichment and isolation of pesticide resistant bacteria.
7. Enrichment and isolation of phosphate solubilising microorganisms

REFERENCE BOOKS

1. Laboratory Manual in Biochemistry by J. Jayaraman. New Age International Publishers
2. An Introduction to Practical Biochemistry by D. T. Plummer TMH Publishers
3. Immobilised Enzymes – M. D. Trevan
4. Advances in Enzymology – Series edited by N. O. Kaplan, Academic Press

IM – 306: Practical Course –VI

Unit-I

1. Isolation of lipolytic, proteolytic, producing microorganisms from suitable source.
2. Production of Amylase by Surface culture method
3. Production of Amylase by Submerged culture method
4. Production of Protease
5. Production of sauerkraut
6. Production of Bio fertilizers using nitrogen fixing and phosphate solubilising isolates and packaging

Unit-II

1. Estimation of Antibiotics–Streptomycin & Tetracycline by suitable assay method.
2. Estimation of Organic Acids–Lactic Acid & Citric Acid by suitable assay method.
3. Immobilization of Amylase by using Sodium Alginate method.
4. Microbiological analysis of Butter by SPC
5. Detection for the presence of *E. coli* & *Staph. Aureus* in Butter
6. Microbial limit test for PSB market fertilizer product.

REFERENCE BOOKS

1. Experimental Microbiology–Rakesh J. Patel & Kiran R. Patel. (Vol. I&II)
2. Practical Biochemistry by Plummer
3. Microbial technology by Peppler & Periman.
4. Bacteriological Techniques- F.K. Baker
5. Bio fertilizers –Vyas & Vyas (Ekta Publication).
6. Citric acid Biotechnology–J. Achrekar.
7. Enzyme Biotechnology–G. Tripathi.
8. Bio fertilizers– Arun Sharma.
9. Industrial Microbiology–Agrawal / Parihar
10. Biotechnology–S. S. Purohit.
11. Agriculture Microbiology–G. Rangaswami & D. J. Bagyaraj

SEMESTER – IV

IM-401: Fermentation Technology-II

UNIT – I

(12)

1. Microbial Production of Vitamins:
 - a. Vitamin C - Organism used production method, process, recovery and assay.
 - b. Vitamin A - Organism used, production method, process, recovery, and assay
2. Production of Antibiotics
 - a. Production of Antibiotics: Organism used, production process and recovery of Chloramphenicol
3. Production of toxoids
 - a. Diphtheria
 - b. Tetanus

UNIT – II

(12)

1. Vinegar Production
 - a. Introduction
 - b. Production Process
 - c. Quality, Grades & uses of Vinegar
2. Production of biofuels
 - a. Ethanol- microorganisms used, fermentation condition, recovery, purification of Ethanol
 - b. Biogas- Biomass used, Microbiology & Biochemistry of biogas production, models used, uses of biogas
 - c. Biodiesel production from algae
3. Microbial Production of Amino Acids
 - a. Production of lysine
4. Microbial Production of Protease, Lipase and Amylase
5. Solvents
 - a. Glycerol
 - b. Acetone butanol

UNIT – III

(12)

1. Bio fertilizers:
 - a. Concept & its need in organic farming
2. Rhizobium Bio fertilizer
 - a. Characteristics
 - b. Host Rhizobium interaction
 - c. N₂ fixation in root-nodules

- d. Production
 - e. Methods of application
3. Azotobacter Bio fertilizer
- a. Characteristics
 - b. N₂ fixation process
 - c. Production
 - d. Methods of application
4. Azospirillum Bio fertilizer
- a. Characteristics
 - b. Association with plants
 - c. Production
 - d. Methods of application

UNIT – IV

(12)

1. VAM Bio fertilizer
- a. Characteristics & types of association
 - b. Production
 - c. Methods of application
2. PSB Bio fertilizer (Phosphate solubilising Bacteria)
- a. Mechanism of phosphate solubilisation
 - b. Production
 - c. Methods of application
3. Quality control of Bio fertilizers as per FCO (Fertilizer Control Order)
- a. Introduction of FCO specifications for bio fertilizers
 - b. Sampling procedure
 - c. Method of analysis
 - d. Standards of bio fertilizers
 - e. Biostability of product bio fertilizer
4. Azolla & BGA Bio fertilizers
- 1. Azolla:
 - a. Characteristics
 - b. Production
 - c. Methods of application
 - 2. BGA:
 - a. Characteristics
 - b. N₂ fixation process
 - c. Production
 - d. Methods of application

REFERENCE BOOKS:

- 1. Industrial Microbiology by L. E. Casida, John Wiley and Sons INC.
- 2. Prescott and Dunn's Industrial Microbiology, 4th edition (1982) by Gerald Reed.
- 3. Microbial technology Vol. I and II by H. J. Peppler and D. Perlman Academic Press INC

4. Principals of Fermentation Technology by P. Stanbury and A. Whitaker, Pergamon Press
5. Fermentation Microbiology and Biotechnology by E. M. T. El-Mansi and C. F. Bryce
Taylor and Francis Ltd. London
6. Bio fertilizers– Arun Sharma.
7. Industrial Microbiology–Agrawal / Parihar
8. Fertilizer Control Order–1985 amended up to June, 2011
9. Bio fertilizers –Vyas & Vyas (Ekta Publication).
10. Agriculture Microbiology by Rangaswamy
11. Enzyme Biotechnology–G. Tripathi

IM – 402: FOOD AND DAIRY MICROBIOLOGY

UNIT – I

(12)

1. Food as a substrate for Microorganisms
2. General principles underlying microbial spoilage of food
3. Microbial spoilage of meat, fruits and vegetables
4. Microbial spoilage of heated canned food
5. General principles of Preservation of food: Asepsis, Removal of microorganisms, killing of microorganisms, reducing the growth rate of microorganisms
6. Methods of food preservation: Thermal processing, cold preservation, Preservation by using chemical preservatives, Food dehydration, Preservation by using Irradiation, Canning of food

UNIT – II

(12)

1. Milk: Definition, composition, Factors affecting composition, Nutritive value of milk
2. Spoilage of milk and milk products:
 - 2.1 Milk as a substrate for microorganisms
 - 2.2 Microbial contamination of milk - sources of contamination, types of microorganisms present in milk
 - 2.3 Biochemical activities during microbial spoilage of milk
3. Fermented foods: Microbiology and biochemistry of
 - 3.1 Fermented cereal foods: Amboli, Jalebi
 - 3.2 Fermented cereal legume foods: Idli, Dhokla
 - 3.3 Fermented vegetable products: Sauerkraut, Pickles
 - 3.4 Fermented milk products: Yoghurt, Cultured butter milk

UNIT – III

(12)

1. Food borne diseases: Food born intoxications: Botulism and staphylococcal intoxication and Food borne infections
2. Prevention and control of food borne diseases
3. Fermented dairy products and their role in controlling food borne diseases:
 - 3.1 Types of fermented dairy products, methods of preparation
 - 3.2 Therapeutic significance and their health properties - mode of action of lactic acid bacteria on enteric pathogens
 - 3.3 Fermented dairy products and their role in controlling gastro intestinal tract disorders

UNIT – IV

(12)

1. Probiotics: probiotic microbial strains, role of probiotics in gastrointestinal disorders, probiotics in reducing risks of cancer, immunogenic effects of probiotics
2. Enzymes in food processing: Need of enzymes, sources of enzymes
3. Applications of enzymes in:
 - 3.1 Production of high fructose syrup

- 3.2 Fruit juice industry, Baking industry, Oils and fat processing
4. Food safety and standards: Food safety issues, Food adulteration, Contaminations with harmful microbes, Metallic contamination, Food Laws and standards, Industrial food safety Laws and standards, HACCP, Indian Food Laws and standards

REFERENCE BOOKS:

1. Food processing Biotechnological application (2000) by S. S. Marwaha & K. Arora, Asiatech Publishers INC, New Delhi
2. Food science, Fifth Edition, Norman N. Potter 1996, CBS publishers and distributors
3. The technology of food preservation, Fourth Edition, Norman W. Desrosier BI Publisher and Distributors, Delhi (1987)
4. Food Microbiology - Adams & Moss
5. Dairy Microbiology by Robinson
6. Outlines of Dairy technology by Sukumar De
7. Milk and Milk Products – Clarence
8. Food Science (5th ed) Norman N. Potter, Joseph N. Hotchkiss

IM-403: QUALITY ASSURANCE AND INDUSTRIAL LAWS

UNIT – I (12)

Total Quality Management and Quality Standards

1. Concept of quality, Meaning of TQM, Elements of TQM, Contribution of Deming and Juran.
2. Benchmarking: Concept and Types of Benchmarking, Advantages and limitations.
 - a. Six Sigma: Meaning, characteristics and importance of Six Sigma, Levels of Six Sigma, Steps in implementing Six Sigma.
 - b. ISO-9000: Meaning and importance of ISO quality standards, 20 elements of ISO 9000.

UNIT – II (12)

1. Industrial Rules and standards as per IP, BP, USP, EP: Indian Pharmacopoeia:
 - a. Introduction
 - b. Concept of pharmacopoeia
 - c. Concept of regulatory authorities
 - d. Types of pharmaceutical products
 - e. Microbiological Q.C
2. International Standards as per WHO, ISI, and Validation in Pharmaceutical industry
 - a. WHO & ISI standards.
 - b. Validation & in-process monitoring of sterilization procedures
 - c. Validation of Laminar Air Flow Cabinet

UNIT – III (12)

1. Law of Contract- General Principles (Indian Contract Act, 1872)
 - a. Definition of Business Law and its sources
 - b. Definition, essential element and kinds of contract
Offer and Acceptance, Capacity of Parties, Consideration, Free Consent and Legality of Objectives
 - c. Void Agreements
 - d. Discharge of Contract
 - e. Remedies for Breach of Contract
2. Special Contract:
 - a. Indemnity and Guarantee Contract: Definitions, Parties to contracts, Distinction between a Contract of Indemnity and a Contract of Guarantee, Types of Guarantee,
 - b. Contract Bailment and Pledge: Definitions, Features, Distinction between Bailment and Pledge
 - c. Contract of Agency: Definition, Modes of creation of agency and its termination.

UNIT – IV

(12)

1. Sale of Goods Act, GST
 - a. Contract of sale of goods: Concept and essentials
 - b. Sale and Agreement to Sale
 - c. Conditions and Warranties
 - d. Performance of contract of sale
 - e. Unpaid seller and his rights
2. Limited Liability Partnership Act, 2008
 - a. Salient features of Limited Liability Partnership Act
 - b. Nature of limited liability partnership
 - c. Incorporation of limited liability partnership
 - d. Limitations of liability of LLP and partners

REFERENCE BOOKS:

1. N. Logothetis , ‘ Managing for Total Quality.’
2. Dr. D. D. Sharma, ‘ Total Quality Management.’
3. Subir Choudhari, ‘ The Power of Six Sigma.’
4. Greg Brue, ‘Six Sigma for Managers’.
5. John T. Rabbit and Peter A. Bergh, ‘ ISO-9000.’
6. Dr. Anjali Ghanekar, ‘ Organisational Behaviour.’
7. Stephon Robbins, ‘ Organisational Behaviour.’
8. Business Law- Kavita Krishnamurthi
9. Essentials of Business and Industrial Laws- B.S. Moshal
10. Business Law- M.C. Kuchhal
11. Elements of Mercantile Law- N.D. Kapoor
12. Mercantile Law- Arun Kumar
13. Mercantile Law- S.S.Gulshan
14. The Principles of Mercantile Law- Avtarsingh
15. Commercial and Industrial Law-A.K. Sen and J.K. Mitra

Websites:

1. [http://www. answers.com/topic/contracts-legal](http://www.answers.com/topic/contracts-legal)
2. [http://www. lectlaw.com/def/1031.html](http://www.lectlaw.com/def/1031.html)
3. [www. expert.com](http://www.expert.com), Expert Law Library

Concerned bare Acts may also be referred.

IM – 404: INDUSTRIAL WASTE MANAGEMENT

UNIT – I (12)

1. Types and Characterization of industrial wastes:
 - 1.1 Types of industrial wastes
 - 1.2 General characteristics of different industrial wastes, pH, suspended solids, volatile solids, COD, BOD and organic carbon
2. Effects of industrial wastes on aquatic life- Effects of industrial wastes of high BOD, effects of waste with toxicants
3. Self-purification in natural waters: Introduction, physical process, chemical process, biological process

UNIT – II (12)

1. Microbiology and biochemistry of wastewater treatment: introduction
 - 1.1 Cell physiology and important microorganisms – important microorganisms, role of enzymes, principles of growth, plasmid borne metabolic activities
 - 1.2 Impact of pollutants on biotreatment
2. Methods of industrial waste treatment: Part-I - Physico-chemical Methods - neutralization, oxidation of cyanides, Chromium reduction, reverse osmosis, carbon adsorption, destruction of phenolic compounds

UNIT – III (12)

1. Methods of industrial waste treatment: Part-II - Biological methods - I
 - 1.1 Activated sludge process- Process, microbiology, sludge bulking
 - 1.2 Trickling filters- Process, Microbiology and applications
2. Methods of industrial waste treatment: Part-III - Biological methods - II
 - 2.1 Lagooning- Aerobic and anaerobic, applications
 - 2.2 Anaerobic digestion- Process, microbiology of bio-gas formation, Applications

UNIT – IV (12)

1. Bio management of industrial waste: technological options for treatment of liquid and solid wastes – bioaugmentation, packaged microorganisms, use of genetically engineered microorganisms in wastewater treatment
2. Industrial waste treatment: methods of treatment of wastes from Dairies, Distilleries, paper and pulp industries, fertilizer industries and Pharmaceutical industries
3. Waste disposal control and regulations: Water pollution control, Regulation and limits for disposal into lakes, rivers, oceans and land

REFERENCE BOOKS

1. Industrial Pollution Control Vol. - I by E. J. Middlebrooks
2. The treatment of industrial wastes. (2nd ed) by E. B. Besselièvre and M. Schwartz
3. Environmental Biotechnology (Industrial pollution management) by S. N.

Jogdand, Himalaya Publishing House

4. Water and water pollution Handbook Vol. – I by Leonard L. Ciaccio
5. Wastewater Treatment by M.N. Rao and A. K. Datta
6. Industrial Pollution by N. L. Sax. Van Nostrand Reinhold Company
7. Encyclopaedia of Environmental Science and Technology Vol. – II by Ram Kumar
8. Water Pollution Microbiology by R. Mitchell
9. Handbook of Water Resources and Pollution Control by H.W. Gehm and J. I. Bregman
11. Environmental Microbiology by P. D. Sharma, Narosa Publishing House, New Delhi

IM – 405: PRACTICAL COURSE –VII (For 50 marks)

UNIT – I

1. Platform tests in dairy industry: COB, alcohol precipitation, titratable acidity, quantitative phosphatase test, mastitis test
2. Physical examination of milk: specific gravity and solids non-fat (SNF)
3. Chemical examination of milk: pH, fat, protein, sugar and ash
4. Production of a Lactic starter culture
5. Fermentative production of gluconic acid

UNIT - II

1. Characterization of industrial wastes: pH, Alkalinity, BOD, COD, TOC, DO, total solids (TS), total suspended solids (TSS), total dissolved solids (TDS), total volatile solids (TVS)
2. Treatability test for industrial effluents
3. Development of an activated sludge culture
4. Minimum 30 days Industrial Training (Training Report with PowerPoint Presentation)

UNIT - III

Industrial Training (50 marks)

REFERENCE BOOKS

1. Official Methods of Analysis of the Association of Official analytical
2. Chemists Vols. I and II. Published by Association of Official analytical
3. Chemists, Suite 400, 2200 Wilson Boulevard, Arlington, Virginia 22201, USA
4. Laboratory Methods in Food Microbiology by D. W. Harrigan, Academic Press
5. Handbook of Techniques in Microbiology by A. S. Karwa, M. K. Rai and H. B. Singh Scientific Publishers, Jodhpur
6. Dairy Microbiology by Robinson
7. Outlines of Dairy technology by Sukumar De
8. Standard Methods in Water and Wastewater Analysis by APHA, AWWA and WPCF
9. Analysis of Plants, Irrigation water and Soils by R. B. Somawanshi and
10. others. Mahatma Phule Agricultural University, Rahuri
11. Microbiological aspects of Anaerobic Digestion – Laboratory Manual by
12. D. R. Ranade and R. V. Gadre, MACS Agharkar Research Institute, Pune
13. Pollution Microbiology: A Laboratory Manual by Melvin S. Finstein, Marcel Dekker Inc.
14. Molecular Cloning – A Laboratory Manual, Vol. 1,2,3 by J. Sambrook, E. F.
15. Fritsch and T. Maniatis
16. Molecular Biology and Biotechnology by J. M. Walker and R. Rapley,
17. Panima Publishing Corp. New Delhi
18. Principles and Techniques of Practical Biochemistry by K. Wilson and J.
19. Walker, Cambridge University Press
20. Molecular Biology Laboratory Manual by Denny R. Randall
21. Plant Tissue Culture by H. D. Kumar

IM – 406: PRACTICAL COURSE – VIII (For 100 marks)

Research Project work