Hindustan College of Science and Technology
Farah-Mathura
(AICTE approved & affiliated to AKTU)

NAAC
CRITERIA-2

Metric No.- 2.6.1 (Q_IM)

Programme Outcomes (POs) and Course Outcomes (COs) for Bio Technology

SEMESTER –III

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ESE	Credit Cr
					L	T	P	CT	TA	CT+TA	TE/PE		
1	BOE3** / BAS304	Science Based Open Elective/BSC (Maths-III/Math IV/ Math V)	T	ES/BS	3	1	0	20	10	30	70	100	4
2	BVE301 / BAS301	Universal Human Value and Professional Ethics/ Technical Communication	T	VA/HS	2	1	0	20	10	30	70	100	3
3	BBT301	Techniques in Biotechnology	T	PC	3	1	0	20	10	30	70	100	4
4	BBT302	Microbiology and Immunology	T	PC	3	1	0	20	10	30	70	100	4
5	BBT303	Biochemistry	T	PC	2	1	0	20	10	30	70	100	3
6	BBT351	Techniques in Biotechnology lab	P	PC	0	0	2		50	50	50	100	1
7	BBT352	Microbiology and Immunology lab	P	PC	0	0	2		50	50	50	100	1
8	BBT353	Biochemistry lab	P	PC	0	0	2		50	50	50	100	1
10	BCC301 / BCC302	Cyber Security/Python programming	T	VA	2	0	0	20	10	30	70	100	2
11	BCC351	Internship Assessment /Mini Project*	P							100		100	2
		Total			**15**	**5**	**6**						**25**

- **Mathematics –III** for CE / ENV and allied branches
- **Mathematics-IV** for Computer/Electronics/Electrical & allied Branches, Mechanical & Allied Branches Textile/Chemical & allied Branches
- **Mathematics-V** for Bio Technology / Agriculture Engineering

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FARAH (MATHURA)

SEMESTER –IV

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ESE	Credit Cr
					L	T	P	CT	TA	CT+TA	TE/PE		
1	BAS404 / BOE4**	BSC (Maths-III/Math IV/ Math V)/Science Based Open Elective	T	BS/ES	3	1	0	20	10	30	70	100	4
2	BAS401 / BVE401	Technical Communication / Universal Human Value and Professional Ethics	T	HS/VA	2	1	0	20	10	30	70	100	3
3	BBT401	Bioprocess Engineering	T	PC	3	1	0	20	10	30	70	100	4
4	BBT402	Genetics and Molecular Biology	T	PC	3	1	0	20	10	30	70	100	4
5	BBT403	Enzyme Engineering	T	PC	2	1	0	20	10	30	70	100	3
6	BBT451	Bioprocess Engineering lab	P	PC	0	0	2		50	50	50	100	1
7	BBT452	Genetics and Molecular Biology lab	P	PC	0	0	2		50	50	50	100	1
8	BBT453	Enzyme Engineering lab	P	PC	0	0	2		50	50	50	100	1
9	BCC402 / BCC401	Python Programming/Cyber Security	P	VA	2	0	0	20	10	30	70	100	2
10	BVE451 / BVE452	Sports and Yoga - II / NSS-II	P	VA	0	0	3			100		100	0
		Total			**15**	**5**	**9**						**23**
		Minor Degree/ Honors Degree MT-1/HT-1											

*The Mini Project or internship (4 weeks) will be done during summer break after 4th Semester and will be assessed during V semester.

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DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW
B.TECH III YEAR V SEMESTER BIOTECHNOLOGY

SEMESTER- V												SESSION2020-21	
Sl. No	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KBT 501	**Genetic Engineering**	3	1	0	30	20	50		100		150	4
2	KBT 502	**Fermentation Biotechnology**	3	1	0	30	20	50		100		150	4
3	KBT 503	**Bioinformatics I**	3	1	0	30	20	50		100		150	4
4	KBT 051-054	Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	KBT 055-058	Departmental Elective-II	3	0	0	30	20	50		100		150	3
6	KBT 551	**Genetic Engineering lab**	0	0	2				25		25	50	1
7	KBT 552	Fermentation Technology Lab	0	0	2				25		25	50	1
8	KBT 553	**Bioinformatics- I virtual lab**	0	0	2				25		25	50	1
9		Mini Project or Internship Assessment*	0	0	2				50			50	1
10	KNC501/ KNC502	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**8**							**950**	**22**

*The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.

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DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW
B.TECH III YEAR VI SEMESTER BIOTECHNOLOGY

SEMESTER-VI												SESSION2020-21	
Sl. No	Subject Codes	Subject	Periods			Evaluation Scheme			End Semester			Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KBT-601	Bioprocess Engineering -II	3	1	0	30	20	50		100		150	4
2	KBT-602	Plant Biotechnology	3	1	0	30	20	50		100		150	4
3	KBT-603	Bioinformatics -II	3	1	0	30	20	50		100		150	4
4	KBT-061 To 064	Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	KBT-651	Bioprocess Engineering –II Lab	0	0	2				25		25	50	1
7	KBT-652	Plant Biotechnology Lab	0	0	2				25		25	50	1
8	KBT-653	Bioinformatics-II Lab	0	0	2				25		25	50	1
9	KNC601/ KNC602	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		Total	0	3	6							900	21

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B.Tech. VII Semester
BIOTECHNOLOGY

SEMESTER- VII													
Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KHU701/ KHU702	HSMC -1 $^{\$}$/ HSMC-2 $^{\#}$	3	0	0	30	20	50		100		150	3
2	KBT-071-074	Departmental Elective-IV	3	0	0	30	20	50		100		150	3
3	KBT-075-078	Departmental Elective-V	3	0	0	30	20	50		100		150	3
4		Open Elective-II	3	0	0	30	20	50		100		150	3
5	KBT751X	LAB-1	0	0	2				25		25	50	1
6	KBT752	Mini Project or Internship Assessment*	0	0	2				50			50	1
7	KBT753	Project I	0	0	8				150			150	4
8		MOOCs (Essential for Hons. Degree)											
		Total	12	0	12							850	18

*The Mini Project or internship (4 - 6 weeks) conducted during summer break after VI semester and will be assessed during VIIsemester.

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SEMESTER- VIII													
Sl. No.	Subject	Subject	Periods			Evaluation Scheme			End Semester			Total	Credit
	Codes		L	T	P	CT	TA	Total	PS	TE	PE		
1	KHU801/ KHU802	HSMC-2*/HSMC-1*	3	0	0	30	20	50		100		150	3
2		Open Elective-III	3	0	0	30	20	50		100		150	3
3		Open Elective-IV	3	0	0	30	20	50		100		150	3
4	KBT851	Project II	0	0	18				100		300	400	9
5		MOOCs (Essential for Hons. Degree)	9	0	18								
		Total										850	18

B.TECH IV YEAR BIOTECHNOLOGY
(DEPARTMENT ELECTIVE SUBJECTS)

DEPARTMENTAL ELECTIVE- IV

KBT071: Genomics and Proteomics

KBT072: Bioseparation and Downstream Processing

KBT073: Environmental Biotechnology

KBT074: Industrial Biotechnology

DEPARTMENTAL ELECTIVE- V

KBT075: Biosafety, Bioethics, IPR & Patents

KBT076: Quality Control and Regulatory affairs

KBT077: Biomaterials

KBT078: Biostatistics & design of experiments

LAB (DEPARTMENTAL ELECTIVE)

KBT751A: Genomics and Proteomic Lab

KBT751B: Bioseparation and Downstream Processing

KBT751C: Environmental Biotechnology Lab

KBT751D: Industrial Biotechnology Lab

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Program Outcomes

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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FARAH (MATHURA)

Program Educational Objectives (PEOs)

1. Equip biotechnology graduates with the skills and knowledge necessary for successful careers in the biotechnology industry.
2. Provide a solid foundation in scientific, engineering, and mathematical principles to enable graduates to solve technical problems in the biotechnology industry.
3. Foster professional and ethical behaviour in students and encourage lifelong learning in biotechnology-related attributes.
4. Inspire students to pursue advanced education and research opportunities.
5. Enhance graduates' technical aptitude, communication skills, and professional capabilities.

Program Specific Outcomes (PSOs)

1. Graduate shall have the ability to apply fundamental knowledge of mathematics, biology, biological processes, and the scientific method to solve complex problems in biotechnology.
2. Graduate shall have the ability to integrate ethical considerations and industrial perspectives with biological knowledge to effectively analyze and address challenges in biotechnology.

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Department:

Course Outcomes COs-B.Tech 2nd,3rd & 4th Year

Batch: 2020-24

B.Tech 3rd Semester

Analytical Techniques in Biotechnology	BBT301	CO1	Acquire Knowledge on types of microscope and its applications in Biotechnology
		CO2	Apply the principle of chromatographic techniques for qualitative and quantitative analysis of biomolecules.
		CO3	Employ various spectroscopic techniques for qualitative and quantitative analysis of biomolecules/Bioanalytes
		CO4	Employ various electrophoresis and centrifugation techniques for analysis of biomolecules/Bioanalytes
		CO5	Acquire knowledge of 3 D printing, flow cytometry and biosensors.
Microbiology & Immunology	BBT302	CO1	Demonstrate morphology & structure of bacterial cell & isolate, identify, culture, preserve and enumerate microbes.
		CO2	Learn the basic features of transduction, conjugation, transformation along with virus structure, classification and reproduction and understand biological nitrogen fixation, bacterial photosynthesis and electron transport system.
		CO3	Identify the major cellular and tissue components of innate and adaptive immune system along with properties of antigens and antibodies and develop a basic understanding of fundamental immunological processes.
		CO4	Interpret the responses of antibody-antigen based interactions and understand regulation of MHC based activation of complement system using cytokines as activators.
		CO5	Develop the understanding of mechanism of bacterial, viral and protozoan diseases, their symptoms and treatment procedures along with microbiology of domestic and waste water and microbes in bioremediation.
Biochemistry	BBT303	CO1	The student should be able to relate the importance of water in biological system and to describethe role of biological buffer.
		CO2	The student should be able to describe structure & function of major biomolecules found incells, that make them indispensable for life.
		CO3	The student should be able to explain energy generation through carbohydrate metabolism andrelated diseases
		CO4	The student should be able to describe energy generation

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			through lipid metabolism and relateddiseases
		CO5	The student should be able to explain the metabolic pathways of amino acids and proteins andrelated diseases, role of nucleic acids in various metabolic activities anddisorders
Energy Science and Engineering	BOE304	CO1	The student should be able to understand the Energy and its Usage
		CO2	The student should be able to understand Nuclear Energy and its application in energy sector.
		CO3	The student should be able to understand Solar Energy and its applications.
		CO4	The student should be able to describe Conventional & non-conventional energy source
		CO5	The student should be able to explain Systems and Synthesis
Technical Communication	BAS301	CO1	The student will be able to understand the nature and objective of Technical Communication relevant for the work place as Engineers
		CO2	The student will be able to develop an understanding of key concepts of writing, designing and speaking.
		CO3	The student will be able to utilize the technical writing skills for the purposes of Technical Communication and its exposure in various dimensions
		CO4	The student will be able to build up interpersonal communication traits that will make the transition from institution to workplace smoother and help them to excel in their jobs.
		CO5	The student will be able to apply technical communication to build their personal brand and handle crisis communication.
Cyber Security	BCC301	CO1	The student will be able to understand the basic concepts of cyber security and cybercrimes.
		CO2	The student will be able to understand the security policies and cyber laws.
		CO3	The student will be able to understand the tools and methods used in cyber crime
		CO4	The student will be able to understand the concepts of cyber forensics
		CO5	The student will be able to understand the cyber security policies and cyber laws
Analytical Techniques in Biotechnology	BBT351	CO1	The student should be able to understand precession , accuracy and spectroscopy
		CO2	The student should be able to understand and use

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Lab			microscopy and paperchromatography
		CO3	The student should be able to understand and perform SDS-PAGE and agarose gelelectrophoresis
		CO4	The student should be able to understand membrane separation techniques
		CO5	The student should be able to liquid-liquid separation experiments, column chromatography
Microbiology & Immunology Lab	BBT352	CO1	Students should be able to apply the principle and application of the equipment andtools used in microbiology laboratory.
		CO2	Students should be able to perform various pure culture techniques used for the isolationand purification of microorganisms.
		CO3	Students should be able to perform the simple and differential staining for themicroscopic identification of microorganism.
		CO4	Students should be able to identify the type of blood group using the standard kitmethod.
		CO5	Students will be able to apply the principles and perform the procedure ofimmune-diffusion.
		CO6	Students should be able to measure the concentration of antigen or antibody in serumsample by using immunological assays.
Biochemistry Lab	BBT353	CO1	The student should be able to perform quantitative and qualitative analysis ofbiomolecules.
		CO2	The student should be able to do the calculations associated with practical work likedilutions, unit conversions and solutions of different concentrations.
		CO3	The student should be able to perform the separation of solutes using chromatographictechniques
		CO4	The student should be able to perform molecular analysis of DNA using agarose gelelectrophoresis
		CO5	The student should be able to design, execute and analyze a biochemistry experimentand make its report.
Internship Assessment/Mini-project	BCC351	CO1	Student will be able to understand and workout on the mini-project problem
		CO2	Student will be able to gain experience to make the project report
		CO3	Student will be able to acquire the necessary confidence to carry out main project in final year

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B.Tech 4th Semester

Bioprocess Engineering	BBT401	CO1	Understand the kinetics of microbial growth and the associated parameters.
		CO2	Utilize sterilization concepts necessary for proper bioreactor operation.
		CO3	Discuss the basics of ideal reactor operation.
		CO4	Explain the concept and mechanism of mass transfer in bioprocessing.
		CO5	Analyze the concept of bioreactor control mechanism and identify suitable controlsystem.
Genetics and Molecular Biology	BBT402	CO1	The student should be able to discuss the basics of heredity and variation.
		CO2	The student should be able to illustrate the organization of genome.
		CO3	The student should be able to describe the linkage, recombination and two-point andthree-point test crosses.
		CO4	The student should be able to analyze the mechanism of DNA replication, transcriptionand translation processes taking place in eukaryotes and prokaryotes.
		CO5	The student should be able to distinguish the various checkpoints in cell cycle whichprevent cancer and understand its regulation along with apoptosis.
Enzyme Engineering	BBT403	CO1	The student should be able to describe structure, function, activity and kinetics ofenzymes.
		CO2	The student should be able to describe the various factors and modes of enzymeinhibition and regulation and incorporate them in industrial applications.
		CO3	The student should be able to summarize processes involved in extraction andpurification of enzymes and develop enzyme assays for research and industry.
		CO4	The student should be able to describe and apply enzymes immobilization techniques.
		CO5	The student should be able to discuss and assemble biosensors important to industries,healthcare and environment, design different types of bioreactors using

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			immobilized enzymes.
Maths V	BAS404	CO1	The student should be able to learn the idea of Fourier Transforms, Z- Transform and application to solve numerical problems.
		CO2	The student should be able to learn the concept of probability distribution and their application.
		CO3	The student should be able to learn the concepts of numerical techniques
		CO4	The student should be able to learn the concept of hypothesis and ANOVA, t – test, and $\chi 2$ – test.
		CO5	The student should be able to learn the idea of design ,statistical quality control and control charts.
Universal Human Values	BVE401	CO1	The student should be able to understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content, and process of value education, explore the meaning of happiness and prosperity, and do a correct appraisal of the current scenario in the society
		CO2	The student should be able to Distinguish between the Self and the Body, and understand the meaning of Harmony in the Self and the Co-existence of Self and Body.
		CO3	The student should be able to Understand the value of harmonious relationships based on trust, respect, and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
		CO4	The student should be able to Understand the harmony in nature and existence, and workout their mutually fulfilling participation in nature.
		CO5	The student should be able to Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work
Python Programming	BCC402	CO1	The student will be able to Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
		CO2	The student will be able to Express proficiency in the handling of strings and functions.
		CO3	The student will be able to Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
		CO4	The student will be able to Identify the commonly used operations involving file systems and regular expressions.
		CO5	The student will be able to Articulate the Object-Oriented

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			Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.
Bioprocess Engineering Lab	BBT451	CO1	Analyze the data on growth kinetics of E. coli.
		CO2	Discuss the upstream and downstream bioprocessing for citric acid and α- amylaseproduction.
		CO3	Analyze the volumetric liquid mass transfer coefficient (KLa) using sodium sulphite method
		CO4	Perform immobilization of enzymes and cells.
		CO5	Develop computational design for fermentative production of L- lysine
Genetics and Molecular Biology Lab	BBT452	CO1	The student should be able to understand basic genetics principles and real lifeimplementation
		CO2	The student should be able to comprehend DNA and its components
		CO3	The student should be able to correlate with genomic composition in an organism
		CO4	The student should be able to understand isolation of DNA and its visualization
		CO5	The student should be able to perform and manage DNA experiments
Enzyme Engineering Lab	BBT403	CO1	The student should be able to extract enzyme from plant and microbial source
		CO2	The student should be able to perform partial purification methods and quantificationof enzyme
		CO3	The student should be able to demonstrate effect of temperature on enzyme activity
		CO4	The student should be able to demonstrate effect of pH and time on enzyme activity
		CO5	The student should be able to demonstrate effect of substrate and enzyme concentrationon enzyme activity, methods of immobilization of enzymes

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Genetic Engineering	KBT501	CO1	To be able to appraise proper use of host and vector for gene cloning
		CO2	Identification of appropriate method for DNA delivery into the host
		CO3	Use of gene library for screening of desired sequence/protein
		CO4	Cloning process of whole organism and applications
		CO5	Process of recombinant protein expression, cell signalling and ethical issues related togene transfer
Fermentation Biotechnology	KBT502	CO1	Student will be able to understand the concepts and process technologies offermentation
		CO2	Student will be able to learn the application and use of different raw materials and itsuse in industrial scale production
		CO3	Student will be able to understand the regulatory system in the microorganism
		CO4	Student will be able to learn the strain improvement technologies and its role inFermentation
		CO5	Student will be able to learn the concepts of the scale up and scale down criteria offermentation process and production of metabolites
Bioinformatics-I	KBT503	CO1	Understand concepts and application of Bioinformatics, types of databases, sequencesimilarity, sequence patterns and profiles
		CO2	Use sequence alignment techniques, database searching, pairwise and multiplesequence alignment using various tools.
		CO3	Understand scoring matrices and its types including PAM , BLOSUM series andmatrices for nucleic acid and protein sequences.
		CO4	Apply phylogeny and its concepts in molecular evolution and different methods ofPhylogenetic tree construction
		CO5	Understand and apply the protein structure prediction and application of bioinformaticsin drug designing
Biomedical instrumentation	KBT053	CO1	Explain and demonstrate the instrumentation involved in biomedical.
		CO2	Understand the working and application of plethysmography, electrocardiography andpacemakers etc.
		CO3	Explain the ultrasonic measurements, biotelemetry and other

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FARAH (MATHURA)

			related instrumentation.
		CO4	Applications of Instrumentation for the clinical laboratory.
		CO5	Explain the Medical Imaging equipments and electrical safety of medical equipments.
Biofuels & Alcohol Technology	KBT055	CO1	Student will be able to explain the basic concepts of metabolism and importance ofmetabolic engineering
		CO2	Student will be able to understand the production of metabolites and its regulatorymechanism
		CO3	Student will be able to explain the applications, specificity and product inhibition ofbioconversion
		CO4	Student will be able to understand the concept of regulation of enzyme production andstrain improvement
Constitution of India	KNC501	CO1	Student will be able to Identify and explore the basic features and modalities about Indian constitution.
		CO2	Student will be able to Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
		CO3	Student will be able to Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
		CO4	Student will be able to Discover and apply different laws and regulations related to engineering practices.
		CO5	Student will be able to Correlate role of engineers with different organizations and governance models.
Genetic Engineering Lab	KBT551	CO1	Demonstrate the isolation of genetic material
		CO2	Perform experiments relating to cloning, ligation, restriction digestion andtransformation, etc
		CO3	Demonstrate the southern blotting for identification of desired DNA in a pool DNAsample
		CO4	Perform the bacterial cell competent for transformation
Fermentation Biotechnology Lab	KBT552	CO1	Student will be able to demonstrate the growth pattern of E.coli
		CO2	Student will be able to perform experiments related to production of antibiotics,enzymes and acids through fermentation process
		CO3	Student will be able to demonstrate the downstream processing of fermentative products
		CO4	Student will be able to perform the solid state fermentation and submerged fermentation
Bioinformatics-I	KBT553	CO1	Demonstrate the retrieval of sequence data

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FARAH (MATHURA)

Lab		CO2	Perform experiments related to locating chromosome and gene expression data.
		CO3	Demonstrate the data retrieval system of PubMed.
		CO4	Perform the ORF finding and retrieval of gene information
Mini Project/Internship	KBT554	CO1	Student will be able to understand and workout the project problem
		CO2	Student will be able to gain experience to make the project report
		CO3	Student will be able to acquire the necessary confidence to carry out main project in final year

B.Tech 6th Semester

Bioprocess Engineering-II	KBT601	CO1	Understand the kinetics of microbial growth and the associated parameters.
		CO2	Utilize sterilization concepts necessary for proper bioreactor operation.
		CO3	Discuss the basics of ideal reactor operation.
		CO4	Explain the concept and mechanism of mass transfer in bioprocessing.
		CO5	Analyze the concept of bioreactor control mechanism and identify suitable controlsystem.
Plant Biotechnology	KBT602	CO1	Student will be able to understand the principle and basic requirements for plant tissueculture
		CO2	Students will be able to explain the difference between tissue and organ culture andtheir applicability
		CO3	Students will be able to understand haploid culture and in vitro selection of mutants.
		CO4	Student will be able to analyze somaclonal variation for improved crop varieties in vitrocultures.
		CO5	Student will be able to identify suitable cryopreservation and re-culture technique for thecultured tissue, development of transgenic plants throughgenetic manipulations
Bioinformatics-II	KBT603	CO1	Understand the various tools and techniques related to insilico modeling ofbio-molecules along with methods of drug designing, protein docking
		CO2	Analyze problems related to collection and analysis of

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FARAH (MATHURA)

			biological data .
		CO3	Develop steady and time dependent solutions along with their limitations
Food Biotechnology	KBT063	CO1	Understand importance of microbes and their products in food industry
		CO2	Acquire knowledge of types of foods and their production methodologies
		CO3	Learn the Hazard Analysis Critical Control Point System (HACCP system) andPredictive Microbiology/Microbial Modelling.
Idea to Business Model	KOE060	CO1	This course can motivate students to have an overall idea how to start and sustain a business enterprise.
		CO2	The students will learn basics of choosing an idea of a business model
		CO3	The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.
Essence of Indian Traditional Knowledge	KNC601	CO1	Correlate role of engineers with different organizations and governance models
Bioprocess Engineering-II Lab	KBT651	CO1	Analyze the data on growth kinetics of E. coli.
		CO2	Discuss the upstream and downstream bioprocessing for citric acid and α- amylaseproduction.
		CO3	Analyze the volumetric liquid mass transfer coefficient (K_La) using sodium sulphite method
		CO4	Perform immobilization of enzymes and cells.
		CO5	Develop computational design for fermentative production of L- lysine
Plant Biotechnology Lab	KBT652	CO1	The student should be able to operate and handle the plant biotechnology labequipments.
		CO2	The student should be able to perform tissue culture media preparation, sterilization andexplants selection.
		CO3	The student should be able to understand in vitro cultures through axillary bud induction
		CO4	The student should be able to analyze plant secondary metabolites from selectedmedicinal plants.
Bioinformatics-II Lab	KBT653	CO1	Understand the basic software and tools used in structure prediction of biomolecules

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Hindustan College of
Science & Technology
FARAH (MATHURA)

		CO2	Conduct experimental procedure for Ramachandran plot and its analysis
		CO3	Construct and analyse of restriction maps, QSAR model and homology model
		CO4	Identify and structurally modify a natural product, to design a compound with thedesired properties and to assess its therapeutic effects, theoretically.
		CO5	Enhance their practical knowledge and thus their employability

B.Tech 7th Semester

Environmental Biotechnology	KBT073	CO1	The student should be able to Grasp the concepts of environmental pollution, Types of pollution, causes, effects, measurement and control of pollution.
		CO2	The student should be able to analyze the role of biotechnology for waste treatment, concept and mechanism of waste to biofuels production.
		CO3	The student should be able to understand the designing and working mechanism of different reactors used for waste water treatment.
		CO4	The student should be able to learn about the Processes and technology for waste utilization and conversion in to value added products
		CO5	The student should be able to grasp the concepts of environmental impact assessment, sustainable development, different act and laws for environment protection.
Bio-safety, Bioethics and IPR	KBT075	CO1	The student should be able to describe various forms of IPR and method of theirregistration
		CO2	The student should be able to state Indian Patent Law and International conventions andtreaties
		CO3	The student should be able to debate legal, socio-economic and ethical issues ofbiotechnology
		CO4	The student should be able to apply rules governing manufacture, use/import/export andstorage of hazardous microorganisms/ genetically engineered organisms or cells
		CO5	The student should be able to demonstrate bio-safety issues and practices inbiotechnology
Project Management & Entrepreneurship	KHU702	CO1	The student should be able to identify and analyze the opportunities forentrepreneurship and innovation in various sectors.
		CO2	The student should be able to apply the principles of Project

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Hindustan College of
Science & Technology
FARAH (MATHURA)

			management including theidea generation, project identification, project formulation, project design and network analysis, project report, project appraisal.
		CO3	The student should be able to evaluate and analyse the financials of a business orenterprise.
		CO4	The student should be able to describe the funding opportunities and other financialalternatives available for business.
		CO5	The student should be able to explain the steps for setting up Small, Medium & Largescale industry, the incentives, subsidies and export possibilitiesavailable for biotech business.
Vision for Humane Society	KOE076	CO1	The student will be able to understand the importance and types of relationship with expressions.
		CO2	The student will be able to develop the competence to think about the conceptual framework of undivided society as well as universal human order.
		CO3	The student will be able to o help the students to develop the exposure for transition from current state to the undivided society and universal human order.
Environmental Biotechnology Lab	KBT751	CO1	The student should be able to learn about various environmental friendly methods for Environmental Biotechnology.
		CO2	The student should be able to perform statistical analysis in the water quality testing
		CO3	The student should be able to prepare various solutions and chemical reagents.
		CO4	The student should be able to perform experiment to evaluate various parameters thataffect the water quality
		CO5	The student should be able to apply general chemical techniques to evaluate microbialcontamination of water
		CO6	The student should be able to apply general microbiological techniques to evaluatemicrobial contaminant in water
Mini Project or internship Assessment	KBT752	CO1	Student will be able to understand and workout the project problem
		CO2	Student will be able to gain experience to make the project report
		CO3	Student will be able to acquire the necessary confidence to carry out main project in final year
Project-I	KBT753	CO1	Student will be able to identify and workout the project problem

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Hindustan College of
Science & Technology
FARAH (MATHURA)

		CO2	Student will be able to find objectives, perform practical work and analyze the results and find the solutions.
		CO3	Student will be able to make the synopsis and project report.

B.Tech 8th Semester

Rural Development Administration & Planning	KHU801	CO1	Students can understand the definitions, concepts and components of Rural Development
		CO2	Students will know the importance, structure, significance, resources of Indian rural economy.
		CO3	Students will have a clear idea about the area development programmes and its impact.
		CO4	Students will be able to acquire knowledge about rural entrepreneurship
		CO5	Students will be able to understand about the using of different methods for human resource planning
Quality Management	KOE085	CO1	Students will be able to learn Quality Concepts, Methods and techniques for manufacture, inspection and control of produc
		CO2	Students will be able to understand Quality Management, Organization structure and design, quality function, decentralization.
		CO3	Students will be able to understand Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study and use of control charts.
		CO4	Students will be able to understand diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability.
		CO5	Students will be able to learn ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.
Digital Media Marketing	KOE085	CO1	Students will be able to learn The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices
		CO2	Students will be able to Create a blog post for your project. Include headline, imagery, links and post.
		CO3	Students will be able to understand the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing.
		CO4	Students will be able to understand Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies

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Hindustan College of
Science & Technology
FARAH (MATHURA)

		CO5	Students will be able to understand the contemporary digital revolution, digital transformation framework
Project-II	KBT851	CO1	Student will be able to identify and workout the project problem
		CO2	Student will be able to find objectives, perform practical work and analyze the results and find the solutions.
		CO3	Student will be able to make the final project report.

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