

## Koneru Lakshmaiah Education Foundation (Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. 08645 - 350200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002, Ph: +91 - 866 - 3500122, 2577715, 2576129.

## DEPARTMENT OF BIOTECHNOLOGY

## B.TECH-BT

ACADEMIC YEAR: 2022-2023

S No	Course Code	Course Title	CO NO.	Description of the Course Outcome
	9	1	CO1	Understand the concepts of grammar to improve communication, reading, and writing skills
1	22UC1101	INTEGRATED	CO2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context and Demonstrate ability to face formal situations / interactions.
к.		PROFESSIONAL ENGLISH	CO3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices
			CO4	Apply the concepts of writing to draft corporate letters, emails, and memos
**	a	ь	CO1	Demonstrating different interpersonal skills for employability
2	22UC1202	ENGLISH PROFICIENCY	CO2	Distinguishing business essential skills
	22001202		CO3	Classifying social media and corporate communication skills
			CO4	Applying analytical thinking skills

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			CO1	Developing critical and analytical reading skills
			CO2	Discovering different interpersonal skills to develop people skills
3	22UC2103	ESSENTIAL SKILLS FOR EMPLYOBAILITY	CO3	To enhance the problem-solving skills of the students through the concepts of Simple Equations, Ratio, Proportion & Variation, Percentages, Profit & Loss, Averages, Allegations, Simple & Compound Interest.
			CO4	Apply diagrammatic representation of the given data to find the possible outcomes in the topics of Deductions, Cubes, Venn Diagrams and Arrangements
		4	CO5	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.
		CORPORATE READINESS SKILLS	CO1	To distinguish product and process and quote them in speaking and writing activities
4	22UC2204		CO2	To apply interpersonal skills
			CO3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.
			CO4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding
		- A	CO1	To understand Constitutional development after Independence
5	22UC0008	INDIAN CONSTITUTION	CO2	To learn the fundamental features of the Indian Constitution
a		SONOTITOTION	CO3	To get a brief idea of the powers and functions of Union and State Governments
		2	CO4	To understand the basics of working of Indian Judiciary and the Election Commission

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			CO1	Understand the importance of Environmental education and conservation of natural resources.
6	22UC0009	ECOLOGY AND	CO2	Understand the importance of ecosystems and biodiversity
		ENVIRONMENT	CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process
			CO4	Understand the importance of Environmental education and conservation of natural resources
		UNIVERSAL HUMAN	C01	Understand and identify the basic aspiration of human beings
7	22UC0010	VALUES & PROFESSIONAL ETHICS	CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.
V.	42	ETHICS	CO3	Analyze the profession and his role in this existence.
		DESIGN THINKING AND INNOVATION	CO1	Understand the basics of design thinking and its implications in product or service development
8	22UC1203		CO2	Understand and Analyze the requirements of a typical problem
			C03	Plan the necessary activities towards solving the problem through ideation and prototyping
			CO4	evaluate the solution and refine them based on the customer feedback
			CO1	Apply measures of efficiency to algorithms and Compare various linear data structures like Stack ADT, Queue ADT, Linked lists.
			CO2	Analyze and compare linear data structures and analyze different searching and hashing techniques
9	23SC1202	DATA STRUCTURES	CO3	Analyze and compare various non – linear data structures like Trees and Graphs
		v v <sup>o</sup>	C04	Analyze and compare various sorting algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in a particular context.
			CO5	Execute lab experiments and develop a small project along with his/her team members.

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			CO 1	Acquire the knowledge of cell and Nuclear Organization
10	10 23BT1101	CELL BIOLOGY	CO 2	Compare Cell division and cell cycle
			CO 3	Acquire the knowledge of tissues and Receptors
			CO 4	Understand membrane Structure
			CO1	Describe the engineering calculations in Bioprocess Technology principles.
11	22BT2221	PROCESS ENGINEERING PRINCIPLES	CO2	Employ the basic principles of ideal gas law for measuring no. of moles of various solutions
-	22012221		CO3	Employ the basic principles of material balance of a various reaction systems and Estimate the chemical and microbial kinetic parameters for better biomass and product formation e
	2	-	CO4	Employ the basic principles of Energy balance of a various reaction systems and Estimate the chemical and microbial kinetic parameters for better biomass and product formation
			CO 1	Acquire the knowledge of terminology and zeroth, first laws of thermodynamics.
12	22BT1202	BIOCHEMICAL THERMODYNAMICS	CO 2	Determine entropy changes and apply second law of thermodynamics.
	22211202		CO 3	Compute thermodynamic properties for fluids.
9		; * _ x	CO 4	Apply chemical engineering thermodynamics to phase and reaction equilibria and design thermodynamic models for microbial growth.

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		g	CO 1	Apply principles of momentum transfer in biological systems
			CO 2	Apply principles of Heat Transfer in Biological systems
13	22BT2208	TRANSPORT PROCESS IN BIOLOGICAL SYSTEMS	CO 3	apply principles of Mass Transfer in Biological systems
		9"	CO 4	Apply separation and purification unit operations in biological products
		*	CO5	Apply unit operations of momentum, heat and mass transfer in bio processing.
	2	e e ·	CO 1	Describe some important design considerations in choosing a battery for a specific application.
		32	CO 2	Predict potential complications from combining various chemicals or metals in an engineering setting
14	22CY1001	ENGINEERING CHEMISTRY	CO 3	Examine water quality and select appropriate purification technique for intended problem
	-	o o	CO 4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable physical properties.
			CO 5	An ability to analyze & generate experimental skills
			C01	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.
			CO2	Understands the deformation of materials in response to action of load, for identification of materials having specific engineering applications.
15	22PH1005	ENGINEERING PHYSICS	CO3	Understands the motion of electrons in microscopic level
	ь	* *	C04	Understand the properties of light and engineering applications of lasers
	,	-	CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects

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Š	1		CO1	Interpret numerical data through various graphs and determination of various constants of the data
16	-		CO2	Measure and estimate the degree of linear relationship between two variables
16	22MT2009	BIOSTATISTICS	C03	Identify the suitable probability distribution to the given experimental data and calculation of various characteristics of the respective probability distributions
	0		CO4	Draw the statistical inference of the given data through various tests of statistical hypothesis, viz., tests for means (single and two), analysis of variance
	= =	. 1	CO1	Understand the functions and properties of bio molecules (carbohydrates, nucleic acids, proteins, lipids) in biological systems.
17	21BT2105	BIOCHEMISTRY	CO2	Understand the organization and biochemical reactions of bio molecules
	21512103		CO3	Understand the importance of various metabolic pathways
	· ·		CO4	Understand the importance of various biosignaling in biological systems
			CO5	Perform techniques used in biochemistry to address biochemical problems
	* x		CO 1	Acquire the knowledge about chronological development, classification, cell structure, characteristics and diseases of microorganisms
18	21BT2106	MICDODIOL COV	CO 2	Construction of growth curve, identification of various factors affecting growth and outline about microbial growth estimation methods
		MICROBIOLOGY	CO 3	Compare various media, isolation, identification and sterilization methods of microorganisms
				Demonstrate various methods of microbiology such as sterilization, isolation, identification and characterization.
		2 4	CO5	Apply various straining techniques for isolation of microbes from different sources.

			CO1	Understand the basic principles of different bio analytical methods
		1	CO2	Knowledge about techniques related to electrophoresis & spectroscopy
19	21BT2107	BIOANALYTICAL TECHNIQUES	CO3	An understanding of use of Radioisotopes in biological sciences and its ethical issues
			CO4	An ability to perform centrifugation, chromatography, electrophoresis & spectroscopy techniques
			C05	Analyze the methods for assay of bio molecules
		MOLECULAR BIOLOGY	CO1	Understand the genome organization & replication
20	22BT2206		CO2	Compare DNA transcription and translation mechanisms
			CO3	Understand the gene regulation mechanisms
			C04	Apply the gene expression in bacteria
		2	CO1	Understand the various defense mechanism of body system
		- x - x	CO2	Compare different types of Ag-Ab reactions
22	22BT2105	IMMUNOLOGY	CO3	Differentiate the role of B and T cells
201	* °		CO4	Development of ELISA method for Ag-Ab reactions
	=	2 U	CO5	Apply the various techniques for the vaccine production

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			CO 1	Acquire the theoretical basis of bioinformatics and understand the access and analyze the biological information from databases.
		9	CO 2	Manipulate the DNA/protein sequences using standalone pc programs and with the help of the worldwide web.
23	22BT2233	BIOINFORMATICS	CO 3	Apply multiple sequence alignment tools on gene and protein sequences to find homologs, construct and interpret the evolutionary trees.
			CO 4	Use genome informatics tools and model protein three-dimensional structure of proteins.
	n 11	-	CO5	Choose the sequences from the databases and apply sequence alignment, tree construction tools to infer their relations.
	22BT3110	GENETIC ENGINEERING	CO1	Understand the process of gene cloning
			CO2	Apply the role of vectors in cloning process
24			CO3	Analyze various types of PCR
			CO4	Compare various gene technology methods
			CO5	Analyze cloning methods using recombinant molecules
9	-	-	CO1	Acquire the knowledge of fermentation process basics
			CO2	Understand the knowledge of medium optimization
25	22BT3111	FERMENTATION TECHNOLOGY	CO3	Acquire the knowledge of medium sterilization.
			C04	Understand the principles of aeration and agitation
			CO5	Demonstrate fermentation processes to produce value added proteins and other biological substances for human, animal therapeutic use, food production processing and bio fuels.

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			CO1	Acquire the knowledge of reaction engineering basics and batch reaction system.
			CO2	Understand different bioreactor systems to analyze microbial growth and product formation.
26	22BT2209	BIOCHEMICAL REACTION ENGINEERING	соз	Compare various multiphase bioreactors
			CO4	Analyze biochemical processes for various biochemical parameters on microbial growth.
		9	CO5	Demonstrate processes to produce value added proteins and other biological substances for human, animal therapeutic use, food production processing and bio fuels.
5	v		CO 1	Acquire the knowledge of plant tissue culture and understand the principles and methods of plant genetic transformation.
			CO 2	Apply concepts of genetic engineering and genome editing to molecular farming in plants
27	22BT3212	PLANT AND ANIMAL BIOTECHNOLOGY	CO 3	Acquire the comprehension of animal cell culture principle and application and scale up of animal cell culture
		- J	CO 4	Apply the concepts of Transgenic Animals, Recombinant DNA Technology, and Tissue Engineering in Animal Biotechnology
			CO 5	Apply tissue culture and genetic transformation in plant and cell culture techniques in animal cells
			CO1	Acquire the knowledge of primary separation and recovery processes
		Á		Apply the principles of solid removal unit and the solid removal unit and t
28	22BT3213	DOWNSTREAM PROCESSING		Apply the principles of aqueous two-phase extraction process and product purification methods
		*."		Analyze the methods of alternative separation, product polishing and formulations
	*			Evaluate the bioseparation methods for recovery, isolation and purification of various bioproducts

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			CO 1	Acquire the knowledge of Genome Organization &Types of Sequences and Recombination
29	22GEG3101	MOLECULAR GENETICS	CO 2	Describe about Gene Expression Regulation
			CO 3	Compare X chromosome & Mt DNA analysis in Forensics
			CO4	Compare Y Chromosome & Mt DNA analysis in Forensics
			CO 1	Acquire the knowledge of vehicles for transgenic technology and transgenic plants
30	22GEG3203	TRANSGENIC TECHNOLOGY	CO 2	Describe transgenic animals and silencing technology
	×	-	CO 3	Develop gene therapy
	0 8	**	CO4	Develop knockouts strategies
			CO 1	Acquire the knowledge of gene expression and Prokaryotic system-
31	22GEG3202	MOLECLAR EXPRESSION	CO 2	Describe mammalian system
	5 ×	TECHNOLOGY	CO 3	Develop various strategies of Protein purification system
			CO 4	Develop various strategies of Protein stability
		0	CO 1	Acquire the knowledge of Genomes
32	22GEG3405	GENOMICS AND	CO 2	Compare micro array analysis  Konoru
		PROTEOMICS	CO3	Develop protein networks
			CO 4	Develop mapping strategies

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			C01	Acquire the Diagnosis of Viral & Bacterial diseases analysis
33	22GEG3204	MOLECULAR MARKERS AND	CO2	Understand Biochemical Disorders
		DIAGNOSTICS	C03	Understand Immunodiagnostics and applications
		-	CO4	Apply DNA based Diagnostics
	3 -	GENE AND ENVIRONMENT	CO 1	Acquire the knowledge of genes and its impact on environment
34	22GEG3508		CO 2	Describe about environmental factors that damage DNA
1	×		CO 3	Compare detoxification and antioxidant defenses
			CO4	Compare stress genes from organisms
		2	CO 1	Students will demonstrate an understanding of the principles and techniques used in DNA analysis for forensic purposes.
35	22GEG3406	DNA FORENSICS	CO 2	Students will develop the skills to interpret DNA evidence collected from crime scenes or other forensic contexts.
	2 10 10 10 10 10 10 10 10 10 10 10 10 10		CO 3	Students will gain an understanding of the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations involved in DNA for the legal and ethical considerations in the legal
		e	CO 4	Students will develop critical thinking and problem-solving skills through hands-on exercises and case studies in DNA forensics

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		CO 1	Acquire the knowledge of microbial technology
5 22GEG3507	MICROBIAL TECHNOLOGY	CO 2	Screen out medium and strain development
=	, , , , , , , , , , , , , , , , , , ,	CO 3	Develop various strategies to produce Primary and secondary Metabolites
		CO 4	Design various strategies to produce Enzymes, recombinant Proteins, and other special bio products.
	\$1 d a)	CO 1	Acquire the knowledge of Fundamentals of pharmaceutical Practice
22IBT3101	PHARMACEUTICAL BIOTECHNOLOGY	CO 2	Asses the drug metabolism and pharmacokinetics and formulate pharmaceutical dosage & blood, plasma products
er e		CO 3	Compare various Pharmaceutical products
		CO 4	Develop various strategies of manufacturing processes
		CO 1	Acquire the knowledge of Introduction of Metabolic Engineering
22IBT3508	METABOLIC ENGINEERING	CO 2	Acquire the knowledge of Genetic improvement of strains
2)		CO 3	Analyze metabolic pathways
		CO 4	Develop experimental determination strategies of of Flux
7	7 22IBT3101	PHARMACEUTICAL BIOTECHNOLOGY	CO 2  A 22 (BT 3508) MICROBIAL TECHNOLOGY  CO 3  CO 4  CO 4  CO 1  CO 2  CO 2  CO 3  CO 4  CO 2  CO 3  CO 4  CO 2  CO 3  CO 4  CO 1  CO 2  CO 3  CO 4

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	22BT2223	BIORESOURCE TECHNOLOGY	C01	Acquire the knowledge of Bioresources
39			C02	Understand the knowledge of Biogas production
			CO3	Describe the methods for Bioethanol and Biobutanol production
			CO4	Describe the methods for Biodiesel production
	*	BIOPROCESS ECONOMICS AND PLANT DESIGN	CO 1	Understand basics of economic evaluation
40	221BT3202		.CO 2	Acquire the knowledge of Bioprocess Economics
			CO 3	Develop various strategies of process design
			CO 4	Design various strategies of Basic considerations in equipment design and Basic Design Problems
		T3304 ENZYME ENGINEERING	CO1	Acquire the knowledge of terminology and classification of enzymes.
41	22IBT3304		CO2	Understand the mechanisms of enzyme catalysis and action.
			CO3	Evaluate the kinetics of enzyme parameters.
			CO4	Understand the various industrial enzymes and their applications.

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	22IBT3405	BIOPROCESS VALIDATION & CGMP	C01	Acquire the knowledge of terminology and classification of enzymes.
42			C02	Understand the mechanisms of enzyme catalysis and action.
			C03	Evaluate the kinetics of enzyme parameters.
			C04	Understand the various industrial enzymes and their applications.
	22IBT3406	FOOD TECHNOLOGY	C01	Acquire the knowledge of food associated microbes
43			CO2	Describe food processing
			C03	Develop various strategies involved in preservation and storage
			CO4	Conclude various principles involved in food microbiology
		BIS3202 BIOMEDICAL INFORMATICS	CO 1	Acquire the knowledge of web programming with Javascript
44	22BIS3202			Understand genomics role in informatics
			CO 3	Analyze biochemical pathways
			CO 4	Develop virtual Physiological Human; geometric models of proteins

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	22BIS3101	MOLECULAR MODELLING AND DRUG DESIGN	CO 1	Acquire the knowledge of Introduction to Molecular Modeling
45			CO 2	Describe the Basic concepts of Protein Modeling and Protein structure Determination
			CO 3	Develop Molecular Dynamics and Simulations
	-		CO 4	Design and construct Molecular modeling strategies in Drug Designing
п	20 10 2		CO 1	Acquire the knowledge of Structural biology of Nucleic Acids
46	22BIS3304	S3304 STRUCTURAL BIOLOGY	CO 2	Describe the Protein dynamics
			CO 3	Compare various techniques for structural biology
			CO 4	Conclude the principles involved in structure predictions and structural elucidation
			CO1	Understand the network properties
47	22BIS3507	7 SYSTEMS BIOLOGY	CO2	Analyze regulatory network throughsystems biology software
			C03	Analyze Algorithms for biochemical network construction
	-		C04	Analyze Microarrays

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			CO 1	Acquire the knowledge of genomics
48	22BIS3405	APPLIED BIOINFORMATICS	CO 2	Describe the Protein dynamics
	I		CO 3	Compare various techniques for applied bioinformatics
	-		CO 4	Conclude the applications of system biology
			C01	Understand the basics of Python and R programming
49	22BIS3203	PYTHON AND R PROGRAMMING	CO2	Analyze Biological sequence analysis with python
	0		CO3	Analyze biological data statistics
-			CO4	Analyze gene expression with R
			CO 1	Acquire knowledge on database systems
50	22BIS3508	DATABASE MANAGEMENT SYSTEMS	CO 2	Apply SQL in relational model
	= 2 n		CO 3	Compare data storage devices
	, i'		CO 4	Analyze current trends in data types

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51	22MBT3101	STEM CELL TECHNOLOGY	CO1	Acquire the knowledge of stem cell technology
			CO2	Understand stem cell characterization and tissue engineering
			CO3	Illustrate various strategies involved in regulation and stem cell.
-			CO4	Apply various principles involved in stem cell therapies.
	22MBT3304	HEALTHCARE BIOTECHNOLOGY	CO1	Acquire the knowledge of simple proteins and therapeutic agents
52			CO2	Acquire the knowledge of Human diseases
			CO3	Describe the various vaccines used
			CO4	Understand the applications of genetic engineering in healthcare
0	22MBT3405	3T3405 CANCER BIOLOGY	CO 1	Acquire the knowledge of cancer
53			CO 2	Understand about various agents in carcinogenesis
			CO 3	Apply molecular biology in various cancer cells
			CO 4	Apply the role of immune cells in Cancer

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	21		CO 1	Understand the basic concepts of neuroscience	7
54	22MBT3406	NEURO BIOLOGY	CO 2	Understand Neurotransmitters and Receptors	
		*	CO 3	Compare and contrast vestibular system	
		2	CO 4	Develop various strategies of nervous system and its Neuronal modulation	
		*	CO 1	Understand concepts of biosensors	1
55	22MBT3507	BIOELECTRONICS AND BIOSENSORS	CO 2	Compare transducers in biosensors	1
			CO 3	Apply bioelectronics in imaging process	1
	g 		CO 4	Develop various strategies for design for biophotonic computer	l
	p		C01	Remember the knowledge of Tissue Engineering and Cell-Based Therapies	
56	22MBT3203	TISSUE ENGINEERING	CO2	Recall the knowledge of Tissue culture basics	C
			CO3	Understand 3D organization and angiogenesis	D.e
	v		CO4	Apply the role of Stem Cells in treating tissue defects using case studies	11
	-	VIROLOGY	CO 1	Acquire the knowledge of viruses	K
57	22MBT3202		CO 2	Acquire the knowledge of techniques in virology	
			CO 3	Analyze structure of viruses	
			CO 4	Compare plant and animal viruses	×

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	-		CO 1	Understand concepts of nanotechnology	7
58	22MBT3508	NANOBIOTECHNOLOGY	CO 2	Compare biopolymer and Lipo polymer strategies	$\forall$
			CO 3	Develop various strategies of nucleic acid based nonmaterial's	1
1		,	CO 4	Conclude various principles involved in Biocompatible material's	$\forall$
			CO 1	Acquire the knowledge of intellectual property rights	1
59	OEBT0002	IPR AND PATENT LAWS	CO 2	Describe the principles and regulatory affairs	1
			CO 3	Develop documentation ,Protocols and Case Studies on patents	1
			CO 4	Compare various Case Studies on Patents	1
	EN	BASICS OF MARKETING FOR ENGINEERS (BME) JAPANESE LANGUAGE (JLG)	CO1	Understand the basic concepts of marketing management	$\forall$
60			CO2	Understand the concepts of Marketing environment, consumer behaviour and Segmentation, Targeting and Positioning (STP)	1
22			CO3	Apply the marketing mix strtegies with special focus on technology products	
			CO4	Apply appropriate strategy for the marketing of high tech products and services	1
			CO1	Understand the Japanese language Basic Proficiency	
61			CO2	Determine the Japanese Vocabulary and Grammar	
			CO3	Examine and interpret Japan Cultural Awareness	1
			CO4	Comprehensive Reading and Listening practice and apply the language skills	1

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62	22ABT3304	GMOs, BIOSAFETY AND BIOETHICS	C01	Relate the role of different biosafety levels and identify the best BSL labs suited for handling different microorganisms and for GMO research
			CO2	Distinguish between different types of IPRs
	-		CO3	Demonstrate the varied types of patents and acquire knowledge about patent filing
			CO4	Identify copyright law and consequences of copyright violations
		SOCIAL INTERNSHIP	CO1	students will demonstrate an increased awareness and understanding of key social issues, including but not limited to poverty, homelessness, inequality, and social injustice.
63	22IE2040		CO2	Students will gain practical experience in delivering social services to diverse populations.
			CO3	students will develop and refine a range of professional skills essential for effective social work practice.
-			CO4	Students will engage in ongoing reflection and critical analysis of their internship experiences.
		TECHNICAL INTERNSHIP	CO1	students will demonstrate proficiency in applying technical knowledge and skills relevant to their field of study or interest
64	22IE3041 TECHNICAL INTERNSHIP		CO2	Students will gain insight into industry practices, standards, and workflows relevant to their technical discipline
			CO3	students will develop and enhance their communication and collaboration skills in a professional context.
		C04	Students will develop critical thinking and problem-solving abilities through real-world technical challenges encountered during the internship	

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