

**JAYPEE INSTITUTE OF INFORMATION
AND TECHNOLOGY**

B. TECH BIOTECHNOLOGY

5th Semester

Course Code	15B11BT511	Semester Odd (Specify Odd/Even)	Semester V Session 2022-2023 Month from July to December
Course Name	Cell Culture Technology		
Credits	4	Contact Hours	4
Faculty (Names)	Coordinator(s)	Prof. Rachana	
	Teacher(s) (Alphabetically)	Prof. Rachana, Dr. Pooja Choudhary	
COURSE OUTCOMES			COGNITIVE LEVELS
CO310.1	Demonstrate knowledge on principles of plant and animal tissue culture.		C2
CO310.2	Identify the requirements to construct a cell culture laboratory.		C3
CO310.3	Apply knowledge and techniques to maintain different types of cell cultures.		C3
CO310.4	Examine cell culture techniques for applications in different fields of biotechnology.		C4
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Plant Cell Culture: An Introduction	Definitions, history of plant cell and tissue culture	2
2.	Organization of tissue culture laboratory & basic principles	Equipments, media preparation and precautions, cellular totipotency and cell differentiation, factors affecting differentiation	4
3.	Suspension cultures	Isolation of single plant cells, suspension cultures and types, measurement of growth, assessment of viability of cultured cells, bioreactors.	3
4.	Type of cultures and their applications	Direct and indirect methods of culture; seed culture, embryo culture, organ culture, callus culture, haploid and triploid production, protoplast isolation and fusion, production of virus free plants, somaclonal variation	6
5.	Somatic embryogenesis & micropropagation	Technique, applications and advances in acclimatization of tissue cultured plants.	4
6.	Industrial applications	Secondary metabolite production and bioconversions through plant cell cultures	2
7.	Introduction to animal cell culture	Advantages and limitations, Laboratory design and layout, aseptic techniques; safety and biohazards, contaminations and eradication	4

8.	Environmental factors and cell culture methods	Culture media, use of serum and serum free media, primary culture, subculture and cell lines, feeder layers; animal cell lines (suspension versus adhered cell culture), Cryopreservation	7
9.	Biology of cultured cells	Cell adhesion molecules, extra-cellular matrix, cell proliferation	2
10.	Characterization of cultured cells	Authentication, Cell morphology, karyotyping, staining, isoenzyme analysis; DNA fingerprinting and DNA profiling	3
11.	Cell separation technology	Physical properties (Density gradient centrifugation), Biological properties (Panning), FACS	3
12.	Scaling up-techniques	suspension and monolayer cultures	2
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
Total	100

PBL: Students will identify relevant topics which use cell culture for laboratory and industrial applications. They will search, select and discuss/present such titles among the class students so that they can gain knowledge about their application in the research institutes and industries.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1. S. S. Bhojwani and M. K. Razadan, Plant tissue culture: theory and Practice, Elsevier, 1996
2. H. S. Chawla, Introduction to Plant Biotechnology, 3rd Edition, Science Publishers, 2009
3. S. Narayanaswamy, Plant cell and tissue culture, Tata Mcgraw Hill, 1992
4. M. K. Razdan, Introduction To Plant Tissue Culture, India Book House Limited, 2003
5. R. Ian Freshney, Culture of animal cells : a manual of basic techniques, Wiley-Liss, 2005, Reviewed in Germany on 19 April 2020
6. John R. W. Masters, Animal cell culture, 3rd Edition, Oxford University Press, 2000
7. A. Mukhopadhyay, Animal Cell Technology, I.K. International, 2009

Course Code	15B17BT571	Semester - Odd (specify Odd/Even)	Semester V Session 2022-2023 Month from July to December
Course Name	Cell Culture Lab		
Credits	4	Contact Hours	2
Faculty (Names)	Coordinator(s)	Prof. Rachana	
	Teacher(s) (Alphabetically)	Prof. Rachana Dr. Priyadarshini Dr. Manisha Singh	
Faculty (Names)	Coordinator(s)	Prof. Rachana	
	Teacher(s) (Alphabetically)	Prof. Rachana Dr. Priyadarshini Dr. Manisha Singh	
COURSE OUTCOMES			COGNITIVE LEVELS
CO370.1	Understand requirements for <i>in vitro</i> culturing of animal cells		C2
CO370.2	Apply the fundamental knowledge of cell culture techniques to maintain animal cell lines		C3
CO370.3	Identify, separate, characterize and differentiate cells for primary and continuous cell lines		C2
CO370.4	Demonstrate practical skills to apply laboratory procedures of cell culture for biotechnology investigations		C3
Module No.	Title of the Module	List of Experiments	CO
1.	Basic preparations and conduction for Animal Tissue Culture Lab	General Introduction and familiarization to animal tissue culture lab: Design and Equipments, learn media preparation (complete and incomplete), sterilization and associated precaution	1 and 2
2.	Identification and maintenance of cell cultures	Learn primary cell culture (cheek cells) isolation, staining and their identification, Detection of various cell culture contaminations (bacterial, fungal) through microscopic examination and Staining, qualitative analysis and differentiation between suspension and adherent cell lines using inverted microscope.	2
3.	Propagation and sub culturing of Cell Culture	Sub culturing of (Splitting and Trypsinization) suspension and adherent cell-lines, Cryo-preservation and resuscitation of Frozen Cell Lines. Differentiation of WTC parental cell line to cardiac cell line	2 and 3
4.	Counting, Estimation and Cell based assays	To learn serial dilution techniques and to calculate cell concentration in order to set up various types of assay's, using haemocytometer and calculation of cell viability in the isolated cells using Trypan blue assay, preparation of growth curve and calculation of doubling time for cell line, determination of cytotoxicity and oxidative stress of the given compound using MTT/NRU, LDH/NO etc. assay.	3 and 4

		Total number of labs	12
Evaluation Criteria			
Components		Maximum Marks	
Mid-Semester lab-viva/ test		20	
End-Semester lab-viva/ test		20	
Day to Day performance (Learning laboratory Skills and handling Laboratory Equipments, attendance)		45	
Laboratory record		15	
Total		100	
PBL: Experiments for this laboratory have been designed in such a way that students can learn from scratch from designing the laboratory till the actual application of animal tissue culture technique in research and industry. The students learn methodology and its application in a systemic stepwise manner.			

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1. Readings in Mammalian cell culture. R. Pollack., Cold Spring Harbour Laboratory (1981).
2. Animal Cell Culture. R. Pollack and S. Pfeiffer, Cold Spring Harbour Laboratory (1971).
3. Experiments with Normal and Transformed cells. R.Crowe., H. Ozer and Dr. Rifkin. Cold Spring Harbour Laboratory (1978).
4. Culture of Animal Cells. R. Ian Freshney and R. Alan., Liss. Inc. (1987).

Course Code	16B1NPH534	Semester: ODD	Semester: V Session 2022-2023 Month from: July to December
Course Name	Bio-Materials Science		
Credits	4	Contact Hours	4
Faculty (Names)	Coordinator(s)	Dr Papia Chowdhury	
	Teacher(s) (Alphabetically)	Dr Papia Chowdhury	
COURSE OUTCOMES			COGNITIVE LEVELS
C301-13.1	Recall basic fundamental of material structure such as crystal defects, phases etc.		Remembering (C1)
C301-13.2	Demonstrate properties of materials such as mechanical, chemical, surface, optical, magnetic etc.		Understanding (C2)
C301-13.3	Selection of materials based on their properties such as ceramic, metal, polymer, composites etc.		Applying (C3)
C301-13.4	Analyzing the applicability of different biomaterials and listing them according to the applied fields like artificial organs.		Analyzing (C4)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Biomaterials and their uses in medical industry	Classification of biomaterials, Discussion about the need of biomaterials in industry, introduction of bionic man, cyborg. Types of biomaterials applied for the replacement of body parts: pacemakers, mammary prosthesis, heart valves, intracellular lenses, orthopedic implants, fixation, spinal replacement. Implant, Transplant, Prosthesis, their need availability and limitations. Basic ideas of crystal structure and bonding of materials used as biomaterials, elementary ideas of crystal defects and phase changes in biomaterials. Classification: metals, ceramics, polymers, advanced materials, nanomaterials. Length scale of material structures and their uses.	8

2.	Mechanical , chemical and optical Properties of Biomaterials	Modulus of elasticity, stress elongation and transfer, wear resistance, Stress-strain relationship, confined and unconfined compression, dynamic shear, pulse wave velocity, electrical and electromagnetic stimulation, stress generated potential (SGP), pulsed electromagnetic field (PEMF), Failure characteristics of materials (Yielding, plastic deformation, creep, fatigue, corrosion wear, impact fracture etc.). Degradation , whiteness and clarity of materials, role of these properties in specific materials for artificial organs Biocompatibility of materials used in artificial organs.	6
3.	Surface properties of Biomaterials	Interface, cohesion, adhesion, Surface energy, contact angles, critical surface tension, thermal treatment of materials, surface improvement (anodization), surface properties influencing cell adhesion, Young's equation, annealing, quenched materials, Surface reconstruction.	5
4.	Magneti c Material s	Concept of magnetic materials used for implantation. Classification – dia-, para-, ferro-, antiferro- and ferri magnetic materials, their properties and applications; Super Paramagnetism. Magnetic Storage, biocompatible magnetic materials, basic idea of super conductivity, uses of super conducting diamagnets with focus on MRI.	5
5.	Polymers and Ceramics	Various types of Polymers and their applications (with specific examples of biopolymers); Optical/ Mechanical behavior and Processing of Polymers; Structure, Types, Properties and Applications of Ceramics; Mechanical behavior and Processing of Ceramics. Hydrolysis and its uses. Application of polymers and ceramics in organ replacement.	8
6.	Optical Materials and optical fibers, lasers	Optical materials and their properties for biomedical engineering. Concept of optical fiber and principle of total internal reflection in optical fiber. Single, multistep & graded index fiber. Numerical aperture and Attenuation coefficient. Transmission losses in optical fiber. Uses of optical fibers in medical industry: Endoscopy, Laparoscopy, capsule endoscopy, their benefits and limitations. Optical materials and optical fibers in dentistry. Propagation characteristics of different fibers; Applications of Laser and optical fibers in Biotechnology, laser as medical cutting tool.	8
Total number of Lectures			40

Evaluation Components	Criteria Maximum
Marks	
T1 20	
T2 20	
End Semester Examination 35	
TA 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]	
Total 100	
<p>Project based Learning (PBL): Students will make some individual projects on selected biomaterial (polymer, ceramics, metals, alloys, semiconductor, composites etc) depending on its applicability for specific Medical Activity. Example: some specific polymers are used to make intraocular lenses, ceramics are used as bone cement for heap joints. Each project work will describe the material properties (physical and chemical), characteristics, whole working principles, advantages and disadvantages of that specific biomaterial to be used for specific purpose. Students will take the help of some experimental data also. Students will take help from available internet sources, current research papers, medical journals and real laboratory experiments for preparing the project. Throughout the preparation of the whole project and by presenting the project work students will gather deep learning about the biomaterials. The overall knowledge will help them to prepare themselves as an efficient biotechnologist according to the requirements of current Medical Industry</p>	
<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>	
1.	Elements of Material Science and Engineering, L.H.Van Vlack, Addison-Wesley 1998
2.	Materials Science and Engineering - An Introduction, W. D. Callister, (Wiley)
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Biomaterials, Sujata V. Bhat, Narosa, New Delhi, 2007

Course Code	16B17BT571	Semester Odd (specify Odd/Even)	Semester V Session 2022-2023 Month from July -Dec
Course Name	IT Practice Lab		
Credits	1	Contact Hours	LTP 0 0 2
Faculty (Names)	Coordinator(s)	Dr. Chakresh Kumar Jain	
	Teacher(s) (Alphabetically)	Dr. Shazia Haider Dr. Chakresh Kumar Jain	
COURSE OUTCOMES			COGNITIVE LEVELS
C373.1	Explain features of programming environment for Python and Perl		Understand Level (C2)
C373.2	Apply Perl based script for bioinformatics problem		Apply Level (C3)
C373.3	Utilize python programming for pattern finding in biological sequences and explore the app designing		Apply Level (C3)
C373.4	Perform the Sequence analysis		Analyze Level (C4)
Module No.	Title of the Module	List of Experiments	CO
1.	Computer basics and Environment	To understand different operating systems and compare them.	C373.1C2
2.	PERL	To understand scalars, arrays and hashes in perl and study its applications.	C373.1 C2
3.	PERL	To understand the use of conditional statements, loops in perl	C373.1 C2
4.	PERL	To understand subroutine in perl and study its applications.	C373.2 C3
5.	PERL	To understand different operators in perl	CO2
6.	PERL	To understand file handling in Perl and study its applications.	C373.2 C3
7.	PERL	To make use of regular expressions of Perl in biological problems.	C373.2 C3
8.	PYTHON	To explore the basics of Python and Installation.	C373.1 C2
9.	PYTHON	To explore the data types, Functions and loops in python.	C373.1 C2
10.	PYTHON	To understand file handling in Python and study its applications.	C373.3 C3
11.	PYTHON	To identify the biological pattern using regular expressions and modules of python	C373.3 C3
12.	PYTHON	To perform the sequence analysis using packages	C373.4 C4
13	App designing	Exploration and basic of App Designing	C373.3 C3

Evaluation Criteria

Components	Maximum Marks
Mid Viva (Written exam)	20
Final Viva (Written exam)	20
D2D (Report/Attendance/Experiment)	60
Total	100

PBL: Students learn and explore the basic knowledge of perl and python and various functions , data structure, modules with understanding the problems such as pattern serach, promoter search, regex operatios and sequeunce file handling. Students are also explained about the sequence analysis and basic use of app desiging with discussion about use in industry and research.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1. M. Model, Bioinformatics programming using Python. Sebastopol, Calif.: O'Reilly Media, 2010.
2. J Tisdall, Mastering Perl for Bioinformatics, O'Reilly Media, 2003

Course Code	15B19BT591	Semester Odd (specify Odd/Even)	Semester V Session 2022-2023 Month from July -Dec
Course Name	Minor project-I		
Credits	1	Contact Hours	LTP 0 0 2
Faculty (Names)	Coordinator(s)	Prof Rachna	
COURSE OUTCOMES			COGNITIVE LEVELS
Sl. No.	DESCRIPTION		
C350.1	Select a relevant biotechnological problem		C1
C350.2	Summarize research literature related to the identified problem		C2
C350.3	Demonstrate data analysis ability		C2
C350.4	Demonstrate verbal and written presentation and communication skills		C2

Course Code	15B11BT413	Semester ODD (specify Odd/Even)	Semester V Session 2022-2022 Month from January- June
Course Name	Bioprocess Engineering		
Credits	3	Contact Hours	3
Faculty (Names)	Coordinator(s)	Prof Sudha Srivastava	
	Teacher(s) (Alphabetically)	Dr. Ashwani Mathur Prof Sudha Srivastava	
COURSE OUTCOMES			COGNITIVE LEVELS
C215.1	Explain design, principle and working of bioreactors		Understand Level (C2)
C215.2	Apply the principles of microbial growth kinetics in bioreactor		Apply Level (C3)
C215.3	Analyze mixing operations, mass and heat transfer in bioreactor		Analyze Level (C4)
C215.4	Compare culture and sterilization methods for industrial scale operations		Evaluate Level (C5)
C215.5	Evaluate the suitability of a given bioreactor for bioproduct development.		Evaluate Level (C5)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Microbial Process Development	Cell growth kinetics, Monod's kinetics, substrate utilization kinetics, Introduction to Upstream & Downstream processes, Batch, fed-batch and continuous cultivation processes, Enzyme Kinetics	6
2.	Bioreactor Systems including Utilities	Types of bioreactors and their applications, Cardinal Rule of bioreactor Design, Utilities of bioreactors, design equation for maximum biomass production	5
3.	Fluid Flow and Mixing	Mixing, power consumption and shear properties of rushton turbine, helical, anchor, bubble column, external loop, airlift etc. Axial and radial flow of liquid in bioreactor.	5
4.	Mass transfer	Oxygen uptake in cell culture, Oxygen transfer in Fermenters, Measurement of dissolved-oxygen concentrations, Estimation of oxygen solubility, Mass-transfer correlations, Measurement of $k_1 a$ & Oxygen transfer in large Vessels, scale up of bioprocesses. Heat transfer Kinetics	8
	Sterilization	Air and Media sterilization: Thermal death of micro-organisms, Batch and continuous sterilization of media, Design of sterilization equipment (deterministic vs probabilistic approach), techniques of air sterilization, air sterilization by fibrous material.	6

	Bioreactor analysis	Ideal reactors for kinetics measurements (batch, fed batch & CSTR), Ideal reactors, Non-ideal reactors (airlift), Immobilized enzyme and cell reactor, multiphase bioreactors	6
	Case studies related applications in various biotech and biopharma industries	Process technology for production of primary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides and plastics. Microbial production of industrial enzymes- glucose isomerase, cellulase, amylase, protease etc.. Production of secondary metabolites- penicillins and cephalosporins, Production of therapeutic proteins: Monoclonal antibodies, viral vaccines	6
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Class Test)	
Total		100	
<p>Project based Learning: The course explains the students the design and operation of bioreactors and the physical and chemical processes that are pivotal in commercial scale operation of bioreactor. Student also learn the association between upstream and downstream processes. Student learn different modes of operating bioreactors, used in Industries and their kinetics. The scalable sterilization instruments used in bio-manufacturing industries are also explained to students. Students also learn the processes involved in bio manufacturing of commercially important metabolites using process engineering principles.</p>			
<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>			
1.	Doran, P.M., "Bioprocess Engineering Principles"		
2.	Biochemical Engineering Fundamentals, Bailey and Ollis McGraw-Hill Education		
3.	Stanbury P. F., Whitaker A and Hall S. J. "Principles of Fermentation Technology" Butterworth-Heinemann; 2 nd edition 1994.		
4.	Aiba, S., Humphrey, A.E., and Millis, N.F. "Biochemical Engineering". University of Tokyo Press.		
5.	Scragg, A.H., "Bioreactors in Biotechnology: A practical approach", Ellis Horwood Publications.		

Subject Code	15B11BT412	Semester : ODD	Semester : V Session : 2022-2023 Month from : July - Dec
Subject Name	Molecular Biology& Genetic Engineering		
Credits	3	Contact Hours	3
Faculty (Names)	Coordinator(s)	1. Dr. Shalini Mani	
	Teacher(s) (Alphabetically)	1. Dr. Vibha Gupta 2. D. Shalini Mani	
COURSE OUTCOMES			COGNITIVE LEVELS
CO214.1	Explain the structure of nucleic acids and chromosomal organization		Understand Level (C2)
CO214.2	Summarize the fundamental concepts of central dogma of life in prokaryotes and eukaryotes.		Understand Level (C2)
CO214.3	Develop critical thinking skills from understanding of classical experiments in Molecular Biology		Apply Level (C3)
CO214.4	Distinguish the basic tools and techniques employed in genetic engineering and integrate the acquired knowledge for designing basic experiments, analyzing observations and predicting results		Analyze Level (C4)
CO214.5	Recognize importance as well as ethical and biosafety issues related to generating transgenic plants, animals and microbes		Evaluate Level (C5)
Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Central Dogma of Molecular Biology	Central Dogma, Chromatin, Nucleosome organization, Chromatin Remodeling,	2
2.	Nucleic Acid Structure and Functional Elements in DNA	DNA and RNA, Classical Models, Prokaryotic Genes, Eukaryotic Genes (Introns and Exons) Organization of Genes on Eukaryotic Chromosomes	3
3.	DNA Replication, Repair and Recombination	Replication in Prokaryotes & Eukaryotes, Breakage and Reunion: Holiday; Meselson-Radding Enzymes, Gene Conversion, Direct Repair, Excision Repair, Post-Replication Recombination-Mediated Repair, SOS Repair. Mobile genetic elements	6
4.	Prokaryotic RNA Transcription	Process: Initiation, Elongation, Termination, gene regulation	5
5.	Eukaryotic Transcription, mRNA, Processing:	Basic Features, Methodologies, RNA Polymerase I, RNA Polymerase III, RNA Polymerase II, Basic Features of RNA Processing, RNA splicing, Eukaryotic mRNA Splicing: tRNA Processing: 5'- and 3'- Ends, and	8

		Intron Splicing E. rRNA Processing: Group I Introns -Ribozymes, and gene regulation Upstream Elements within the Promoter: Enhancers: Sequence Elements not in Promoter Regulation of Tissue-Specific Gene, transcription, Transcription Control by Small Molecules: Lipid-Soluble Hormones	
6.	Genetic Code and Protein Synthesis: Prokaryotic and Eukaryotic System	The role of triplet codon in the translation process, Basics of Translation, Components in the Translation Process, tRNA, Ribosomes	5
7.	Gene manipulation: Introduction, DNA manipulative enzymes	Restriction enzymes and other DNA modifying enzymes; Basic techniques of gene manipulation - Gel electrophoresis, Blotting and DNA transformation techniques, Polymerase Chain Reaction; Sequencing & Mutagenesis; Gene silencing	4
8.	Vector Biology	Cloning vectors – plasmid and phage vectors, cosmids, phagemids and other advanced vectors, Ti plasmid; Specialized vectors - shuttle vectors and expression vectors	3
9.	Gene Cloning strategies	Cloning of PCR products, Cloning genomic DNA (Construction of Genomic library, cDNA library, Screening Libraries with Gene Probes, Screening Expression Libraries, Positional Gene Cloning, Subtractive cloning, Functional cloning	5
10	Genetic Manipulation of Plants and Animals	Production of Industrially Important, Metabolites, Genetically Engineered Strains of Animals and Plants, applications in Agriculture and animal husbandry; Scope and application; Ethical and Biosafety Issues	3
Total number of Lectures			44

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test-1, Assignment-1&2, Case studies 1, 2& 3)
Total	100

PBL: With the increasing number of biotech firms and interest, the future scope of the proposed course is very bright. Students were made aware of the concepts of Molecular biology, recombinant technology and synthetic Biology by groups discussions, quizzes and problem-solving exercises. To develop ethical concepts, students were asked to make a mini proposal to apply concepts of molecular Biology and genetic engineering in the betterment of society

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)

1.	Molecular Biology of the Gene, fifth edition: Menlo Park, CA: Benjamin/Cummings Watson, J. D., 2008.
2.	Gene Cloning and DNA Analysis: an Introduction. Seventh edition: Oxford: Blackwell Pub, Brown, T. A. 2015.
3.	Molecular Biotechnology: Principles and Applications of Recombinant DNA, fourth edition: Washington, D.C.: ASM Press Glick, B. R., & Pasternak, J. J. 2010
4.	Recent research articles and reviews related to each module.

Detailed Syllabus

Subject Code	16B1NHS435	Semester : ODD	Semester: V Session: 2022-2023 Month: August 2022 to Dec 2022
Subject Name	SOCIOLOGY OF MEDIA		
Credits	3	Contact Hours	(3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Priyanka Chhapariya
	Teacher(s) (Alphabetically)	Dr. Priyanka Chhapariya Shikha Kumari

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C303-2.1	Demonstrate a basic understanding of different concepts used in the systematic study of Sociology of Media	Understanding(C 2)
C303-2.2	Examine various sociological theoretical orientations towards media and society.	Analyzing(C 4)
C303-2.3	Analyze the key issues related to the processes of Production of Media, Popular Culture and consumer culture.	Analyzing(C 4)
C303-2.4	Critically evaluate the Cultural Consumption, Social Class & the process of construction of subjectivities and audience reception in new Media	Evaluating(C 5)
C303-2.5	Create positive and critical attitude towards the use of new media and understanding of threats of Digital Age	Creating(C 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to the Course	1
2.	Theoretical Orientation	<ul style="list-style-type: none"> ● Functionalist Approach to the Sociology of Media and Popular Culture ● Critical Approach to the Sociology of Media and Popular Culture 	8

		<ul style="list-style-type: none"> ● Symbolic Interactionist Approach to the Sociology of Media and Popular Culture ● Different theories of Media 	
3.	Concept of Popular Culture and its critical analysis	<ul style="list-style-type: none"> ● What is popular culture? ● Difference between 'pop' culture and 'high' culture ● What distinguishes popular culture from other kinds of culture (art, folk culture)? Is there a distinction at all anymore? ● Visualizing Society through 'pop' culture/media ● Risks and rituals that come with Popular Culture 	8
4.	New media	<ul style="list-style-type: none"> ● Difference between tradition media and new media ● New media as technology ● New Information Technology (brief history in case of India) 	5
5.	Media & State	<ul style="list-style-type: none"> ● Mediatization of Society ● Free-speech Media 	5
6.	Consumption of Media and Media reception	<ul style="list-style-type: none"> ● Social Actors as Audience/ Audience as market– Theory ● Media effects: Media and representations (gender, ethnic)- the under-representation and misrepresentation of subordinate groups. ● Media and the construction of reality: media logic and cultivation analysis theory ● Information Society vs Informed Society ● Cultural Consumption and Social Class 	9
7.	Media in Global Age	<ul style="list-style-type: none"> ● Rise of Network Society- Manuel Castells ● Global Media: impact of market & state ● Global Perspectives: The world on our doorstep ● Marketing and aesthetics in everyday life 	7
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project, Presentation and attendance)	
Total		100	

Project Based Learning- Each student will review research papers applying assumptions of different media theories studies in the course and submit a project.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Joseph Turow, <i>Media Today: An Introduction to Mass Communication</i> , 3 rd Ed., Taylor & Francis. UK. (2008).
2.	JA Fisher 'High Art v/s Low Art, in Berys Nigel Gaut & Dominic Lopes (eds.), <i>The Routledge Companion to Aesthetics</i> . Routledge 2001
3.	G. Ritzer, 'McDonaldization of Society, . <i>The Journal of American Culture</i> . Volume 6, Issue 1. (2001 [1983]) Pp. 100-107.
4.	Manuel. Castells, 'Introduction', in <i>Rise of Network Society: The Information Age: Economy, Society and Culture</i> , 2 nd Ed (1996).

Detailed Syllabus
Lecture-wise Breakup

Subject Code	16B1NHS434	Semester :ODD	Semester V Session 2022-2023 Month: August - December
Subject Name	Introduction to Contemporary Form of Literature		
Credits	3	Contact Hours	3 (3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Debjani Sarkar
	Teacher(s) (Alphabetically)	Dr. Debjani Sarkar

<u>Course Outcomes:</u>		
	Course Outcome	COGNITIVE LEVELS
C303-6.1	Interpret & relate with the genres, periods, and conventional as well as experimental forms of literature as current ethical, technological and cultural reflections of society.	CL-2 Understand
C303-6.2	Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society.	CL-3 Apply
C303-6.3	Analyze select representative texts of different cultures thematically and stylistically.	CL-4 Analyse
C303-6.4	Determine the reciprocal relationship between the individual and culture individually and/or through a research-based paper/poster presentation.	CL-5 Evaluate
C303-6.5	Create literary, non-literary write-up with proper applied grammar usage, individually and in a team.	CL-6 Create

Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
1.	Introducing Literary Theories	<ul style="list-style-type: none"> ● From Formalism to Reader Response Theory: Major Terms & Concepts ● Narrative Art & Narratology ● Language & Style: An Introduction 	12
2.	Introducing New Forms & Sub Genres Today: Features & Portions	<ul style="list-style-type: none"> ● New Fiction: Graphic Novels, Cyberpunk ● Non Fiction: Memoirs & Autobiographies, Biographies 	4
3.	Modern Retellings/ Children's Literature	<u>Cinderella (Poem) - Roald Dahl</u>	3
4.	European Lit./Travel/ Memoir/ Spiritual Literature	<u>Eat, Pray & Love (Travelogue & cinematic adaptation)</u>	4
5.	Written Communication Through Non-Fiction	<i>Personal Narratives (Diary, Blog, Memoirs, Travelogue)</i>	4
6.	Commonwealth / Indian Literature	<u>Hayavadana (Short Play) - Girish Karnad</u>	4
7.	Afro-American Lit/ Post Colonial Literature	<u>Sweetness (Short Story) – Toni Morrison</u>	3
8	Sci-fi (Cyberpunk)	<u>Neuromancer (Science Fiction) – William Gibson</u>	4
9	Canadian Literature/ Speculative Fiction	<u>The Penelopiad- Margaret Atwood</u>	4
Total number of Hours			42

Project Based Learning: Students will be required form groups of 4-5 and write a research article on a chosen text (novel, short story, drama, poetry, prose or film) and analyze it through one/or more of the following theoretical perspectives including Reader response theory, Structuralism and Post-structuralism, Narratology etc.

The objective of this project would be to help students understand the textual, socio-political and cultural dimensions of literature and its imitation of life. It would also enhance the thinking and analytical skills of the students.

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Class Interaction)
Total	100
Recommended Reading material: Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	M.H. Abrams, 'A Glossary of Literary Terms'.7 th Edition, Hienle&Hienle: Thomson Learning, USA, 2021
2.	Mark William Roche, 'Why Literature matters in the 21 st Century', 1 st Edition, Yale University Press, 2004.
3	https://allpoetry.com/poem/8503199-Cinderella-by-Roald-Dahl Online video version: https://www.youtube.com/watch?v=dLmNG5EbHvc . An interview with Dahl: https://www.youtube.com/watch?v=pA7kUPStmPE
4	Elizabeth Gilbert, 'Eat, Pray & Love. 1 st Edition, Penguin,US, 2006. For online version: http://mrs-sullivan.com/wp-content/uploads/Eat-Pray-Love-Book-on-pdf.pdf An interview with Elizabeth : https://www.youtube.com/watch?v=m9B9zFo4RFw
5	William Zinsser, 'On Writing Well: The Classic Guide to Writing Nonfiction', Harper Perennial; 30th Anniversary ed. Edition, 2016 For Online version: http://richardcolby.net/writ2000/wp-content/uploads/2017/09/On-Writing-Well-30th-Anniversa-Zinsser-William.pdf
6	Girish Karnad, 'Hayavadana', 1st Edition, Oxford University Press, Delhi, 1975 (30th Impression, 2012). For online version: https://pdfcoffee.com/hayavadana-girish-karnadpdf-pdf-free.html An interview with Karnad: https://www.youtube.com/watch?v=laL7oWWuLGI

7	<p>https://www.newyorker.com/magazine/2015/02/09/sweetness-2</p> <p>Audio version: https://www.youtube.com/watch?v=ltKXTZTBmPs_</p> <p>An interview with Morrison: https://www.youtube.com/watch?v=DQ0mMjII22I&list=RDDQ0mMjII22I&start_radio=1&rv=DQ0mMjII22I&t=107</p>
8	<p>William Gibson, 'Neuromancer', 1st Edition, The Berkley Publishing Group, New York, 1984.</p> <p>For online version http://index-of.es/Varios-2/Neuromancer.pdf</p>
9	<p>Margaret Atwood, 'The Penelopiad', 1st Edition, Canongate Series, Knopf, Canada, 2005.</p> <p>For online version: https://www.langhamtheatre.ca/wp-content/uploads/2010/09/The-Penelopiad.pdf</p> <p><u>An interview with Atwood:</u> https://www.youtube.com/watch?v=D5Wj_JQ6NhY</p>

Course Code	16B1NHS433	Semester: Odd	Semester V; Session 2022-2023 Month from August to Dec 2022
Course Name	Financial Management		
Credits	3	Contact Hours	3 (3-0-0)
Faculty (Names)	Coordinator(s)	Dr. Shirin Alavi Dr. Sakshi Varshney	
	Teacher(s) (Alphabetically)	Dr. Sakshi Varshney Dr. Shirin Alavi	

COURSE OUTCOMES		COGNITIVE LEVEL
C303-3.1	Understand the fundamental concepts of Financial Management and Analyze the time value of money in taking investment decisions.	Analyze (Level 4)
C303-3.2	Contrast the various forms of business organizations, evaluate the source of funds and measures their financial performance through ratio analysis.	Evaluate (Level 5)
C303-3.3	Evaluate investment projects using capital budgeting techniques.	Evaluate (Level 5)
C303-3.4	Apply the concept of cost of capital into evaluation of investment projects.	Apply (Level 3)
C303-3.5	Evaluate the leverage capacity of a business and its applications in selection of Long term source of finance	Evaluate (Level 5)
C303-3.6	Understand the practical considerations for managing working capital requirements in a firms	Understand (Level 2)

Module No.	Title of Module	Topics in the module	No. of Lectures for the module
1	Introduction	Basic Financial concepts-Meaning of Accounting, Accounting Concepts and Conventions ,Introduction to Double Entry System and Accounting equation Definition and objectives of Financial management.	4
2	Time value of money	Compounding, Discounting, Annuity, Perpetuity, Loan Amortization	5
3	Analysis of Financial Statements	Understanding of Balance Sheet and Income Statements, Ratio Analysis, Interpretation, Importance and limitation	5

4	Capital Budgeting: Principle Techniques	Nature of Capital Budgeting, Evaluation Techniques: Discounting (NPV,IRR etc.) and Non-discounting Techniques (payback, ARR etc.)	6
5	Long-Term Sources of Finance	Definition, Types, advantages and disadvantages.	4
6	Concept and measurement of cost of capital	Definition, measurement of specific costs, computation of Overall Cost of Capital	5
7	Cash Flows for Capital Budgeting	Identification and determination of relevant cash flows	5
8.	Leverages and Capital Structure decision and working Capital Management	Break Even Analysis, Operating, Financial and Combined leverage, Capital Structure EBIT- EPS analysis, Concept of working capital management, Evils of Excess or Inadequate Working Capital, Cash Management-Inventory Management	8
	Total number of Lectures		42
Evaluation Criteria Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project+ Quiz+ Class participation)	
Total		100	

Project-Based Learning: Each student in a group of 4-5 will opt a company which is listed in at least one of the stock exchanges of India. To make subject application based the students analyze latest financial data and other information of last two years of chosen company by the financial tool of Ratio\ analysis and use this financial data for decision making. Understanding Balance sheet and financial statements of the business firm enhances the students' knowledge on organizational structure of the firm and financial analysis helps the employability into financial sector.

Recommended Reading material; Author(s) Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	Chandra, P., <i>Financial Management Theory and Practice</i> , 7th ed., Tata McGraw Hill, 2007.
2	Horne, J.C.V. and Wachowicz, J.M. <i>Fundamentals of Financial Management</i> , 13th ed., Pearson Publication, 2009. Accessed online: https://wps.pearsoned.co.uk/ema_uk_he_wachowicz_fundfinman_13/106/27149/6950308.cw/-/6950310/index.html
3	Khan, M.Y. and Jain, P.K. <i>Financial Management: Text, Problems and Cases</i> , 8th ed., McGraw Hill Education, 2019.
4	Kishore, R.M., <i>Financial Management</i> , 6th ed, Taxmann, 2007.
5	Mukherjee, M and Hanif.M., <i>Financial accounting</i> , 8th ed., Tata McGraw Hill, 2008.
6.	Pandey, I.M., <i>Financial management</i> , 11th ed, Vikas Publishing House Pvt Ltd, 2015

Course Code	16B1NHS532	Semester: ODD (specify Odd/Even)	Semester: 5th Month from: Aug to Dec 2022
Course Name	Planning and Economic Development		
Credits	03	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Amba Agarwal and Dr. Amandeep Kaur	
	Teacher(s) (Alphabetically)	1. Dr. Amba Agarwal 2. Dr. Amandeep Kaur	
COURSE OUTCOMES			COGNITIVE LEVELS
C303-4.1	Understand the issues and approaches to economic development.		C2
C303-4.2	Evaluate National income accounting, human development index and sustainable development.		C5
C303-4.3	Apply an analytical framework to understand the structural characteristics of development.		C3
C303-4.4	Analyze the role of Macroeconomic stability & policies and Inflation in the development process.		C4
C303-4.5	Evaluate the importance of federal development and decentralization.		C5
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Economic Development and its Determinants	Economic growth and development. Indicators of development. Approaches to economic development. Rostows Stages of Growth.	5

2.	National Income Accounting	National Income Accounting, Green GNP and Sustainable development	5
3.	Indicators of development	PQLI, Human Development Index (HDI) and gender development indices.	4
4.	Demographic Features, Poverty and Inequality	Demographic features of Indian population; Rural-urban migration; Growth of Primary, Secondary and Tertiary Sector.	5
5.	Inflation and Business Cycles	Inflation. Business cycle. Multiplier and Accelerator Interaction.	6
6.	Macro-Economic Stability & Policies	Monetary Policy. Fiscal Policy. Role of Central Bank & Commercial banks in the development of the country. Balance of payments; currency convertibility and Issues in export-import policy.	6
7.	Federal Development	The Federal Set-up - The Financial Issues in a Federal Set-up, Principles for Efficient Division of Financial Resources between Governments. Financial Federalism under Constitution. Finance Commissions in India, Terms of References and its Recommendations	6
8.	Planning and Development	Need for planning, Decentralisation, Rural and Urban local bodies.	5
Total number of Lectures			42

Evaluation Criteria
Components Maximum
Marks T1 20
T2 20
End Semester Examination
35 TA 25 (Assignment +
Quiz)
Total 100

Project-based Learning: Each student in a group of 4-5 will opt a topic and submit a report related to India's Development Indicators based on following parameters; National Income, State Income, Human Development Index (HDI), Gender Development Indices (GDI), Demographic Profile, Migration, Sectoral contributions of income and employment, Poverty, Income Inequality & literacy,

Federal Structure, Budgetary estimates, Tax and Monetary Policy, Distribution of financial resources from central to state to local bodies. Understanding fundamental development indicators will upgrade student's knowledge on various Economic Development front and improve mechanism to formula suitable policy design, which further strengthen their employability into public and private decision-making body.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Todaro, M.P., Stephen C. Smith, Economic Development, Pearson Education, 2017
2.	Thirwal, A.P., Economics of Development, Palgrave, 2011
3.	Ahuja, H. L., Development Economics, S Chand publishing, 2016
4.	Ray, Debraj, Development Economics, Oxford University Press, 2016
5.	Meier, G.M., Leading Issues in Economic Development, Oxford University Press, New Delhi, 2008
6.	Ahuja, H. L., Development Economics, S Chand publishing, 2016
7.	Benavot, Aaron. "Education, gender, and economic development: A cross-national study." Sociology of education (1989): 14-32.
8.	Falk, Armin, and Johannes Hermlé. "Relationship of gender differences in preferences to economic development and gender equality." Science 362, no. 6412 (2018).

Detailed Syllabus

Course Code	17B1NHS531	Semester: Odd	Semester V Session 2022 -2023 Month from August - December
Course Name	Technology and Culture		
Credits	3	Contact Hours	(3-0-0)

Faculty (Names)	Coordinator(s)	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Swati Sharma

COURSE OUTCOMES		COGNITIVE LEVELS
C303-5.1	Understand socio-cultural factors and their effect on individuals, organizations and the business environment	Applying (C 2)
C303-5.2	Appraise technological convergence and cultural divergence, relate the differences to the literature and suggest solutions	Evaluating (C 5)
C303-5.3	Interpret and communicate effectively in physical and virtual teams by evaluating appropriate concepts, logic and selecting the apt IT tools.	Evaluating (C5)
C303-5.4	Evaluation of the theoretical knowledge to adapt to cultural differences in global work environment.	Evaluating (C 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	<ul style="list-style-type: none"> ▪ The Information Technology Revolution ▪ The concept of Network societies ▪ Technology and Culture-how cultural beliefs influence technology 	5
2.	Dimensions of Culture	<ul style="list-style-type: none"> ▪ Evolution of Culture ▪ Principal theories of Culture: Kluckhohn and Strodbeck, Hofstede, Trompenaars and Schwartz ▪ Cultural Diversity and cross-cultural literacy 	6
3	Levels of Culture	<ul style="list-style-type: none"> ▪ Levels of Culture ▪ Measurement of Culture 	5

4.	Cross cultural communication in physical and virtual teams	<ul style="list-style-type: none"> ▪ The Communication Process ▪ Language and Culture ▪ Non-Verbal Communication ▪ Barriers to Cross Cultural Understanding 	6
5.	Negotiation and Decision Making	<ul style="list-style-type: none"> ▪ Theories of Negotiation ▪ Negotiation and Intercultural Communication ▪ Decision making in cross cultural environment ▪ Expatriate Management 	6
6.	Culture and Marketing	<p>Culture and research</p> <p>Culture and Consumer behaviour</p> <ul style="list-style-type: none"> ▪ Culture and Marketing 	7
7.	Cross Culture and Leadership	<ul style="list-style-type: none"> ▪ Leadership and Culture ▪ Theories of Culture centric leadership and their Global Relevance ▪ Developing Competencies for Global citizens ▪ Women as International Leaders ▪ Cross Cultural Training ▪ Ethical Guidelines for Global Citizens 	7
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project and Oral Viva)
Total	100

Project based learning: Students in group of 4-5 members are required to present a term paper exploring the influence of culture on diverse aspects of business, design and technology.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2020). <i>International marketing</i> . McGraw-Hill Education.
2.	Coyle, D., <i>The Culture Code: The Secrets of Highly Successful Groups</i> , Bantam, 2018
3.	Fletcher, R., & Crawford, H. (2013). <i>International marketing: an Asia-Pacific perspective</i> . Pearson Higher Education AU.

4.	Gerard Bannon, J. (red.). Mattock, Cross-cultural Communication: The Essential Guide to International Business.2003
5.	Maidenhead.Riding the Waves of Culture: Understanding Cultural Diversity in Business (2012).3rd edition. McGraw Hill.
6.	Madhavan,S., Cross Cultural Management: Concepts and Cases(2 nd Ed),Oxfor University Press 2016.
7.	Robertson, Ronald. Globalization: Social theory and global culture, London: Sage, 1992.

Subject Code	19B12HS311	Semester: ODD	Semester V Session 2022-2023 Month from July to December	
Subject Name	ENTREPRENEURIAL DEVELOPMENT			
Credits	3	Contact Hours	3-0-0	
Faculty (Names)	Coordinator(s)	Dr. Deepak Verma		
	Teacher(s) (Alphabetically)	Dr. Deepak Verma		
COURSE OUTCOMES			COGNITIVE LEVELS	
C303-8.1	Understand basic aspects of establishing a business in a competitive environment		Understand Level (C2)	
C303-8.2	Apply the basic understanding to examine the existing business ventures		Apply Level (C3)	
C303-8.3	Examine various business considerations such as marketing, financial and teaming		Analyze Level (C4)	
C303-8.4	Assessing strategies for planning a business venture		Evaluate Level (C5)	
Module No.	Subtitle of the Module	Topics in the module		No. of Lectures for the module
1.	Entrepreneurial perspective	Foundation, Nature and development of entrepreneurship, importance of entrepreneurs, Entrepreneurial Mind, Individual entrepreneur Types of entrepreneurs		8
2.	Beginning Considerations	Creativity and developing business ideas; Legal issues; Creating and starting the venture; Building a competitive advantage		14

3.	Developing Marketing Plans	Developing a powerful Marketing Plan, E commerce, Integrated Marketing Communications	6
4.	Developing Financial Plans	Sources of Funds, Managing Cash Flow, Creating a successful Financial Plan Developing a business plan	11
5.	Leading Considerations	Developing Team, Leading the growing company, Resources for growth	3
Total number of Lectures			42
<p>Evaluation Criteria</p> <p>Components Maximum Marks</p> <p>T1 20</p> <p>T2 20</p> <p>End Semester Examination 35</p> <p>TA 25 (Assignment, Project, Class Participation, Attendance)</p> <p>Total 100</p> <p>Project based learning: Each student in a group of 4-5 will work on developing business plan around a new idea. They will include the major business consideration in the plan. The students will present the business plans. Discussions on these practical issues will enhance students' understanding of entrepreneurship. The students will learn from other groups as well through other groups' presentations.</p>			
<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>			
1.	Robert D Hisrich, Michael P Peters & Dean A Shepherd, "Entrepreneurship" 10 th Edition, McGraw Hill Education, 2018		
2.	Norman M. Scarborough and Jeffery R. Cornwell, "Essentials of entrepreneurship and small business management" 8th Edition, Pearson, 2016		
3.	Rajiv Roy, "Entrepreneurship", 2 nd Edition, Oxford University Press, 2011		
4.	Sangeeta Sharma, "Entrepreneurship Development", 1 st Edition, Prentice-Hall India, 2016		
5.	John Mullins, "The New Business Road Test: What entrepreneurs and investors should do before launching a lean start-up" 5th Edition, Pearson Education, 2017		

Detailed Syllabus

Course Code	20B13HS311	Semester: Odd	Semester: V Session: 2022-2023 Month: August-December
Course Name	Indian Constitution and Traditional Knowledge		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	<ul style="list-style-type: none"> ● Dr. Chandrima Chaudhuri ● Dr. Namreeta Kumari ● Ms, Shikha Kumari

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C305.1	Demonstrate an understanding about the early Indian traditional political thought and the constitutional design by knowing about the structure of government in place	Understand(C2)
C305.2	Demonstrate an understanding of the role of Indian President, Prime Minister, Governor, other members of the legislature in their mutual interaction and local governments as representatives of the common masses	Understand (C2)
C305.3	Analyze the working of Indian federalism with reference to centre-state relations	Analyze(C4)
C305.4	Analyze the impact of the contemporary challenges such as caste and gender to the working of Indian democracy	Analyze(C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	The Indian Constitution	<ul style="list-style-type: none"> ● Historical Background to the Indian Constitution. ● Salient features of the Indian Constitution. ● Fundamental Rights (Part III of the Indian Constitution) ● Fundamental Duties (Part IVA of the Indian Constitution). ● Directive Principles of the State Policy (Part IV of the Indian Constitution). ● Amendments to the constitution 	8
2.	Organs of the Government	<ul style="list-style-type: none"> ● The Executive: President, Prime Minister and Governor- appointment, powers and functions ● The Legislature: Parliament and its components- Lok Sabha and Rajya Sabha (composition and functions) ● The Judiciary: Supreme Court-composition, functions, appointment and jurisdiction 	8

3.	Nature of Federalism in India	<ul style="list-style-type: none"> ● Centre-State Legislative Relations ● Centre-State Administrative Relations ● Centre-State Financial Relations ● Special Provisions of some state and the 5th and 6th schedule ● Emergency provisions 	8
4.	Local Governance in India	<ul style="list-style-type: none"> ● Urban local governance: Municipality-Structure & Functions. ● Rural Local governance: Panchayat-Organization and Powers. ● Civil Society: the participation of the people in local governance 	8
5.	Traditional knowledge	<ul style="list-style-type: none"> ● Kautilya- Theory of state. ● Mandala theory. ● Saptanga theory 	6
6.	Challenges to Indian Democracy	<ul style="list-style-type: none"> ● Caste as a critical factor in the Indian Constitution. ● Gender as critical to the process of Continentalization 	4
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Project)
Total	100

Project: Projects based on important Supreme Court judgments have to be submitted by the students as a part of the project-based learning method. This would help the students to know about the interpretation of the various rights done by Supreme Court which would help them in their workplace as well as in general life.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A.A. George, <i>Important Judgements that transformed India</i> , New Delhi: McGraw Hill, 2020
2.	B. Chakraborty, <i>Indian Constitution: Text, Context and Interpretation</i> , New Delhi: Sage Publications, 2017
3.	B.K.Sharma, <i>Introduction to the Constitution of India</i> , New Delhi: Prentice Hall of India, 2002

4.	M.Laxmikanth, <i>Indian Polity</i> , 6 th edition, Noida: McGraw Hill, 2019
5.	M.P.Singh and R. Saxena, R, <i>Indian Politsics: Contemporary Issues and Concerns</i> , New Delhi: PHI Learning, 2008
6.	R. Kangle, <i>Arthashashtra of Kautilya</i> , New Delhi: Motilal Publishers, 1997
7.	Videos- Samvidhan series produced by Rajya Sabha Television .https://www.youtube.com/watch?v=0U9KDQnIsNk

Course Code	16B1NMA531	Semester Odd	Semester V Session 2022-2023 Month from Aug 2022- Dec 2022
Course Name	Discrete Mathematics		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Vipin Chandra Dubey	
	Teacher(s) (Alphabetically)	Dr. Vipin Chandra Dubey	
COURSE OUTCOMES: After the successful completion of this course, the student will be able to			COGNITIVE LEVELS
C301-1.1	explain partial order relations, Hasse diagram, lattices and recursive functions.		Understanding Level (C2)
C301-1.2	solve the difference equations using generating function and Z transform.		Applying Level (C3)
C301-1.3	explain the propositional and predicate calculus to check the validity of arguments.		Understanding Level (C2)
C301-1.4	demonstrate graphs, digraphs, trees and use it to solve the different problems of graph theory.		Applying Level (C3)
C301-1.5	illustrate various algebraic structures and their properties.		Understanding Level (C2)
C301-1.6	explain the theory of formal languages and solve the related problems of automata		Applying Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Relations and Lattices	Relations and their composition. Pictorial representation, matrix and graphical representations. Equivalence relations and partitions. Partial ordered relations and Hasse diagram. Lattices.	5

2.	Functions	Functions and Recursively defined functions, generating functions, solution of recurrence relations by generating function. Z transforms, solution of difference equations by Z transform.	8
3.	Propositional Calculus	Propositions- simple and compound. Basic logical operators. Implication. Truth tables. Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers.	4
4.	Graphs	Graphs and related definitions, subgraphs, isomorphism, paths and connectivity. Eulerian graph and Konigsberg problem. Hamiltonian graph. Labelled and weighted graphs. Tree Graphs Minimum spanning Tree (Prim's algorithm). Graph colorings. Four color problem.	7
5.	Directed Graphs	Trees, Digraphs and related definitions. Rooted trees. Algebraic expressions and Polish notation. Sequential representation. Adjacency matrix. Path matrix. Shortest path. Linked representation of directed graphs. Binary trees.	5
6.	Algebraic Structures	Groups- definitions and examples, order of elements, subgroup, condition for subgroups. Quotient groups, Lagrange theorem and applications, Rings, integral domains and Fields- definition and examples.	7
7.	Languages and Grammars	Strings (words) and languages, grammars, types of grammars, Finite state machines, finite state automata, regular languages and regular expressions.	6
Total number of Lectures			42

Evaluation Components	Criteria Maximum
Marks T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	100

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to the diversified applications of graph theory and theory of automata. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material:

1.	Lipschutz, S. and Lipson, M., Discrete Mathematics, 2 nd Edition, Tata McGraw-Hill, 1997.
2.	Rosen, K. H., Discrete Mathematics and its Application, 7 th Edition, Tata McGraw-Hill, 2011.
3.	Liu, C. L., Elements of Discrete Mathematics, 2 nd Edition, Tata McGraw-Hill, 1998.
4.	Kolman, B., Busby, R. C. and Ross, S., Discrete Mathematical Structures, 6 th Edition, Prentice Hall, 2018.
5.	Deo, N., Graph Theory, Prentice Hall, 2004.
6.	Grimaldi, R.P., Discrete and Combinatorial Mathematics, 5 th Edition, Pearson Education, 2011.

Course Code	21B12BT311	Semester Odd	Semester Vth Session 2022-2023 Month from July - Dec
Course Name	Phenomics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	1. Dr. Chakresh Kumar Jain
	Teacher(s) (Alphabetically)	Dr. Chakresh Kumar Jain

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Explain Phenomics and its principles	Understand Level (C2)
CO2	Summarise the Phenotyping technologies and resources	Understand Level (C2)
CO3	Apply computational method in solving expression of phenotypic traits.	Apply Level (C3)
CO4	Analyze the use of model systems for crop development	Analyze Level (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Overview of Phenomics	Fundamentals of Phenomics , understanding of fundamental biology through phenomics, Root, seed phenomics, challenges and scope of phenomics	5
2.	Experimental Designs for Next Generation Phenotyping	Randomized Complete Block Design, Augmented Block Design, Modeling and Appropriate Analyses and important considerations , Genetic Sampling and Effective Population Size	6

3.	Technologies for Phenotyping	Phenotypic Traits , Remote Sensing, Root phenotyping techniques, phenotypic parameters, disease phenomics, imaging techniques	7
4.	Phenomics data and analysis	phenotypic data , formats, Entity–Quality Formalism, association studies, phenotype microarrays data analysis, QTL, markers, gene expression markers, Epigenetic variation and models	8
5.	Computational resources for Phenomics data	International Plant Phenotyping Network (IPPN) , Open Traits Network (OTN) data analysis using ML, PhenomicDB, Deep Plant Phenomics	7
6.	Applications of phenomics	Crop development , long-term food security, Model system <i>Arabidopsis thaliana</i> , Controlled and filed environment, Enviratron Understanding genome function in bacteria	9
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz, Project based evaluation)
Total	100

PBL: Students will be assigned the topic under PBL to explore phenotyping techniques and its applications in phenomics through available resources/ computational databases in the understanding the crop development

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)

1.	Fritsche-Neto, R., Borém, A “ Phenomics How Next-Generation Phenotyping is Revolutionizing Plant Breeding”, Springer International Publishing Switzerland 2015, Pp 125, ISBN 978-3-319-13677-6
2.	John M. Hancock, “ Phenomics”, CRC Press Taylor & Francis Group, 2014,Pp269.
3	Yang, Zheng Rong, “ Machine :Learning Approaches to Bioinformatics”, New Delhi world Scientific, Pp 336, 2017
4	Research papers and manuals

Course Code	15B11BT413	Semester : Odd (specify Odd/Even)	Semester V Session 2022-2023
Course Name	Bioprocess Engineering		
Credits	3	Contact Hours	3
Faculty (Names)	Coordinator(s)	Prof. Sudha Srivastava	
	Teacher(s) (Alphabetically)	Dr. Ashwani Mathur Prof. Sudha Srivastava	
COURSE OUTCOMES			COGNITIVE LEVELS
C215.1	Explain design, principle and working of bioreactors		Understand Level (C2)
C215.2	Apply the principles of microbial growth kinetics in bioreactor		Apply Level (C3)
C215.3	Analyze mixing operations, mass and heat transfer in bioreactor		Analyze Level (C4)
C215.4	Compare culture and sterilization methods for industrial scale operations		Evaluate Level (C5)
C215.5	Evaluate the suitability of a given bioreactor for bioproduct development.		Evaluate Level (C5)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Microbial Process Development	Cell growth kinetics, Monod's kinetics, substrate utilization kinetics, Introduction to Upstream & Downstream processes, Batch, fed-batch and continuous cultivation processes, Enzyme Kinetics	6
2.	Bioreactor Systems including Utilities	Types of bioreactors and their applications, Cardinal Rule of bioreactor Design, Utilities of bioreactors, design equation for maximum biomass production	5
3.	Fluid Flow and Mixing	Mixing, power consumption and shear properties of rushton turbine, helical, anchor, bubble column, external loop, airlift etc. Axial and radial flow of liquid in bioreactor.	5
4.	Mass transfer	Oxygen uptake in cell culture, Oxygen transfer in Fermenters, Measurement of dissolved-oxygen concentrations, Estimation of oxygen solubility, Mass-transfer correlations, Measurement of $k_L a$ & Oxygen transfer in large Vessels, scale up of bioprocesses. Heat transfer Kinetics	8
	Sterilization	Air and Media sterilization: Thermal death of micro-organisms, Batch and continuous sterilization of media, Design of sterilization equipment (deterministic vs	6

		probabilistic approach), techniques of air sterilization, air sterilization by fibrous material.	
	Bioreactor analysis	Ideal reactors for kinetics measurements (batch, fed batch & CSTR), Ideal reactors, Non-ideal reactors (airlift), Immobilized enzyme and cell reactor, multiphase bioreactors	6
	Case studies related applications in various biotech and biopharma industries	Process technology for production of primary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides and plastics. Microbial production of industrial enzymes- glucose isomerase, cellulase, amylase, protease etc.. Production of secondary metabolites- penicillins and cephalosporins, Production of therapeutic proteins: Monoclonal antibodies, viral vaccines	6
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Class Test)	
Total		100	
<p>Project based Learning: The course explains the students the design and operation of bioreactors and the physical and chemical processes that are pivotal in commercial scale operation of bioreactor. Student also learn the association between upstream and downstream processes. Student learn different modes of operating bioreactors, used in Industries and their kinetics. The scalable sterilization instruments used in bio-manufacturing industries are also explained to students. Students also learn the processes involved in bio manufacturing of commercially important metabolites using process engineering principles.</p>			
<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>			
1	Doran, P.M., "Bioprocess Engineering Principles"		
2	Biochemical Engineering Fundamentals, Bailey and Ollis McGraw-Hill Education		
3	Stanbury P. F., Whitaker A and Hall S. J. "Principles of Fermentation Technology "Butterworth-Heinemann; 2 nd edition 1994.		
4	Aiba, S., Humphrey, A.E., and Millis, N.F. " Biochemical Engineering". University of Tokyo Press.		
5	Scragg, A.H., "Bioreactors in Biotechnology: A practical approach", Ellis Horwood Publications.		