AC 25.04.24 ITEM NO: 3.3

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelor of Science
Course: T.Y.Bsc
Subject: **Biotechnology**

Choice Based Credit System (CBCS)
with effect from
Academic Year 2024-2025

TYBSC Biotechnology Course Structure

Semester V

Course code KUSBT24	Title	Theory /Practical	Marks	Credits	Nos of Lectures & Practical
501	Cell biology	Theory	100	2.5	60
502	Medical Microbiology & Instrumentation	Theory	100	2.5	60
503	Genomes and Molecular Biology	Theory	100	2.5	60
504	Marine Biotechnology	Theory	100	2.5	60
P501+502	Cell biology+ Medical Microbiology & Instrumentation	Practical	100	3.0	72
P503+504	Genomes and Molecular Biology+ Marine Biotechnology	Practical	100	3.0	72
KUSBTAC24 501	Biosafety	Theory	100	2.0	48
KUSBTACP24 501	Biosafety	Practical	100	2.0	48
	TOTAL		**800**	**20**	**480**

Semester VI

Course code KUSBT24	Title	Theory/ Practical	Marks	Credits	Nos of Lectures & Practical
601	Biochemistry	Theory	100	2.5	60
602	Industrial Microbiology	Theory	100	2.5	60
603	Pharmacology and Neurochemistry	Theory	100	2.5	60
604	Environmental Biotechnology	Theory	100	2.5	60
P 601-P 602	Biochemistry& Industrial Microbiology	Practical	100	3	72
P 603-P 604	Pharmacology - Neurochemistry and Environmental Biotechnology (50M)+ Project work (50M)	Practical	100	3	72
KUSBTAC24 601	Agribiotechnology	Theory	100	2.0	48
KUSBTAC P24 601	Agribiotechnology	Practical	100	2.0	48
	TOTAL		**800**	20	**480**

Semester V

Course code KUSB T24	Title	Unit	Topics	Credit	No of Lectures
501	Cell Biology	I: Cell cycle	Cell cycle Introduction: Prokaryotic and Eukaryotic- **3 Lectures;** The Early Embryonic Cell Cycle and the Role of MPF-**4 Lectures;** Yeasts and the Molecular Genetics of Cell-Cycle Control – **4 Lectures;** Apoptosis, Cell-Division Controls in Multicellular Animals- **4 Lectures**	2.5	15
		II: Cell Signalling	Cell signalling and signal transduction:Introduction General Principles of Cell Signaling - **3 Lectures;** Signaling via G-Protein-linked Cell-Surface Receptors - **3 Lectures;** Signaling via Enzyme-linked Cell-Surface Receptors - **3 Lectures;** Target-Cell Adaptation, The Logic of Intracellular - **3 Lectures;** Signaling: Lessons from Computer-based "Neural Networks"- **3 Lectures**		15
		III: Developmental Biology	Overview of how the modern era of developmental biology emerged through multidisciplinary approaches - **5 Lectures;** Stages of development- zygote, blastula, gastrula, neurula cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation ,lineages of three germ layers, fate map - **6 Lectures;** Mechanisms of differentiation- cytoplasmic determinants, embryonic induction, concept of morphogen, mosaic and regulative development Pattern formation-- axis specification, positional identification (regional specification), Morphogenetic movements, Model organisms in Developmental biology - **4 Lectures**		15
		IV: Cancer Biology	Cancer: Introduction, Cancer as a Microevolutionary Process - **4 Lectures**; The Molecular Genetics of Cancer - **6 Lectures**; Cancer and Virus Cancer diagnosis and chemotherapy - **5 Lectures**		15
		Total			60

References:

1. Molecular Cell Biology. 7th Edition, (2012) Lodish H., Berk A, Kaiser C., K Reiger M., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA
2. Molecular Biology of the Cell, 5th Edition (2007) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA
3. Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA
4. The Cell: A Molecular Approach, 6th edition (2013), Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA
5. Developmental Biology; Scott Gilbert; 9th Edition

Course code KUSBT24	Title	Unit	Topics	Credit	No of Lectures
502	**Medical Microbiology and Instrumentation**	I: Virology	Introduction to viruses-Position in biological spectrum; Virus properties - **2 Lectures**; General structure of viruses Baltimore Classification and Taxonomy(ICTV) - **2 Lectures**; Cultivation of viruses - **2 Lectures**; Reproduction of ds DNA phages Hepatitis /ss RNA (influenza), animal viruses and plant (TMV)virus - **4 Lectures;** Virus purification and assays - **2 Lectures;** Cytocidal infections and cell damage - **2 Lectures;** Viroids and Prions - **1 Lecture**	2.5	15
		II: Chemotherapeutic drugs	Discovery and Design of antimicrobial agents -**1 Lecture**; Classification of Antibacterial agents, Selective toxicity, MIC, MLC - **2 Lectures** Inhibition of cell wall synthesis (Mode of action for): Beta lactam antibiotics: Penicillin, Cephalosporins; Glycopeptides: Vancomycin; Polypeptides: Bacitracin -**2 Lectures** Injury to Plasma membrane: Polymyxin – **1 Lecture**; Inhibition of protein synthesis Aminoglycosides, Tetracyclines Chloramphenicol, Macrolides-Erythromycin- **2 Lectures**; Inhibition of Nucleic acid synthesis: Quinolones, Rifampicin, Metronidazole - **2 lectures**; Antimetabolites: Sulphonamides, Trimethoprim - **1 lecture**; Drug Resistance: Mechanism, Origin and transmission of drug resistance - **1 lecture**; Use and misuse of antimicrobial agents - **1 lecture**; Antifungal drugs, Antiviral drugs - **2**		15

			lectures		
		III: Spectroscopy	Principle, instrumentation, working and applications of: Fluorescence Spectroscopy - **3 Lectures** Luminometry - **3 Lectures** Light scattering spectroscopy - **3 Lectures** Infrared Spectroscopy - **3 Lectures** Atomic absorption Spectroscopy - **3 Lectures**		15
		IV: Bio-analytical techniques	Principle, working and applications of: Affinity chromatography - **2 Lectures** Ion-exchange chromatography - **2 Lectures** Molecular (size) exclusion chromatography - **2 Lectures;** HPLC - Method development and validation- **3 Lectures**; Isotopes in Biology: Nature of radioactivity - **1 Lecture**; Detection Techniques using GM counter, Scintillation counter, autoradiography - **4 Lectures**; Applications of Tracer techniques in Biology - **1 Lecture**		15
		Total			60

References:

1. Principles and techniques in biochemistry and molecular biology (2010), Keith Wilson and John Walker, 7th edition, Cambridge University Press
2. Biophysics (2002) Vasantha Pattabhi and N. Gautham, Kluwer Academic Publishers
3. Physical Biochemistry: principles and applications, 2nd edition (2009), David Sheehan , John Wiley & Sons Ltd
4. HPLC method validation for pharmaceuticals: a review (2013), Harshad V. Paithankar, International Journal of Universal Pharmacy and Bio Sciences 2(4): July-August.
5. Mim's Medical Microbiology 5th edition
6. Microbiology by Prescott Harley and Klein 5th edition Mc Graw Hill
7. Medical Microbiology Jawetz,E., Brooks,G.E, Melnick,J.L., Butel,J.S Adelberg E. A 18th edition

8. Medical Microbiology by Patrick Murray 5th edition
9. Foundations In Microbiology by Talaro and Talaro Third edition W.C Brown
10. Understanding Viruses by Teri Shors

PRACTICALS

KUSBTP24 501-502 **3 credits** **72hrs**

1. Separation of components from a mixture using Affinity chromatography (Kit may be used)
2. Separation of components from a mixture using ion exchange chromatography (Kit may be used)
3. Separation of components from a mixture using Size exclusion chromatography (Kit may be used)
4. HPLC method validation.
5. MIC and MLC of any one antibiotic
6. Antibiotic sensitivity test using agar cup method
7. Antibiotic sensitivity test using paper disc method
8. Antibiotic sensitivity test using ditch method.
9. Cancer Biology: (Field visit and 2 page report in the journal)
10. Chick embryo candling and inoculation methods Demonstration experiment
11. Book review (Emperor of all Maladies)

Course Code KUSBT24	Title	Unit	Topics	Credit	No of Lectures
503	**Genomics and Molecular Biology**	I: Genetic engineering of plants	Genetic engineering of plants; Methodology. Plant transformation with the Ti plasmid of *A.tumefaciens*, Ti plasmid derived vector system - **4 Lectures;** Transgenic plants: Physical methods of transferring genes to plants : electroporation, microprojectile bombardment, liposome mediated, protoplast fusion- **5 Lectures;** Vectors for plant cells - **4 Lectures;** Improvement of seed quality protein - **2 Lectures**	2.5	15
		II: Transgenic Animals	Transgenic mice- methodology-retroviral method, DNA microinjection, ES method - **5 Lectures;** genetic manipulation with cre-loxP - **2 Lectures;** Vectors for animal cells - **2 Lectures;** Transgenic animals recombination system - **2 Lectures;** Cloning live stock by nuclear transfer - **2 Lectures;** Green Fluorescent Protein - **1 Lectures;** Transgenic fish – **1 Lectures**		15
		III: Tools in Molecular Biology	Cloning vectors-Plasmids (pUC series), Cosmids, phagemids M13, shuttle vectors, YAC vectors, expression vectors pET - **4 Lectures;** Gene cloning-Isolation and purification of DNA; Isolation of gene of interest: Restriction digestion, electrophoresis, blotting, cutting, and joining DNA, methods of gene transfer in prokaryotes and eukaryotes - **3 Lectures;** Recombinant selection and screening methods: genetic, immunochemical, Southern and Western analysis, nucleic acid hybridization, HART,HRT- **2 Lectures;** Expression of cloned DNA molecules and maximization of expression - **2 Lectures;** Cloning strategies-genomic DNA libraries, cDNA libraries, chromosome walking and jumping - **4 Lectures**		15
		IV: Gene sequencing and editing	Maxam Gilbert's method, Sanger's dideoxy method, Automated DNA sequencing, Pyrosequencing - **6 Lectures;** Human genome mapping and it's implications in health and disease - **3 Lectures**; RNAi, ZNF(Zinc finger nucleases), TALENS(Transcription Activator Like Effector Nucleases), CRISPER/Cas system(Clustered Regularly Interspersed Repeats) - **6 Lectures**		15
		Total			60

References:

1. iGenetics A Molecular Approach 3rd Edition Peter J. Russell.
2. Molecular Biotechnology-Principles and Applications of Recombinant DNA Technology 3rd Edition Glick B.R., Pasternak J.J., Patten C.L.
3. Principles of Gene Manipulation 7th Edition Primrose S.B., Twyman R.M.
4. Biotechnology 3rd Edition S.S. Purohit.
5. Genomes 3rd Edition T.A. Brown.
6. Biotechnology B.D. Singh.
7. Gene Cloning and DNA Analysis 6th Edition T.A. Brown.
8. Genomics Cantor C.R., and Smith C.L. John Wiley & Sons. (1999)

Course Code KUS BT24	Title	Unit	Topics	Credit	No. of Lectures
504	**Marine Biotechnology**	I: Marine Biotechnology- Introduction & Bioprospecting	Introduction to Marine Biotechnology- **1 lecture;** The marine ecosystem and its functioning: intertidal, estuarine, salt marsh, mangrove, coral reef, coastal &deep sea ecosystems. Hydrothermal vents- **4 lectures;** Bioprospecting, Marine Microbial Habitats and Their Biotechnologically relevant Microorganisms- **2 lectures;** Methods for Microbial Bioprospecting in Marine Environments **- 2 lectures;** Biotechnological Potential of Marine Microbes **-1 lecture;** Bioactive compounds from other Marine Organisms: fungi, Microalgae, Seaweeds, Actinomycetes, sponges - **5 lectures**	2.5	15
		II: Marine Drugs and Enzymes	Drugs from Marine organisms: Pharmaceutical compounds from marine flora and fauna - marine toxins, antiviral and antimicrobial agents - **4 lectures;** Approved Marine Drugs as Pharmaceuticals **- 2 lecture;** Marine Natural products and its Challenges **- 2 lectures;** Marine Microbial Enzymes- Marine Extremozymes and Their Significance, Current Use of Marine Microbial Enzymes - **7 lectures.**		15
		III: Marine Functional foods and Nutraceuticals	Marine Functional Foods: Marine Sources as Healthy Foods or Reservoirs of Functional Ingredients **-3 lectures;** Marine-Derived Ingredients with Biological Properties- **3 lectures;** Functional Foods Incorporating Marine-Derived Ingredients **-2 lectures;** Marine Nutraceuticals : Marine Bioactives as Potential Nutraceuticals, Functional Carbohydrates, Polyunsaturated Fatty Acids- **3 lectures;** Carotenoids, Soluble Calcium, Fish Collagen and Gelatin, Marine Probiotics **-4 lectures.**		15
		IV: Marine Bioresources and	Marine Bioresources, Marine Secondary Metabolites, Marine Proteins, Marine Lipids- **4 lectures;** Cosmetics from Marine Sources: Scenario of Marine Sources in the Cosmetic Industry, Cosmetics: Definition and Regulations,		15

		Cosmetics	Cosmeceuticals , Target Organs and Cosmetics Delivery Systems , Components of Cosmetics, Major Functions of Some Marine Components in Cosmetics and Cosmeceuticals , Treatments Based on Marine Resources , Products Based on Marine Resources - **11 lectures.**		
		Total			60

References:

1. Kim, S.K. Springer Handbook of Marine Biotechnology; Springer: Berlin, Germany; Heidelberg, Germany, 2015.
2. Nollet, Leo M. L- Marine microorganisms- extraction and analysis of bioactive compounds-CRC Press_Taylor& Francis (2017)
3. R. S. K. Barnes, R. N. Hughes(auth.)-An Introduction to Marine Ecology, Third Edition-Wiley-Blackwell (1999)
4. Blanca Hernández-Ledesma, Miguel Herrero-Bioactive Compounds from Marine Foods-Plant and Animal Sources-Wiley-Blackwell (2013)
5. Fabio Rindi, Anna Soler-Vila, Michael D. Guiry (auth.), Maria Hayes (eds.)-Marine Bioactive Compounds_ Sources, Characterization and Applications-Springer US (2012)
6. W. Evans-Trease and Evans Pharmacognosy 15 th ed.-Saunders (2010)

PRACTICALS

KUSBTP24 503-504 **3 credits** **72hrs**

1. Transformation in *E.coli.*
2. Genomic DNA Extraction: Animal cells.
3. Restriction enzyme digestion and ligation (Kit may be used).
4. Phage titration: *Demonstration*
5. Polymerase chain reaction. *Demonstration*
6. Gradient plate technique
7. Bacterial gene expression (Kit may be used).
8. Study of any 5 marine bacteria and algae (Macro and micro)
9. DPPH assay for antioxidant extracted from marine algae
10. Extraction of carotenoids from marine algae/Bacteria/Fungi
11. Extraction and estimation of Gelatin / Collagen.
12. Extraction of alkaloids from marine organisms and their separation by TLC.

Course Code KUSBTAC24 601	Title	Unit	Topics	Credits	Lectures
Applied component	**Biosafety**	I: Introduction to biosafety	Introduction - **1 lecture** Biological Risk Assessment, Hazardous Characteristics of an Agent- **2 lectures;** Genetically modified agent hazards - **1 lecture**; Cell cultures - **1 lecture;** Hazardous Characteristics of Laboratory Procedures - **1 lecture;** Potential Hazards Associated with Work Practices – **2 lectures;** Safety Equipment and Facility Safeguards - **2 lectures**; Pathogenic risk and management - **2 lectures**	2.0	15
		II: GLP	Concept of GLP- **1 lectures;** Practicing GLP- **1 lecture**; Guidelines to GLP - **2 lectures;** Documentation of Laboratory work - **1 lectures;** Preparation of SOPs - **2 lectures**; Calibration records - **1 lectures;** Validation of methods - **1 lectures;** Documentation of results - **1 lecture**; Audits & Audit reports - **1 lecture.**		12
		III: Detection and testing of contaminants	Microbial Contamination in food and pharma product - **3 lectures**; Some common microbial contaminants - **3 lectures;** Microbiological Assays for pharmaceutical products - **4 lectures**; Regulatory Microbiological testing in pharmaceuticals - **3 lectures.**		12
		IV: Biosafety in Biotechnology	Concepts on biosafety in Biotechnology - **2 lectures;** Regulating rDNA technology -**2 lectures;** Regulating food and food ingredients -**3 lectures;** Genetically engineered crops, livestock Bioethics -**3 lectures;** Contemporary issues in Bioethics - **2 lectures.**		12
		Total			**48**

References:

1. Pharmaceutical Microbiology - Hugo, W.B, Russell, A.D 6th edition Oxford Black Scientific Publishers.
2. Biosafety in Microbiological and Biomedical Laboratories - 5th Edition, L. Casey Chosewood Deborah E. Wilson U.S. Department of Health and Human Services Centers for Disease Control and Prevention National Institutes of Health.
3. Molecular Biotechnology –Principles and Applications of Recombinant DNA Glick, B.R, Pasternak, J.J Patten, C.L 3rd edition ASM press

PRACTICALS

KUSBTACP24 501

Applied Component- Biosafety 2 Credits 48hours

1. Validation of micropipette, measuring cylinders, colorimeters
2. Calibration of pH meter and weighing balance
3. Vitamin B12 bioassay
4. Testing for adulterants in food; ex. Starch in milk
5. Making SOP for any 2 major laboratory instruments
6. Sterility of injectables

Semester VI

Course Code KUS BT24	Title	Unit	Topics	Credits	Lectures
601	**Biochemistry**	I: Protein Biochemistry	Protein structure: Protein Tertiary and Quaternary Structures **-2 Lectures;** Protein Denaturation and Folding – **3 Lectures**; Protein Function: Reversible Binding of a Protein to a Ligand: Oxygen-Binding Proteins – **2 Lectures;** Complementary Interactions between Proteins and Ligands: Immunoglobulins – **1 Lecture**; Protein Interactions Modulated by Chemical Energy: Actin, Myosin, and Molecular Motors **-3 Lectures**; Protein purification – **4 Lectures.**	2.5	15
		II: Metabolism	Carbohydrate biosynthesis and its regulation: Peptidoglycan in Bacteria **-2 Lectures;** Starch and sucrose in Plants **-4 Lectures;** Glycogen in Animals **- 4 Lectures;** Biosynthesis and regulation of Cholesterol, Atherosclerosis – **5 Lectures.**		15
		III: Endocrinology	Mechanism of action of group I and II hormones- **1 Lecture;** Structure, storage, release, transport, biochemical functions and disorders associated with hormones secreted by Hypothalamus **-1 Lecture;** Anterior Pituitary gland - GH, stimulating hormones) **-1 Lecture;** Posterior Pituitary gland – oxcytocin and vasopressin **-1 Lecture;** Thyroid gland – Thyroxine, calcitonin - **2 Lectures;** Parathyroid gland – PTH **-1 Lecture;** Adrenal medulla – epinephrine and norepinehprine **-1 Lecture;** Adrenal cortex – Glucocortocoids - **1 Lecture;** Pancreas – insulin and glucagon **- 2 Lectures;** Female Gonads – estrogen and progesterone **- 2 Lectures;** Male gonads – testosterone- **1 Lecture;** Placenta – hCG **- 1 Lecture.**		15
		IV:	Minerals and Vitamins;		

		Nutrition	Dietary sources, bioactive form, functions and disorders associated with fat soluble (A D E K) and water soluble vitamins- **7 Lectures;** Minerals - physiological and biochemical functions of principal and trace elements. - **7 Lectures;** Malnutrition – Over nutrition (obesity) and PEM (Kwashiorkor and Marasmus)- **1 Lecture.**		15
		Total			60

References:

1. Lehninger, principles of biochemistry, 4th edition (2005), David Nelson and Michael Cox *W.H. Freeman* and Company, New York.
2. Biochemistry , 4th edition (2010), Voet and Voet, John Wiley and sons, USA
3. Harper's Illustrated Biochemistry, 27th edition, RK Murray, DK Granner, PA Mayes and VW Rodwell, McGraw Hills publication.
4. Biochemistry, 4nd edition (2017), Satyanarayana and Chakrapani, Books & Allied (P) Ltd
5. Nutrition Science, 6th edition (2017), Srilakshmi, new age international publishers.

Course Code KUS BT24	Title	Unit	Topics	Credit	No. of Lectures
602	**Industrial Microbiology**	I: Dairy technology	Milk: Normal flora, changes in raw milk - **2 lectures;** Enumeration - **1 lecture**; Factors affecting bacteriological quality - **1 lecture**; Dairy technology Preservation methods - **2 lectures**; Pasteurization- **1 lecture**; Starter Cultures - **2 lectures;** Fermented products-Production process and spoilage of Cheese: Swiss and Cheddar - **2 lectures;** Butter - **2 lectures;** Yogurt - **1 lectures** and Buttermilk - **1 lecture.**	2.5	15
		II: Down-stream Processing (DSP)	Introduction of DSP - **2 lectures;** Foam separation - **1 lecture**; Types of Precipitation - **1 lecture**; Filtration **2 lectures**, Centrifugation - **1 lecture;** Chromatography in DSP - **2 lectures;** Cell disruption- physical and chemical methods - **2 lectures;** Solvent recovery, Membrane processes - **1 lecture;** Drying - **1 lecture**; Crystallization and Whole broth processing - **2 lectures**.		15
		III: Fermentation process	Introduction to Inoculum development - **2 lectures;** Bacterial and fungal inoculum development with one example each - **3 lectures**, scale up, scale down - **2 lectures**; Production of: Streptomycin - **1 lecture;** Protease - **1 lecture;** Mushroom - **1 lecture;** Glutamic acid - **1 lecture;** Lysine - **1 lecture,** ethanol production **1 lecture** Semi-synthetic Penicillin **1 lecture**, Biotransformation - **1 lecture.**		15
		IV: QA-QC	Concept of GMP- **1 Lectures;** Requirements of GMP implementation - **2 Lectures;** Documentation of GMP practices - **2 Lectures**; Regulatory certification of GMP - **2 Lectures;** Quality Control (QC**)**: Concept of QC - **2 Lectures;** Requirements for implementing QC -		15

			2 Lectures; QA concepts: Concept of QA - **2 Lectures;** Requirements for implementing - **2 Lectures**.		
		Total			60

References:

1. Applied Dairy Microbiology Elmer H Marth and James L Steele Mercel Dekker Inc New York, 2nd edition
2. Microbial Technology Peppler,H.J and Perlman,D 2nd Academic Press Practicals
3. Industrial Microbiology Prescott and Dunn CBS publishers
4. Dairy technology by Yadav and Grower
5. Fermentation technology by Stanbury and Whittkar
6. Pharmaceutical Microbiology by Russel and Hugo

PRACTICALS

KUSBTP24 601-602 **3 credits** **72hrs**

1. Estimation of Milk protein-Pynes method
2. Microbial analysis of Milk by MBRT and RRT
3. Phosphatase test in Milk
4. DMC of milk sample
5. Isolation of Normal flora from Milk and curd
6. Determination of blood glucose levels for detection of diabetes mellitus.
7. Determination of serum cholesterol (total, HDL and LDL ratio)
8. Estimation vitamin C by DCPIP method from food samples.

Course Code KUSBT 24	Title	Unit	Topics	Credits	No of Lectures
603	**Basic pharmacology and Neurochemistry**	I: General principles of Pharmacology	Mechanism of drug action - **2 Lectures;** drug receptors and biological responses - **2 Lectures;** second-messenger systems, the chemistry of drug–receptor binding - **2 Lectures;** dose–response relationship: therapeutic index - **3 Lectures;** ED, LD, - **2 Lectures;** Potency and Intrinsic Activity - **2 Lectures;** Drug antagonism - **2 Lectures.**	2.5	15
		II: Drug Absorption and Distribution	Absorption of drugs from the alimentary tract - **2 Lectures;** factors affecting rate of gastrointestinal absorption - **2 Lectures;** absorption of drugs from lungs - **1 Lecture;** skin - **1 Lecture;** absorption of drugs after parenteral administration factors influencing drug distribution - **2 Lectures;** binding of drugs to plasma proteins - **2 Lectures;** Physiological barriers to drug distribution - **3 Lectures.**		15
		III: Basic Toxicology and Regulatory Toxicology	Background Definitions - **1 Lectures;** Causation: degrees of certainty Classification - **1 Lectures;** Causes Allergy in response to drugs Effects of prolonged administration: chronic organ toxicity - **2 Lectures;** Adverse effects on reproduction - **1 Lecture;** <u>Poisons</u>: Deliberate and accidental self-poisoning Principles of treatment Poison-specific measures General measures - **2 Lectures;** Specific poisonings: cyanide, methanol, ethylene glycol, hydrocarbons, volatile solvents, heavy metals, - **3 Lectures;** herbicides and pesticides, - **2 Lectures;** biological substances (overdose of medicinal drugs is dealt with under individual agents**)** - **1 Lecture;** Incapacitating agents: drugs used for torture - **1 Lecture;** Nonmedical use of drugs - **1 Lecture.**		15
		IV: Neurochemistry	Anatomy and functioning of the brain - **2 Lectures;** Neuronal pathways - **2 Lectures;**		15

			Propogation of nerve impulses - **2 Lectures;** Neuronal excitation and inhibition - **3 Lectures;** Synapses and gap junctions - **3 Lectures;** Action of Neuro toxins and neurotransmitters - **3 Lectures.**		
		Total			60

References:

1. Textbook of Medical Physiology Guyton, A.C and Hall 11th edition J.E Saunders
2. Modern Pharmacology with clinical Applications Craig,C.R, Stitzel,R.E 5th edition
3. Clinical Pharmacology Bennet,PN,Brown,M.J, Sharma,P 11th edition Elsevier
4. Biochemistry Metzler, D.E Elsevier

Course Code KUSBT24	Title	Unit	Topics	Credits	No of Lectures
604	**Environmental Biotechnology**	I: Renewable sources of energy	Energy sources renewable – solar energy, wind power, geothermal energy and hydropower, biomass energy - **5 Lectures;** Biogas technology- biogas plant & types, biodigester. Biogas- composition, production and factors affecting production, uses - **5 Lectures;** Biofuels – ethanol production. Microbial hydrogen production Biodiesel, Petrocrops - **5 Lectures;**	2.5	15
		II Industrial effluent treatment	Biological processes for industrial effluent treatment, aerobic biological treatment- activated sludge process, CASP, advanced activated sludge processes (any two) Biological filters, RBC, FBR - **5 Lectures;** Anaerobic biological treatment- contact digesters, packed bed reactors, anaerobic baffled digesters, UASB - **3 Lectures;** Solid waste treatment - **2 Lectures;** pollution indicators & biosensors - **2 Lectures;** biodegradation of xenobiotics- persistent compounds, chemical properties influencing biodegradability, microorganisms in biodegradation - **2 Lectures;** Use of immobilized enzymes or microbial cells for treatment - **1 Lecture.**		15
		III Wastewater treatment	Wastewater treatment- introduction, biological treatment, impact of pollutants on biotreatment, use of packaged organisms and genetically engineered organisms in waste treatment - **5 Lectures;** Heavy metal pollution – sources, microbial systems for heavy metal accumulation, techniques used for heavy metal removal - **5 Lectures;** biosorption by bacteria, fungi and algae, factors affecting biosorption limitations of biosorption - **5 Lectures.**		15
		IV Hazardous waste management	Biodegradation of waste from tanning industry - **2 Lectures;** petroleum industry - **2 Lectures;** paper & pulp industry - **2 Lectures;** Dairy - **2 Lectures;** Distillery - **2 Lectures;** Dye - **1 Lecture;** Antibiotic industry - **2 Lectures;** Removal of oil spillage & grease deposits - **2 Lectures.**		15
		Total			60

References:

1. Environmental Biotechnology Allan Scragg Oxford University press
2. Environmental Biotechnology (Basic concepts and applications) Indu Shekar Thakur IK International
3. Environmental Biotechnology (Industrial pollution management) S.D. Jogdand Himalaya Publishing House

PRACTICALS

KUSBTP24 603-604 **3 credits** **72hrs**

1. LD 50, ED 50 evaluation using suitable models e.x daphnia
2. Study the effect of heavy metals on the growth of bacteria.
3. Determination of Total Solids from an effluent sample.
4. Study of physico-chemical (pH, color, turbidity, BOD, COD) parameters of any one industrial effluent sample
5. Estimation of chromium from Effluents (Demonstration)
6. Visit to ETP/ CETP

Course Code KUSBTAC24 601	Title	Unit	Topics	Credit	No. of Lectures
Applied component	**Agri Biotechnology**	I: Precision Agriculture and Agriculture systems	Introduction to Agriculture and Agriculture systems- **1 Lecture;** Green house Technology-- Types of green house, importance, functions and features of green house, Design criteria and calculation -**2 Lectures;** Construction material, covering material and its characteristics, growing media, green house irrigation system. nutrient management -**3 Lectures;** Greenhouse heating, cooling and shedding and ventilation system, Computer controlled environment - **3 Lectures**;, Phytotrons, fertigation and roof system -**1 Lecture;** Precision Cultivation- tools, sensors for information acquisition -**2 Lectures.**	2	12
		II: Plant stress biology	Abiotic stress –Physiological and molecular responses of plants to water stress, salinity stress, temperature stress – heat and cold, Photooxidative stress, stress perception and stress signaling pathways, Ionic and osmotic homeostasis, reactive oxygen species scavenging- **4 Lectures;** Biotic stress - plant interaction with bacterial, viral and fungal pathogens, plant responses to pathogen– biochemical and molecular basis of host-plant resistance , toxins of fungi and bacteria , systemic and induced resistance –pathogen derived resistance, signalling - **8 Lectures.**		12
		III: Molecular Markers in Plant Breeding	Genetic markers in plant breeding-- Classical markers, DNA markers (RFLP, RAPD, AFLP, SSR, SNP)- **4 Lectures;** Application of Molecular Markers to Plant Breeding [quantitative trait locus (QTL) mapping] - **4 Lectures;** Plant DNA Barcoding- Barcoding Markers (matK, rbcl, ITS, tmH-psbA), steps, recent advances, Benefits, Limitations - **4 Lectures.**		12

		IV: Biofertilizers and Biopesticides	Biofertilizer: Nitrogen-fixing Rhizobacteria - Symbiotic Nitrogen Fixers -**2 Lectures;** Nonsymbiotic Nitrogen Fixers Plant Growth Promoting Microorganisms-Phosphate-Solubilizing Microbes (PSM), Phytohormones and Cytokinins, Induced Systemic Resistance- **2 Lectures;** Plant Growth Promotion by Fungi--Mycorrhizae Arbuscular Mycorrhizae Ectomycorrhizae **-2 Lectures;** Microbial Inoculants -- Inocula, Carriers, and Applications, Monoculture and Co-culture Inoculant Formulations Biocontrol, Polymicrobial Inoculant Formulations-**3 Lectures;** Biopesticides – types, Bacillus thuringiensis, insect viruses and entomopathogenic fungi (characteristics, physiology, mechanism of action and application) **-3 Lectures.**		12

References:

1. M. Ajmal Ali, G. Gyulai, F. Al-Hemaid -Plant DNA Barcoding and Phylogenetics, LAP Lambert Academic Publishing (2015)
2. P. Parvatha Reddy (auth.)-Sustainable Crop Protection under Protected Cultivation-Springer Singapore (2016)
3. S.B. Anderson (ed.), Plant Breeding from Laboratories to Fields, InTech,2013
4. Henry Leung, Subhas Chandra Mukhopadhyay (eds.) - Intelligent Environmental Sensing (2015, Springer International Publishing)
5. Travis R. Glare, Maria E. Moran-Diez - Microbial-Based Biopesticides_ Methods and Protocols (2016, Humana Press)
6. Altieri, Miguel A.Farrell, John G-Agroecology- The Science Of Sustainable Agriculture, Second Edition-CRC Press (2018)
7. Arie Altman, Paul Michael Hasegawa-Plant Biotechnology and Agriculture_ Prospects for the 21st Century-Academic Press (2011)

PRACTICALS

Applied component-Agri-Biotechnology

KUSBTACP24 601 **2 credits** **48 hrs**

1. RAPD analysis demonstration experiment
2. Isolation of Rhizobium
3. Isolation of Azotobacter
4. Isolation of Phosphate solubilising bacteria
5. Study of effect of abiotic stress on plants.
6. Rapid screening tests for abiotic stress tolerance (drought, - PEG, Mannitol &salinity NaCl)
7. Estimation of antioxidants and antioxidant enzymes - Ascorbate, Catalase, and Peroxidase
8. Visit to green house facility and submission of field visit report.

Evaluation Scheme for First Year(UG) under AUTONOMY

I. Internal Evaluation for Theory Courses – 40 Marks

(i) Continuous Internal Assessment 1 (Assignment-Tutorial/ Presentations) – 20 Marks
(ii) Class Internal Assessment 2 – 20 Marks (Class Test with Fill in the Blanks, True or False & Answer the following)

II. External Examination for Theory Courses – 60 Marks

Duration: 2 Hours
Theory question paper pattern:
All questions are compulsory.

Question	Based on	Options	Marks
Q.1	Unit I, II, III,	*Any 12 out of 15 (MCQ/FIB)*	12
Q.2	Unit I	*Any 2 out of 4*	12 (6+6)
Q.3	Unit II	*Any 2 out of 4*	12 (6+6)
Q.4	Unit III	*Any 2 out of 4*	12 (6+6)
Q.5	Unit I, II, III,	*Any 3 out of 6*	12 (4+4+4)

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 50 Marks (30 marks External + 20 marks Internal)
- Duration: 2 Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be attended.
- Certified Journal is compulsory for appearing at the time of Practical Exam

During the academic year 2024-2025, the University of Mumbai is set to revise the syllabus for T.Y.B.Sc Biotechnology. Department of Biotechnology of Kirti M. Doongursee College will adopt syllabus with the changes made by the university.