



### Department of Biotechnology

### B.Sc. Biotechnology

S.No.	Course Code	Course Name	Course Outcomes
<b>SEMESTER- I</b>			
1.	21UBTC11	Core Course - I: Cell Biology and Genetics	<b>CO1[K1]:</b> define the cell regulations and gene interactions <b>CO2[K2]:</b> illustrate the structure and functions of cellular components <b>CO3[K3]:</b> determine the factors responsible for inherited disorders <b>CO4[K4]:</b> compare the different stages of cell cycles <b>CO5[K4]:</b> differentiate linkage and crossing over
2.	21UBTC1P	Core Course - II: Practical: Cell Biology and Genetics	<b>CO1[K2]:</b> demonstrate the preparation of mounting cytogenetic techniques <b>CO2[K3]:</b> apply basic knowledge of cells and genes <b>CO3[K4]:</b> distinguish internal structural organization of plant and animal cells <b>CO4[K5]:</b> evaluate the stages of cell division in plants <b>CO5[K6]:</b> perform monohybrid and dihybrid cross
3.	21UBTS11	Skill Enhancement Course - I: Biotechnology and Human Welfare	<b>CO1[K1]:</b> outline the Biotechnological tools and their products for commercial purposes <b>CO2[K2]:</b> explain the basic techniques of Biotechnology. <b>CO3[K3]:</b> determine the steps involved in gene cloning <b>CO4[K4]:</b> analyse the role of Biotechnology in Pollution control <b>CO5[K4]:</b> differentiate the primary and secondary metabolites
<b>SEMESTER- II</b>			
4.	21UBTC21	Core Course - III: Biochemistry and	<b>CO1[K1]:</b> describe the catabolic reactions of carbohydrates, lipids and amino acids



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		Metabolism	<b>CO2[K2]:</b> explain the properties of Biomolecules <b>CO3[K3]:</b> determine the mechanism of enzyme actions <b>CO4[K4]:</b> analyse the role of enzymes in metabolic pathways <b>CO5[K4]:</b> classify biomolecules based on structure and function
5.	21UBTC2P	Core Course - IV: Practical: Biochemistry	<b>CO1[K2]:</b> illustrate the principles of instruments used in biochemistry <b>CO2[K3]:</b> perform the analytical techniques for the estimation of Biomolecules <b>CO3[K4]:</b> analyse the chromatographic techniques to separate Biomolecules <b>CO4[K5]:</b> evaluate the effect of physical factors in enzyme synthesis <b>CO5[K6]:</b> prepare phosphate and acetate buffers
6.	21UBTS21	Skill Enhancement Course - II: Plant and Animal Physiology	<b>CO1[K1]:</b> describe the mechanism of digestion of food materials in animals <b>CO2[K2]:</b> illustrate various physiological processes in plants <b>CO3[K3]:</b> determine the mechanism of circulation in animals <b>CO4[K4]:</b> discriminate the metabolic pathways in plants <b>CO5[K4]:</b> analyse the process of photosynthesis in plants
<b>SEMESTER- III</b>			
7.	21UBTC31	Core Course - V: Microbiology	<b>CO1[K1]:</b> describe the principles and working mechanism of microscopes <b>CO2[K2]:</b> differentiate the microorganisms based on their morphology <b>CO3[K3]:</b> determine the aspects of microbial nutrition and growth <b>CO4[K4]:</b> classify and identify the microorganisms taxonomically <b>CO5[K5]:</b> appraise the diversity of microorganisms
8.	21UBTC3P	Core Course - VI: Practical: Microbiology	<b>CO1[K2]:</b> demonstrate the safe practices in a microbiology laboratory <b>CO2[K3]:</b> perform the techniques for pure culture isolation and maintenance



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			<p><b>CO3[K4]:</b> distinguish the microorganisms morphologically by using staining techniques</p> <p><b>CO4[K5]:</b> choose the selective media for the cultivation of microbes</p> <p><b>CO5[K6]:</b> elaborate the antibacterial potential of microorganisms</p>
9.	21UBTA31	Allied Course - III: Biological Sciences	<p><b>CO1[K1]:</b> list out the economic importance of plants and microorganisms</p> <p><b>CO2[K2]:</b> illustrate the systems of classification</p> <p><b>CO3[K3]:</b> dramatize the general characters and life cycle of algae, fungi, plants, Invertebrates and chordates</p> <p><b>CO4[K4]:</b> differentiate the dicot plants from monocot plants</p> <p><b>CO5[K5]:</b> assess the evolutionary changes that occur in simple to complex Organisms</p>
10.	21UBTA3P	Allied Course - III: Practical: Biological Sciences	<p><b>CO1[K2]:</b> explain the vegetative and reproductive structures of algae, fungi and plants</p> <p><b>CO2[K3]:</b> perform the dissection of dicot flowers</p> <p><b>CO3[K4]:</b> distinguish animals based on their morphology</p> <p><b>CO4[K5]:</b> assess the external, digestive and reproductive system of animals</p> <p><b>CO5[K6]:</b> elaborate physiological characteristics of plants and animals</p>
11.	21UBTN31	Non Major Elective Course - I: Infectious Diseases	<p><b>CO1[K1]:</b> describe the principles of infectious diseases.</p> <p><b>CO2[K2]:</b> explain the epidemiology of infectious diseases</p> <p><b>CO3[K3]:</b> determine the diagnosis and treatment of various diseases</p> <p><b>CO4[K4]:</b> differentiate communicable and noncommunicable diseases</p> <p><b>CO5[K4]:</b> analyse the mode of transmission of pathogens</p>
12.	21UBTS31	Skill Enhancement	<b>CO1[K2]:</b> explain the techniques used in the culture of edible mushrooms



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		Course - III: Practical: Entrepreneurship In Biotechnology – I	<b>CO2[K3]:</b> determine the commercially important algae for mass production <b>CO3[K4]:</b> analyse the factors influencing Spirullina cultivation <b>CO4 [K5]:</b> appraise the advance methods involved in silk production <b>CO5 [K6]:</b> elaborate the life cycle of Honey bee
<b>SEMESTER- IV</b>			
13.	21UBTC41	Core Course - VII: Molecular Biology and Microbial Genetics	<b>CO1[K1]:</b> outline the concepts of central dogma of cell <b>CO2[K2]:</b> illustrate the causes of genetic variations by mutation <b>CO3[K3]:</b> determine the role of enzymes in molecular events <b>CO4[K4]:</b> analyse the factors and mechanisms in DNA damage and Repair <b>CO5[K5]:</b> justify the benefits of transposable elements in microbial genetics
14.	21UBTC4P	Core Course - VIII: Practical: Molecular Biology and Microbial Genetics	<b>CO1[K2]:</b> demonstrate the principles of electrophoresis <b>CO2[K3]:</b> perform nucleic acids isolation and quantification from biological samples <b>CO3[K4]:</b> examine the effect of mutagens in the isolation of auxotrophic mutants <b>CO4[K5]:</b> assess the role of enzymes in microbial genetics <b>CO5[K6]:</b> elaborate the microbial gene transfer techniques
15.	21UBTA41	Allied Course - IV: Bioanalytical Tools	<b>CO1[K1]:</b> state the principles and working mechanism of microscopes <b>CO2[K2]:</b> explain the principles and applications of chromatography and spectrometry <b>CO3[K3]:</b> apply the electrophoresis technique in separation of biomolecules



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			<p><b>CO4[K4]:</b> analyse the role of radioactive isotopes in bioanalytical techniques</p> <p><b>CO5[K5]:</b> appraise the importance of biosensors</p>
16.	21UBTA4P	Allied Course - IV: Practical: Bioanalytical Tools	<p><b>CO1[K2]:</b> estimate the lipids and antioxidants in biological samples</p> <p><b>CO2[K3]:</b> apply the knowledge of blotting techniques in identification of proteins</p> <p><b>CO3[K4]:</b> examine the morphology of plant and animal tissues using Microscopes</p> <p><b>CO4[K5]:</b> choose the appropriate technique for the separation of plant pigments</p> <p><b>CO5[K6]:</b> prepare subcellular fractions from rat liver cells</p>
17.	21UBTM41	Self Paced Learning (Swayam Course) Cell Culture Technologies	<p><b>CO1[K1]:</b> identify the background and the key words in cell culture technologies</p> <p><b>CO2[K2]:</b> demonstrate independent and self-paced learning for clear Understanding of the concept</p> <p><b>CO3[K3]:</b> develop computer and communication skills to broaden their knowledge in the course</p> <p><b>CO4[K3]:</b> use high quality reading resources, communication tools and technology to send assignments and to take up test</p> <p><b>CO5 [K4]:</b> analyse critically and apply technical skills to comprehend the ideas or theories in the video lectures</p>
18.	21UBTM42	Self Paced Learning (Swayam Course) Cell Culture Technologies	<p><b>CO1[K1]:</b> identify the background and the key words in cell culture technologies</p> <p><b>CO2[K2]:</b> demonstrate independent and self-paced learning for clear Understanding of the concept</p> <p><b>CO3[K3]:</b> develop computer and communication skills to broaden their</p>





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			<p>knowledge in the course</p> <p><b>CO4[K3]:</b> use high quality reading resources, communication tools and technology to send assignments and to take up test</p> <p><b>CO5 [K4]:</b> analyse critically and apply technical skills to comprehend the ideas or theories in the video lectures</p>
19.	21UBTN41	Non Major Elective Course - II: Mushroom Cultivation	<p><b>CO1[K1]:</b> describe the general structure and Morphology of Mushrooms and their nutritional values</p> <p><b>CO2[K2]:</b> classify edible and non - edible mushrooms</p> <p><b>CO3[K3]:</b> apply various control measures for Pests and disease</p> <p><b>CO4[K4]:</b> examine the opportunities in preparing Value added products and their market value.</p> <p><b>CO5[K4]:</b> analyse suitable method to cultivate mushrooms</p>
20.	21UBTS41	Skill Enhancement Course - IV: Practical: Entrepreneurship in Biotechnology - II	<p><b>CO1[K2]:</b> explain the techniques used in vermicomposting</p> <p><b>CO2[K3]:</b> determine the commercially important microorganisms for wine production</p> <p><b>CO3[K4]:</b> analyse the factors affecting aquaculture</p> <p><b>CO4[K5]:</b> appraise the advance methods involved in aquaculture</p> <p><b>CO5[K6]:</b> elaborate the role of microorganisms in biogas production</p>
<b>SEMESTER- V</b>			
21.	21UBTC51	Core Course - IX: Plant Biotechnology	<p><b>CO1[K1]:</b> outline the organization and structural features of plant genome</p> <p><b>CO2[K2]:</b> illustrate the types of culturing plant tissue</p> <p><b>CO3[K3]:</b> choose the appropriate method for gene transfer in plants</p> <p><b>CO4[K4]:</b> analyse the role of markers and reporters in gene expression</p> <p><b>CO5[K5]:</b> appraise the applications of genetic engineering in crop development</p>



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22.	21UBTC52	Core Course - X: Animal Biotechnology	<b>CO1[K1]:</b> outline the concepts in animal tissue culture <b>CO2[K2]:</b> illustrate the ethical issues related to animal studies <b>CO3[K3]:</b> apply the gene transfer techniques to develop transgenic animals <b>CO4[K4]:</b> analyse the role of viral vectors in gene transfer <b>CO5[K4]:</b> differentiate primary and secondary cell lines
23.	21UBTC53	Core Course - XI: Food Biotechnology	<b>CO1[K1]:</b> outline the nutritive value of foods <b>CO2[K2]:</b> illustrate the food safety guidelines <b>CO3[K3]:</b> determine the impact of adulterants in food <b>CO4[K4]:</b> analyse the food borne infections caused by food pathogens <b>CO5[K4]:</b> classify the methods of preservation
24.	21UBTC5P	Core Course - XII: Practical: Plant, Animal And Food Biotechnology	<b>CO1[K2]:</b> illustrate the types of media in plant and animal tissue culture <b>CO2[K3]:</b> apply the concepts and principles of Plant tissue culture to develop the plant hybrids <b>CO3[K4]:</b> analyse the cell viability and cytotoxicity of animal cells <b>CO4[K5]:</b> assess the microbial population in different food samples <b>CO5[K6]:</b> develop primary cell lines from chick embryo
25.	21UBTO51	Major Elective Course - I: Biostatistics	<b>CO1[K1]:</b> outline the basic concepts in Statistics methods <b>CO2[K2]:</b> illustrate the methods in collection and representation of data <b>CO3[K3]:</b> apply appropriate statistical methods for analysing one or two variables <b>CO4[K4]:</b> analyse the role of software packages in statistical analysis <b>CO5[K4]:</b> differentiate parametric and nonparametric statistics
26.	21UBTO52	Major Elective Course - I: Biophysics	<b>CO1[K1]:</b> outline the basic principles of biophysics <b>CO2[K2]:</b> demonstrate the theoretical aspects of biophysical techniques



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			<b>CO3[K3]:</b> apply suitable biophysical technique to analyse biological samples <b>CO4[K4]:</b> determine the role of radiolabelling techniques to detect in radioisotopes <b>CO5[K4]:</b> analyse the molecular structure of biomolecules using spectroscopy
27.	21UBTO53	Major Elective Course - I: Bioinstrumentation	<b>CO1[K1]:</b> outline the basic principles of bioinstruments <b>CO2[K2]:</b> demonstrate the working mechanism of bioinstruments <b>CO3[K3]:</b> apply suitable chromatographic techniques to separate biological samples <b>CO4[K4]:</b> determine the role of various detectors in measuring radioactivity <b>CO5[K4]:</b> analyse applications of cryopreservation technique in tissue processing
28.	21UBTO54	Major Elective Course - II: Genetically Modified Organisms	<b>CO1[K1]:</b> describe the methods for producing GMO <b>CO2[K2]:</b> illustrate the ethical issues related to GMO <b>CO3[K3]:</b> apply gene manipulation technique in crop productivity <b>CO4[K4]:</b> analyse the importance of GMO in environmental protection <b>CO5[K5]:</b> evaluate the Biosafety concerns of genetically modified crops
29.	21UBTO55	Major Elective Course - II: Natural Products	<b>CO1[K1]:</b> outline the scope of metabolites produced by plants <b>CO2[K2]:</b> illustrate the methods of synthesis of secondary metabolites <b>CO3[K3]:</b> determine the biotechnological applications of metabolites <b>CO4[K4]:</b> analyse the role of metabolic engineering for the production of plant products





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			<b>CO5[K5]:</b> appraise the functions of primary and secondary metabolites
30.	21UBTO56	Major Elective Course - II: Medicinal Plants	<b>CO1[K1]:</b> identify medicinal plants (family/genus - level) <b>CO2[K2]:</b> demonstrate the importance of medicinal plants <b>CO3[K3]:</b> apply suitable techniques for the processing of medicinal plants <b>CO4[K4]:</b> analyse the role of role of ethnobotany in modern Medicine <b>CO5[K5]:</b> assess the economic importance of medicinal plants
31.	21UBTS51	Skill Enhancement Course - V: Nanobiotechnology And Cancer Biology	<b>CO1[K1]:</b> define the structural properties of nanomaterial <b>CO2[K2]:</b> illustrate the different methods of nanomaterial synthesis <b>CO3[K3]:</b> determine the application of nanoparticles in drug delivery and therapy <b>CO4[K4]:</b> analyse the mechanisms of cancer development <b>CO5 [K5]:</b> assess the role of carcinogen in causing cancer
32.	21UBTJ51	Internship	<b>CO1[K2]:</b> demonstrate depth of expertise in coherent area of biotechnology <b>CO2[K3]:</b> employ technical information using scientific communications, scientific operations and procedures <b>CO3[K3]:</b> develop effective oral and written communication skills in the field of biotechnology <b>CO4[K6]:</b> develop hands on training experience and skill in biotechnology <b>CO5[K6]:</b> create awareness on logistic and economic and realities of functioning in a work environment
<b>SEMESTER- VI</b>			
33.	21UBTC61	Core Course - XIII: Recombinant DNA Technology and	<b>CO1[K1]:</b> list out the enzymes used in recombinant DNA technology. <b>CO2[K2]:</b> explain the biology of cloning vectors <b>CO3[K3]:</b> choose the suitable method for finger print identification



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		Forensic Science	<b>CO4[K4]:</b> distinguish the differences in the DNA patterns through DNA profiling <b>CO5[K4]:</b> analyse different methods of DNA sequencing
34.	21UBTC62	Core Course - XIV: Immunology and Immunotechnology	<b>CO1[K1]:</b> detail the organization of the immune system and their functions <b>CO2[K2]:</b> illustrate the types of Antigen and Immunoglobulin <b>CO3[K3]:</b> choose the appropriate Immunotechniques for diagnosis <b>CO4[K4]:</b> analyse the factors responsible for Immunodeficiency and auto immune disease <b>CO5[K4]:</b> differentiate cell mediated and humoral immune response
35.	21UBTC63	Core Course - XV: Industrial Biotechnology	<b>CO1[K1]:</b> describe the concepts of fermentation <b>CO2[K2]:</b> illustrate the importance of strain improvement <b>CO3[K3]:</b> choose the suitable downstream processing method for product recovery <b>CO4[K4]:</b> analyse the role of microbes in Bioremediation and waste management <b>CO5[K5]:</b> appraise the applications of Industrial Biotechnology
36.	21UBTC6P	Core Course - XVI: Practical: Recombinant DNA Technology and Industrial Biotechnology	<b>CO1[K2]:</b> explain the procedure to extract DNA from different biological sample <b>CO2[K3]:</b> apply the electrophoresis technique to separate DNA, RNA and Plasmid <b>CO3[K4]:</b> differentiate the recombinants from non - recombinants <b>CO4[K5]:</b> choose the suitable method to isolate industrial important microbes <b>CO5[K6]:</b> produce fermented beverages using small scale production
37.	21UBTC6Q	Core Course- XVII:	<b>CO1[K2]:</b> demonstrate the Immunotechniques



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		Practical: Immunology and Immunotechnology	<b>CO2[K3]:</b> perform ELISA <b>CO3[K4]:</b> analyse the WBC and RBC count using heamocytometer <b>CO4[K5]:</b> choose the appropriate bleeding and immunization method <b>CO5[K6]:</b> prepare serum and complement
38.	21UBTO61	Major Elective Course- III: IPR, Bioethics and Biosafety	<b>CO1[K1]:</b> define various forms of intellectual property rights <b>CO2[K2]:</b> illustrate guidelines of patenting the biological materials <b>CO3[K3]:</b> determine the importance of biosafety measures to be followed in laboratory <b>CO4[K4]:</b> analyse the ethical issues related to stem cell research and gene cloning <b>CO5[K4]:</b> distinguish patentable and nonpatentable products
39.	21PBTO62	Major Elective Course - III: Evolutionary Biology	<b>CO1[K1]:</b> outline the concepts of life origin on earth <b>CO2[K2]:</b> explain the theories of Evolution. <b>CO3[K3]:</b> apply H - W Law to detect the allele and genotype frequencies in a population. <b>CO4[K4]:</b> analyse the role of mass extinction in evolution. <b>CO5[K4]:</b> differentiate the principles of Macro and Micro evolution
40.	21UBTO63	Major Elective Course - III: Stem Cell Biology	<b>CO1[K1]:</b> list out the types of stem cells. <b>CO2[K2]:</b> explain the basic properties and characterization of stem cells <b>CO3[K3]:</b> determine the role of stem cells in tissue engineering <b>CO4[K4]:</b> analyse the ethical consideration of stem cell research. <b>CO5[K4]:</b> appraise the functions of Stem cell niches



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41.	21UBTS61	Skill Enhancement Course - VI: Bioinformatics and Functional Genomics	<b>CO1[K1]:</b> outline the scope and applications of Bioinformatics <b>CO2[K2]:</b> explain the principles of Microarray technology <b>CO3[K3]:</b> apply the bioinformatic tools in sequence alignment and molecular docking. <b>CO4[K4]:</b> analyse the importance of bioinformatics in gene prediction <b>CO5[K5]:</b> assess the protein interactions using two hybrid system