Jaypee Institute of Information Technology

B.Tech. Biotechnology

Semester VI

Course Descriptions

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B11BT611	**Semester** Even	**Semester VI Session** 2019 -2020 **Month from** January- June
Course Name	Comparative & Functional Genomics		
Credits	4	**Contact Hours**	4

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain the fundamental concepts of functional genomics, transcriptomics and proteomics	Understand (C2)
CO2	Apply advanced techniques for improved diagnostics and therapeutics	Apply (C3)
CO3	Categorize different bioinformatics tools related to genomics and proteomics	Apply (C3)
CO4	Integrate and infer the bioinformatics data obtained through genomics studies	Analyze (C4)

Pre-requisite
[10B11BT511]- Introduction to Bioinformatics

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Genes and Genomes	Basics structure of gene and organization in prokaryotic to eukaryotic, features of genome structure and complexity, evolutionary conservation, type of model organism, their structure number of genes sequencing status, type of maps genetic linkage maps, physical maps, techniques used to map their significance relation with human genome	3
2.	Whole Genome Sequencing Technologies	Human genome project fact sheet, techniques used for sequencing (shot gun sequencing), mapping techniques (BAC, YAC), genome assembly problems	2
3.	Genome Annotation i.e. Mining Genomic Sequence Data	Sequential annotation, structural annotations, prediction of gene and their elements like ORF finder, promoter region ,LDA method, functional genomics, Dijkstra's algorithm, application in functional correlation	3
4.	Haplotyping: Concepts and Applications	Basics of haplotyping and its application in disease	2
5.	Pharmacogenomics: Concepts and Applications in	Basics of phylogenomic, methods used and application, Basics of	4

	Healthcare	pharmecogenomics and relation with disease, personalized medicine	
6.	SNP Technologies: Platforms & Analysis	SNP structure, techniques, prevalence and application in population genetics	3
7.	Gene Silencing Mechanisms	RNAi, non coding RNAs, Structure and biogenesis difference between SiRNA, MiRNAs, protein involve in RISC, prediction rule set, CRISPER	3
8.	Gene Cloning and Expression Platforms	Introduction: Gateway technology; Microarrays; SAGE; GIS	3
9.	DNA Protein Interactions	General; CHIP assay, EMSA; Library screening; DNA foot-printing; south western analysis; one hybrid assay	5
10.	Phage display	introduction; peptide display; antibody display; phage and phagemid system	4
11.	Protein-protein Interactions	Ribosome display; tandem affinity purification; Yeast two hybrid system, GST pull Down	4
12.	Quantitative proteomics	MALDI-TOF; LC-MS-MS, ICAT method; 2-D technology; Biomarkers; protein arrays	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment-1&2, Home Assignment, Quiz and case studies)
Total	**100**

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. M. Lesk. *Introduction to Genomics*. United Kingdom (UK): Oxford University Press, 2007.
2.	T.A. Brown. Genomes-3. United Kingdom (UK): Oxford University Press, 2007.
3.	D. C. Liebler and J. R. Yates. *Introduction to Proteomics*. New York, USA: Humana Press, 2002.
4.	Protein-Protein Interactions, Methods and Applications, Editors: Meyerkord, Cheryl L., Fu, Haian (Eds.), 2015
5.	N. C. Jones and P. A. Pevzner. *Introduction to Bioinformatics Algorithms (Computational Molecular Biology)*. Massachusetts, USA: MIT Press, 2004.
6.	DNA-Protein Interactions, Principles and Protocols, Editors: Leblanc, Benoît P., Rodrigue, Sebastien (Eds.), 2015

Detailed Syllabus

Lab-wise Breakup

Course Code	15B17BT671	**Semester: EVEN**	**Semester VI Session** 2019 -2020 **Month from** January to June
Course Name	**Comparative and Functional Genomics Lab**		
Credits	1	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	Dr. Manisha Singh, Dr. ShaziaHaider, Dr. Sonam Chawla, Prof. Sudha Srivastava Dr.Vibha Gupta, Prof. Vibha Rani,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Explain the basic concept of genes and genome using various databases	Understand Level (C2)
C374.2	Compare and analyze functional genomic and proteomic data using computational tools	Analyze Level (C4)
C374.3	Utilize the acquired knowledge of gene expression technologies	Analyze Level (C3)
C374.4	Apply and analyze cloning and expression of gene of interest	Analyze Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1-4	Basic skills of transcriptomics	RNAase free water preparation and DEPC treatment of labware	**CO2**
		RNA isolation from plant tissues	**CO2**
		Quality assessment of isolated RNA	**CO4**
		Primer designing for quantitative RT-PCR	**CO2**
5-9	Basic skills of proteomics	Induction and expression of recombinant proteins	**CO2**
		SDS-PAGE analysis of differential expression of recombinant proteins	**CO4**
		SDS-PAGE analysis of differential-------- contd.	**CO4**

		Gel densitometry using ImageJ	**CO4**
		Western blotting for expressed protein confirmation	**CO2**
10-12	Analysis of molecular interactions	To interpret the protein- protein interaction using STRING	**CO 3**
		Visualization of molecular interaction network and identification of crucial gene(s) using Cytoscape	**CO 1**
		Identification of clusters/Modules in a network	**CO3**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Exam	20
End Term Exam	20
Day to Day	60
Total	**100**

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.	Keith Wilson, John Walker. ―Principles and Techniques of Practical Biochemistry‖. Cambridge University Press, 2000
2.	https://vlab.amrita.edu/?sub=3&brch=187&sim=1331&cnt=1 (Western blotting)
3	http://vlab.amrita.edu/index.php?sub=3&brch=273&sim=1501&cnt=1 (Primer designing)
4	http://vlab.amrita.edu/?sub=3&brch=186&sim=319&cnt=1(Polyacrylamide gel electrophoresis)
5	Design of experiments, principle and the expected outcome and related literature will be provided to the student

Department of Biotechnology

Programme Name: B.Tech Biotechnology

Semester: VIth

Course Name & Code: Minor Project II (15B19BT691)

Course Outcomes:

At the completion of the course, students will be able to,

Sl. No.	DESCRIPTION	COGNITIVE LEVEL (BLOOM's TAXONOMY)
C351.1	Outline the specific biotechnological problem and explain the related scientific approaches	Understanding level (Level 2)
C351.2	Summarize the literature related to the specified topic	Understanding level (Level 2)
C351.3	Analyze and demonstrate team effort in presentation and data analysis	Analysing level (Level 4)
C351.4	Organize the data and develop scientific report writing skills	Applying level (Level 3)

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Lecture-wise Breakup

Course Code	16B1NBT631	**Semester** EVEN **(specify Odd/Even)**		**Semester** VI **Session** 2019 -2020 **Month from** January to June	
Course Name	BIOECONOMICS				
Credits	4		**Contact Hours**	4	

Faculty (Names)	**Coordinator(s)**	DR. ASHWANI MATHUR
	Teacher(s) (Alphabetically)	DR. ASHWANI MATHUR

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-2.1	Relate and summarize biological products as economic resources	Understanding (Level 2)
C330-2.2	Demonstrate understanding of economic pronciples for biological resources and develop the concept of sustainability	Understanding (Level 2)
C330-2.3	Make use of neoclassic economic theories and bioeconomic principles to find a robust solution to biotechnological and sustainability issues	Applying (Level 3)
C330-2.4	Apply the knowledge of bioeconomic principles and SWOT analysis technique for developing sustainable solution and profit maximization from fisheries and agricultural sectors	Applying (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to bioeconomics	Bio-economics- Concept, Development of Economics and Bioscience (Concept of resource economics for scarcity of biological resources), Bioresource elasticity, Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm)	5
2.	Bioeconomics and thermodynamics	Thermodynamic analysis and thermo economics, Exergy cost, Exergetic efficiency, Concepts of Sadi Carnot, Rudolf Clausius and Thermodynamics, John Stuart Mill's concept of steady state in nature, 1st and 2nd Laws of Thermodynamics applied to economics, economic processes and elasticity, entropy and utility, Energy analysis and economic evaluation	5
3.	Bioeconomics and sustainability	Benefits and challenges of knowledge-based bioeconomy, sustainable food security (Europe and African Perspective), Development of resource (agricultural) efficient bioeconomy, Social and economic challenges for bioeconomy	5
4.	SWOT analysis of Bioeconomy	Rationale and criteria for SWOT analysis of Bioeconomies, Formulation of theory using mathematical models, Role of econometric tools in analysis.	5
5.	Generic bioeconomic mathematical models	Bioeconomic Models- Dynamic resource harvesting model, Dynamic optimization model, Demand-limited bionomic equilibrium, Growth and aging- The cohert model	6
6.	Ecological	Forestry model, Regulation of renewable resource	6

	bioeconomics and bioeconomy for agriculture	harvesting, Investing in agriculture harvesting capacity,	
7.	Fisheries bioeconomics and mathematical models.	Inherent characteristic of fish stocks, The multi-cohert model for fisheries, The system science approach in fisheries bioeconomics	6
8.	Introduction to bioeconomics	Bio-economics- Concept, Development of Economics and Bioscience (Concept of resource economics for scarcity of biological resources), Bioresource elasticity, Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm)	5
		Total number of Lectures	43

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Class Test-1/MCQ)
Total	**100**

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.	Sundar I. " Introduction to Bioeconomics", Global Research Publication, New Delhi, India, 2011
2.	Demirel, Y. "Nonequlibrium Thermodynamics- Transport and rate processes in Physical, Chemical and Biological Processes", Elsevier
3.	Antoine Missemer. Nicholas Georgescu-Roegen and degrowth. European Journal of the History of Economic Thought, Taylor & Francis (Routledge), 2017, 24 (3), pp.493-506.
4.	Virgin, I., and Morris, J.E. "Creating sustainable bioeconomies", (Taylor and Francis Group), USA, 2016
5.	Clark, C.W. "Mathematical bioeconomics", John Wiley & Sons, USA, 2010

Detailed Syllabus

Course Code	16B1NBT632	Semester EVEN (specify Odd/Even)	Semester VI Session 2019 -2020 Month from January to June
Course Name	Antimicrobial resistance		
Credits	4	Contact Hours	4

Faculty (Names)	Coordinator(s)	DR. Vibha Gupta
	Teacher(s) (Alphabetically)	DR. Vibha Gupta

Course Outcome:

Upon completion of the course students will be able to:

S. No.	Course Outcomes	Cognitive levels
C331-1.1	Explain the importance of antimicrobials and emerging resistance	**C2**
C331-1.2	Describe the biological mechanisms of antibiotic resistance	**C2**
C331-1.3	Analyze antimicrobial susceptibility tests	**C4**
C331-1.4	Support Antibiotic stewardship	**C5**

Pre-requisite : NA

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Course overview	Basic overview of antibiotic resistance; Importance of optimizing antimicrobial usage for maintaining cost-effective therapies	2
2.	Antimicrobial Classes	Discovery and History of antibiotics, importance of antibiotics, Different classes of antimicrobials (bacterial, Viral & fungal) and their mode of action	6
3.	Mechanisms of Resistance	Molecular mechanisms of Resistance; Emergence and spread of resistance; Microbial resistance – a global issue	6
4.	Techniques for detection of resistance	Antimicrobial susceptibility tests; methods for detecting antimicrobial resistance; Obtaining good results; interpretation of antimicrobial susceptibility results; genomic analysis tools to detect resistance genes	10
5.	New antimicrobial approaches	Alternative therapies to antibiotics – phage therapy, probiotics, vaccines, etc.	7
6.	Antimicrobial Stewardship	Roles and responsibilities of different stakeholders in antimicrobial stewardship (including physician,	10

		pharmacist, microbiologist, hospital administrators); Case studies - Antimicrobial stewardship strategies by WHO, ICMR etc.	
Total number of Contact hours			**41**

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.	KaterynaKon and Mahendra Rai "Antibiotic Resistance: Mechanisms and New Antimicrobial Approaches" Academic press 2016
2.	CARD - Comprehensive Antibiotic Resistance Database (https://card.mcmaster.ca/) site for information on publicly available resistance genes and related information.
3.	Research papers and Reports provided as per the course content.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NBT633	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from** January to June
Course Name	INSTRUMENTATION TECHNIQUES IN BIOTECHNOLOGY		
Credits	**4**	**Contact Hours**	**4**

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Faculty (Names)	**Coordinator(s)**	DR. PRIYADARSHINI
	Teacher(s) (Alphabetically)	DR. PRIYADARSHINI

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-2.1	Explain the principles, practices and instrumentation	Apply Level (C2)
C330-2.2	Apply understanding of the principles, practices and instrumentation	Apply Level (C3)
C330-2.3	Compare and contrast techniques of different instruments for their strength, limitations and creative use for problem-solving.	Apply Level (C4)
C330-2.4	Assess sample preparation method(s) and problem solving	Apply Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic laboratory Instruments	Background of instrumentation, Principle, working and applications of centrifugation, pH meter and other basic instruments	5
2.	Microscopy techniques	Principle, working and applications of simple microscope, electron microscopy (SEM & TEM), confocal, fluorescence and phase contrast microscopy.	7
3.	Spectroscopy techniques	Principle, working and applications of UV, Visible, IR, NMR, Fluorescence, circular dichroism, Atomic Absorption spectroscopy, Surface plasmon resonance, Nuclear magnetic resonance, X-ray diffraction.	7
4.	Mass spectrometry techniques	a) Introduction to Ionisation, Mass analysers, Detectors b) Structural information by tandem mass spectrometry c) Analysing protein complexes	7

		d) Computing and database analysis	
5.	Radioisotopic techniques	a) Principles & application of radioisotope b) The nature of radioactivity c) Detection and measurement of radioactivity d) Other practical aspects of counting of radioactivity and analysis of data e) Safety aspects	6
6.	Flow cytometry	a) Principles of the Flow Cytometer b) Principles of Fluorescence c) Data Analysis d) Controls in Flow Cytometry e) Optimizing your Experiments	5
7.	Live imaging techniques.	a) Issues of maintaining cell viability during imaging b) Types of techniques and microscopy used for live-cell imaging c) Applications of Live Cell Imaging	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1, Assignment2)
Total	**100**

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.	I. D. Campbell, Biological spectroscopy (Benjamin/Cummings Pub. Co, Menlo Park, Calif, 1984), Biophysical techniques series
2.	K. Wilson, J. M. Walker, Eds., Principles and techniques of biochemistry and molecular biology (Cambridge University Press, Cambridge, UK: New York, 7th ed., 2009).
3.	D. B. Williams, C. B. Carter, Transmission electron microscopy a textbook for materials science (Springer, New York, 2009; http://dx.doi.org/10.1007/978-0-387-76501-3).
4.	R. M. Silverstein, Spectrometric identification of organic compounds (John Wiley & Sons, Hoboken, NJ, 7th ed., 2005)
5.	Darzynkiewicz, Z., Crissman, H.A. and Robinson, J.P. (eds.) (2001) Cytometry. 3rd edition. Part A and B. Methods in Cell Biology, Volume 63 and 64, Academic Press, San Diego, USA. (ISBN 0-12-203053-2 (Part A); 0-12-203054-0 (Part B)).

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NBT634 ELECTIVE	**Semester** EVEN	**Semester VI Semester Session** 2019 - 2020 **Month from** January to June
Course Name	Genetic Disorder and Personalized Medicine		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Sujata Mohanty
	Teacher(s) (Alphabetically)	Dr. Sujata Mohanty

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-1.1	Apply knowledge of genetic principles to understand disease etiology, clinical features and mode of inheritance	Apply Level (C3)
C330-1.2	Explain and interpret different molecular diagnoses and genetic test results	Understand Level (C2)
C330-1.3	Analyze the role of population and quantitative genetics for genetic disorders	Analyze Level (C4)
C330-1.4	Develop the concept of Personalized Medicine and integrate information from HGP databases	Apply Level (C3)
C330-1.5	Assess the genetic counseling process and its impact from a cultural, ethical and psychosocial perspective	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Genetic Disorder and Principles of their Inheritance**	**Introduction to Medical Genetics, Genetic Disorder and Concern, Clinical Features, Genetic Principles to Understand Disease Etiology, and Mode of Inheritance, Pedigree analysis and carrier screening**	**08**
2.	Genetic Screening and DNA Banking	Preventive Genetics; DNA Banking and Clinical DNA Testing, Cytogenetic, Molecular and Biochemical Common as well as Modern Technology based Genetic Tests and their Results Interpretation	08
3.	Population and Quantitative Genetics	Application of population genetics in genetic risk calculation within Family/Population, heritability factor estimation	06
4.	Case studies	Case studies; Epigenetics, Uniparental disomy, Mosaicism, Inborn errors of metabolism, cancer genetics etc.,	06
5.	Human Genome Projects	Human Genome Projects and Outcomes: Initial Reference Genome, 100,000, Encode, Gencode and the future prospects, Integration of genomic information in Biomedical Sciences, Related Databases	06
6.	Concept of	Personalized Medicine, Study of Genetic resources (OMIM,	04

	Personalized Medicine	Gene tests, Gene clinics etc.)	
7.	Genetic counseling	The Genetic Counseling Process and Its Impact from a Cultural, Ethical and Psychosocial Perspective	04
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1, Class Test, assignment 2)
Total	**100**

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.J.F. Griffiths, S.R. Wessler, R.C. Lewontin, S.B. Carroll, *Introduction to Genetic Analysis* ,9th Ed, WH Freeman, 2015
2.	C. Szalai (Eds), *Genetics and Genomics*, 1st Edition, Tipotex, 2014
3.	S. Gersen, M. B. Keagle (Eds), *The Principles of Clinical Cytogenetics*, Humana Press, 2010
4.	M.R. Speicher, A.G. Motulsky, and S.E. Antonarakis (Eds)*Vogel and Motulsky's Human Genetics*. Berlin Heidelberg: Springer, 2010
5.	E.S. Tobias, M. Connor, M.F. Smith, *Essential Medical Genetics*, 7th Ed, John Wiley & Sons
6.	***Genetic disorder and related databases*** e.g. ***Indian Genetic Disease Database (http://www.igdd.iicb.res.in/IGDD/home.aspx),*** ***Rare Disorder by Ministry of health and family welfare (https://mohfw.gov.in/diseasealerts/rare-diseases), Clinical genomic databases (https://research.nhgri.nih.gov/CGD/)***
7.	Current research articles relevant to this subject will be provided as study materials and discussed in the class.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester VI Session** 2019 -2020 **Month from** January to June
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. SantoshiSengupta (Sec-62), Dr. Deepak Verma (Sec-128)
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr. Santosh Dev, Dr.SantoshiSengupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
304-5.2	Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions	Analyze Level (C4)
304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
304-5.4	Evaluate management processes for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Project Management: Introduction	Characteristics of project; Life Cycle of Project; Project Model; Project Management as discipline; Contemporary aspects of Project Management	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model, Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-Resource Leveling and Loading.	6
6.	Budgeting, Control and Project	Estimating Project Budgets, Improving the process of cost estimation, Basics, Importance, Purpose of control, Types	4

	Termination	of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination, Types of termination, typical termination activities.	
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Oral Questions)
Total	**100**

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.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications
2.	TimmothyKloppenborg, Contemporary Project Management, 5th[t] Edition, Cengage Learning, 2017
3.	Vohra, N. D., Quantitative Techniques in Management, 5th Edition, Tata McGraw Hill Publishing Company, 2017

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B1NHS635**	**Semester: Even**	**Semester: VI Session: 2019 -2020** **Month from:** January to June
Course Name	**Organizational Behavior**		
Credits	**3**	**Contact Hours**	**3(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Ms PuneetPannu (Sec 62) &DrAnshuBanwari (Sec 128)**
	Teacher(s) (Alphabetically)	**DrAnshuBanwari** **Ms PuneetPannu**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-6.1	Identify dynamic human behavior through an insight into relationships between individuals, groups and organizations	Apply (C3)
C304-6.2	Analyze individual management style as it relates to influencing and managing behavior in the organization.	Analyze (C4)
C304-6.3	Decide and justify set of strategies for meeting the special challenges in the 21st century competitive workplace	Evaluate (C5)
C304-6.4	Assess the potential effects of important developments in the external environment on behavior in organizations	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Introduction to OB: Challenges and Opportunities	Interdisciplinary Field, Concepts, Approaches, Responding to Globalization; Improving Quality & Productivity; Improving Customer Service; Improving People Skill; Empowering People; Stimulating Innovation & Change; Coping with Temporariness; Positive Organizational Behavior, Working in Networked Organizations; Balancing Work-Life Conflict	3
2	Managing Workforce Diversity	Major forms of Workplace Diversity, Valuing Diversity, Role of Disabilities, Discrimination, Diversity Initiatives, Diversity Awareness and Affirmative Action, Diversity Management and strategies to implement it Competitive Advantage of Diversity Management Generational Workforce	4
3.	Job Design and Flexible Job Environment	Job Design & its uses; Flexible Job Environment; Job Enrichment Model	2
4.	Leadership: Authentic Leadership	Inspirational Approach to Leadership: Authentic, Ethical & Servant Leadership Defining Authentic Leadership through Intrapersonal, Interpersonal and Developmental	6

		Aspects; Basic Model Of Authentic Leadership; Practical Approach to Authentic Leadership through the research of Terry and Bill George; Authentic Leadership: Trust and Ethics, Dimensions of Trust, Counseling & Mentoring	
5.	Power & Politics	Concept of Power; Sources of Power Contingencies of Power; Power Tactics; Measuring Power Bases: Power Authority Obedience Organizational Politics: Types Factors contributing to Political Behavior; Consequences & Ethics of Politics	5
6.	Employee Engagement	Creating a Culture of Engagement, Models of engagement, Benefits of Employee Engagement, Gallup Study, Methods of engaging employees – from entry to exit, Managers Role in Driving Engagement	2
7.	Organizational Culture & Workplace Spirituality	Creating Organizational Culture Approaches to Organizational Culture; How employees learn culture; Measuring Organizational Culture; Spirituality & Organizational Culture	3
8.	Organizational Change & Development	Organizational Change: Meaning & Types; Technology & Change; Resistance to Change v/s Inviting Change; Approaches to Organizational Change; Planning & Implementing Change; Organizational Development; OD Interventions & Change	3
		Total number of Lectures	**28**

Evaluation Criteria

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

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. Robbins, T. Judge, S. Sanghi**, *Organizational Behavior*, 13th Ed, Prentice-Hall India, 2001
2.	**P.Subba Rao**, *Organizational Behavior: Text Cases & Games*, 2nd Edition, Himalaya Publishing House , 2015
3.	**John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt**, *Organizational Behavior*, 12th Edition, Wiley India Pvt. Ltd, 2012
4.	**Debra L.Nelson and James C. Quick**, *Organizational Behavior*, Cengage Learning, India Edition, 2009
5.	**Steven L. McShane and Mary Ann Von Glinow**, *Organizational Behavior Essentials*, Tata McGraw Hill Publishing Company Ltd, 2007
6.	**Jerald Greenberg**, *Behavior in Organizations*, 10th Ed, PHI Learning Pvt Ltd

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B1NHS636**	**Semester : Even**	**Semester VI Session** 2019 -2020 **Month from:** January to June
Course Name	**Literature & Adaption**		
Credits	**3**	**Contact Hours**	**2-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. Monali Bhattacharya (Sector 62) & Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava, Dr. Monali Bhattacharya

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-3.1	Understand and outline the elements and theories of adaptation and its various forms, and relate with the texts reflecting the cultural, moral and linguistic changes in the contemporary society.	Understanding Level (C2)
C304-3.2	Utilize visual literacy to analyze the language and style adopted in filmed texts and examine them as reflections of Readers' and Audience' values and perceptions in the context of myriad cultures and multidisciplinary settings individually and in groups.	Applying Level (C3)
C304-3.3	Analyze texts and their adaptations beyond the surface level of narrative or character as reflections of value systems of various cultures and times individually and in a team.	Analysing Level (C4)
C304-3.4	Evaluate, interpret and document source texts and adaptations thematically and stylistically to learn the nuances of language, culture and values of the society.	Evaluating Level (C5)
C304-3.5	Compose and make an effective presentation of a literary/non literary piece in any genre and design an ethical adaptation of any literary/non literary piece in another form individually and in groups.	Creating Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction Literary Devices	Figures of speech, Character, Plotline, Conflict, Point of View	2
2.	Literature & Adaptation	Understanding Cultural Contexts Forms of Adaption Cinematography & Narratology	4
3.	Framework	Adaptation Theories; Reader Response & Audience Response Theories Case study of the Classic Fairy Tale The Sleeping and its contemporary adaptation Maleficent	7

4.	Play & adaptations	The Pygmalion: George Bernard Shaw Hamlet : William Shakespeare	6
5.	Novel & Adaptations	Pride & Prejudice: Jane Austen The Giver: Lois Lowry The Godfather: Mario Puzo	9
		Total number of Lectures	28

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Seminar/Presentation , Oral Questions)
Total	**100**

Recommended Reading material:

1.	**Linda Hutcheon**, *A Theory of Adaptation*, Routledge, 2006
2.	**Mark William Roche**, *Why Literature matters in the 21st Century*, 1st edition, Yale University Press 2004
3.	**George Bernard Shaw**, *Pygmalion*, Electronic Version, Bartleyby.com, New York, 1999
4.	**Stanley Wills &Gary Taylor**, *The Complete Works. The Oxford Shakespeare* (Compact ed.). Oxford: Clarendon Press. , 1988.
5.	https://www.sparknotes.com/film/sleepingbeauty/
6.	**Jane Austen**, *Pride & Prejudice*, Reprint, Thomas Egerton, 2013
7.	**Mario Puzo,** *The Godfather*, 1st Edition, G. P. Putnam's Sons, USA, 1969
8.	**Lois Lowry,** *The Giver, 1st Edition,* Houghton Mifflin Harcourt Publishing Company, USA, 1993

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2019-2020 **Month from:** January to June
Course Name	**Medical & Industrial Applications of Nuclear Radiation**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	DrPapia Chowdhury
	Teacher(s) (Alphabetically)	DrPapia Chowdhury &DrManojTripathi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-11.1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
C302-11.2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
C302-11.3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
C302-11.4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Nucleus, Radioactivity & Dating**	Structure of matter**;** Nucleus:Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect;Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)**Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	**17**
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear	09

		Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of differen MRI, Applications of NMR in quantum computation;	
4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using $\beta+\gamma$ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	**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**

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.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN (specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from:** January to June
Course Name	Marketing Management		
Credits	**3(2-1-0)**	**Contact Hours**	28

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C305-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-305-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Understanding New Age Marketing**	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	**Marketing Environment and Market Research and insights**	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment. Company's Micro and Macro Environment Responding to the Marketing Environment	3
3	**Strategic Planning and the marketing Process**	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic	5

		Marketing Process.	
4	**Consumer and Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	5
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behaviour in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards. Importance of marketing in CSR and business sustainability.	2
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment Viva…)
Total	**100**

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.	Grewal and Levy, Marketing, 5th Edition, Mc Graw Hill Education,2017
2.	Darymple, Douglas J ., and Leonard J. Parsons, Marketing Management: Text and Cases, 7th Edition, John Wiley & Sons(Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.
4.	Winer, Russell S ., Marketing Management, 2nd Edition, Prentice Hall,2003.
5	Dalrymple, Douglas J ., and Leonard J. Parsons, 2nd Edition, Wiley Publication, 2000.

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester** : VI **Session** 2019 -2020 **Month from:** January to June
Course Name	Econometric Analysis		
Credits	2-1-0	**Contact Hours**	03

Faculty (Names)	**Coordinator(s)**	ManasRanjanBehera
	Teacher(s) (Alphabetically)	ManasRanjanBehera

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	*Demonstrate* the key concepts from basic statistics to understand the properties of a set of data.	Understanding Level - C2
CO2	*Apply* Ordinary Least Square method to undertake econometric studies.	Apply Level - C3
CO3	*Examine* whether the residuals from an OLS regression are well-behaved.	Analyze Level - C4
CO4	*Evaluate* different model selection criteria for forecasting.	Evaluation Level - C5
CO5	*Create* models for prediction from a given set of data.	Creation Level - C6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Statistical Inference	Point and interval estimation; ;The Z distribution ;The Null and Alternate hypotheses ;The chi-square distribution; The F distribution; The t distribution	3
2.	Regression Analysis	Two variable regression model; The concept of the PRF; Classical assumptions of regression; Derivation of the OLS estimators and their variance; Properties of OLS estimators under classical assumptions; Gauss-Markov Theorem; Tests of Hypothesis, confidence intervals for OLS estimators; Measures of goodness of fit: R square and its limitations; Adjusted R square and its limitations	7
3.	Econometric Model Specification	Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias	5
4.	Failure of Classical	Multi-collinearity and its implications; Auto-correlation: Consequences and Durbin-Watson test	2

	Assumptions	;Heteroskedasticity: Consequences and the Goldfeld - Quandt test	
5.	Forecasting	Forecasting with a)moving averages b) linear trend c) exponential trend CAGR; Forecasting with linear regression; Classical time series decomposition; Measures of forecast performance: Mean square error and root mean square error; Limitations of econometric forecasts	5
6.	Time Series Analysis	Univariate Time Series Models: Lag Operator, ARMA , ARIMA models, Autoregressive Distributed Lag Relartionship	3
7.	Linear Programming	Linear programming; Dual of a linear programming problem; Simplex method Transportation	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+ Assignment+Viva -Voce)
Total	**100**

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.	Gujarati, D.N. (2002), Basic Econometric (4^{th} ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2^{nd} ed.), New York: Macmillan.

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B12HS612	Semester : Even	**Semester** VI **Session** 2019 -2020 **Month from** January to June
Course Name	Social Media and Society		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Infer the implications of digital change, and the concept of social media and e-marketing in the context of the changing marketing landscape	Apply Level(C3)
C304-1.2	Elaborate the implications of cyber branding and digitization on online marketing mix decisions	Create Level (C6)
C304-1.3	Develop specific models related to social media and social media analytics	Create Level (C6)
C304-1.4	Evaluate concepts related to Search Engine Marketing, Customer Centric Web Business models and Web Chain Analysis	Evaluate Level(C5)
C304-1.5	Illustrate the new age marketing practices	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction , Individuals Online and Rules for engagement for social media	What is social media marketing, the importance of social media for influencing target audience, Patterns of internet usage, Internet user demographics, The Behavioural Internet, E-Marketing, The Virtual world, the changing Marketing Landscape, E -Marketing-Strengths and Applications, Online Marketing Domains, Digital Marketing Optimization, The Need for Digital Engagement	4
2.	The Online Marketing Mix	The Online Marketing Mix, Consumer Segmentation, Consumer Traits, Consumers and Online Shopping Issues, E-Product, E-Place, E-Price, E-Promotion, Website Characteristics affecting online purchase decision.	3
3.	The Online Consumer and Social Media	The Digital Ecosystem, Online Consumer Behavior, Cultural Implications of key web characteristics, Models of website visits, Web 2.0 and Marketing, The collaborative web, Network evolution, Network science, Marketing with networks, Metcalfe's law, Netnography, Social Media Model by McKinsey, Social Media Tools-Blogs, Wikis, Online Communities, Facebook, Twitter, You Tube , Flickr, Microblogging.	4

4.	Online Branding and Traffic Building	Cyber branding, Online brand presence and enhancement, The Digital Brand Ecosystem, Brand Experience, Brand Customer Centricity, Brands and Emotions, The Diamond Water paradox, Internet Traffic Plan, Search Marketing Methods, Internet Cookies and Traffic Building, Traffic Volume and quality, Traffic Building Goals, Search Engine Marketing, Keyword Advertising, Keyword value, Internet Marketing Metrics, Websites and Internet Marketing.	4
5.	Web Business Models ,Social Media Strategy ,Social Media Marketing Plan	The value of a Customer Contact, Customer Centric Business Management, Web Chain of Events, Customer Value Analysis and the Internet, Business Models, Revenue Benefits, Value Uncertainty, Purchase Importance, Define a social media plan, explain the social Media marketing planning cycle, list the 8C's of strategy development.	4
6.	Market Influence analytics in a Digital Ecosystem	Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem, The Digital Ecosystem, Knowledge as a value proposition, CGM and Consumer behavior, The value of the power of influence, Amplifying Social Media Campaigns.	4
7.	The Contemporary Digital Revolution and its impact on society	Online Communities and Co-creation, The fundamentals of online community management strategies, The World of Facebook, The Future of Social media Marketing—Gamification and Apps, Game based marketing The world of Apps, Apps and the Indian Diaspora	3
8.	Integrating Mobile into Social Media Marketing	Types of Mobile Marketing, Progression of the mobile as a Marketing channel, some Indian mobile marketing campaigns, Impact of Social Media on government, the economy, development, and education	2
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment , Class Test and Attendance)
Total	**100**

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.	Digital Marketing ,Seema Gupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018
2.	Social Media Marketing A Strategic Approach, Melissa Barker,DonaldBarker,Second Edition Cengage Learning ,2017.
3.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015

4.	Social Media Marketing, Liana “Li” Evans,First Edition , Pearson, 2011.

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B13BT311	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from** January to June
Course Name	Nanoscience in Food Technology		
Credits	2	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	Prof.Sudha Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain properties of nanoparticles and nanoemulsions	**Understand Level (C2)**
CO2	Outline food processing, packaging and preservation	**Understand Level (C2)**
CO3	Apply nanotechnology concepts to improve food quality, texture, and shelf life	**Apply Level (C3)**
CO4	Analyze food quality degradation and pathogens detection, using nanosensors	**Analyze Level (C4)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Nanomaterials	Introduction to nanomaterials, nanoemulsions, method of synthesis and identification of nanoemulsions	5
2.	Food Packaging and Preservation	Introduction to food processing, packaging and preservation. Modified atmosphere packaging, active packaging and intelligent packaging.	6
3.	Application of nanotechnology in Food and agriculture	Microemulsions for delivery of nutraceuticals, edible films and coating for food, Polymer nanocomposites, effect of nanomaterials on mechanical, thermal and barrier properties of polymers. Application of nanotechnology for pesticide delivery, nutrient uptake etc. Nanomaterials in Food-Health and Safety Issues	7
4.	Biosensors for monitoring food quality	Time temperature indicators, pathogen detection using biosensors, Pesticide detection using biosensor.	6
		Total number of Lectures	**24**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30
End Term	40
TA	30 (Assignment, Presentations, Project based Evaluation)
Total	**100**

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.	VellaichamyChelladurai, Digvir S. Jayas, 2018 Nanoscience and Nanotechnology in Foods and Beverages CRC Press, ISBN 9781498760638
2.	Recent Research papers

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B19BT692**	**Semester** Even **(specify Odd/Even)**	**Semester VI Session 2019-2020** **Month from** January to June
Course Name	**Applied Mushroom Biology**		
Credits	2	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Manisha Singh
	Teacher(s) (Alphabetically)	Dr. Manisha Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO692.1	Define mushroom biology	Remembering Level (C1)
CO692.2	Experiment with mushroom cultivation	Applying Level (C3)
CO692.3	Explain environmental and medicinal aspects of mushroom	Understanding Level (C2)
CO692.4	Analyze economics of mushroom cultivation	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Principles of Mushroom Biology	Introduction, concepts, types, uses of mushrooms, Edible and poisonous mushrooms	2
2.	Global production	Agribusiness involving mushrooms, global status, opportunities and constraints	2
3.	Mushroom cultivation	Cultivation: Culturing, preservation methods, spawn production, quality attributes, storage, transport of commercially important mushrooms Lab: Bed preparation, use of different types of substrates (straw, cotton mill waste, water hyacinth etc.) for cultivation of oyster, white button, shiitake and caterpillar mushrooms	8
4.	Mushroom biotechnology	Constraints in transformation, production of new varieties, genomic and proteomic approaches	4
5.	Environmental & Medicinal aspects	Bioremediation using mushrooms, Production of nutraceuticals & value-added products Lab: Quality checks in cultivation process, processing and preservation	8
6.	Economics	Economics of setting up a commercial mushroom production unit Lab: Report on economics of production	4
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T2	20
End Semester Examination	35
TA	45

Total	**100**

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.	SHU-TING CHANG , PHILIP G. MILES: MUSHROOMS: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact, SECOND EDITION, CRC Press, 2011
2.	Research papers and manuals

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NMA633	**Semester :** Even	**Semester** VI **Session** 2019 - 2020 **Month from** Januaryto June	
Course Name	Statistics			
Credits	4	**Contact Hours**	3-1-0	
Faculty (Names)	**Coordinator(s)**	Dr. Himanshu Agarwal		
	Teacher(s) (Alphabetically)	Dr. Anuj Bhardwaj, Dr. Himanshu Agarwal, Dr. Pinkey Chauhan		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-1.1	make use of measures of central tendency, dispersion, skewness and, kurtosis for description and visualization of population data.	Applying Level (C3)
C302-1.2	apply correlation and regression in statistical analysis of data.	Applying Level (C3)
C302-1.3	explain sampling theory and its distributions.	Understanding Level (C2)
C302-1.4	explain the concepts and properties of estimation theory.	Understanding Level (C2)
C302-1.5	apply sampling and estimation theory to find the confidence interval.	Applying Level (C3)
C302-1.6	analyze small and large sample data by using the test of hypothesis.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's *t* distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency,	10

		UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	
5.	Parametric Interval Estimation	definition of confidence interval, pivotal quantity, confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	5
6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutprials)
Total	**100**

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.	**Biswas and Srivastava**,A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing House, New Delhi.
2.	**W. Feller**, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern-Ltd, 1971
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj &Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 6th edition, Pearson Education Asia, 2002.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2019 - 2020 **Month from** January to June
Course Name	Operations Research		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Neha Sighal	
	Teacher(s) (Alphabetically)	Prof. PatoKumari Dr. AmitaBhagat	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-3.1	construct mathematical models for optimization problems and solve linear programming problems (LPP) using graphical and simplex method.	Applying Level (C3)
C302-3.2	apply two-phase, Big-M and dual simplex method for linear programming problems.	Applying Level (C3)
C302-3.3	make use of sensitivity analysis to linear programming problems.	Applying Level (C3)
C302-3.4	solve transportation, assignment and travelling salesman problems.	Applying Level (C3)
C302-3.5	apply cutting plane and branch & bound techniques to integer programming problems.	Applying Level (C3)
C302-3.6	examine optimality conditions and solve multivariable nonlinear problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear	Pure and Mixed Integer Linear Programming	6

	Programming Problems	Problems, Cutting Plane Method, Branch and Bound Method.	
7.	Non Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria

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

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.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2005.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.
6.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2005.

Numerical Aptitude (16B19MA691)

Course Description

Course Code	16B19MA691	**Semester** Even	**Semester** VI **Session** 2019-2020 **Month from January to June**		
Course Name	Numerical Aptitude				
Credits	2		**Contact Hours**	2-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. TraptiNeer			
	Teacher(s) (Alphabetically)	Dr. Mohd. Sarfaraz			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C305-5.1	Explain basics of mathematical aptitude.	Understanding Level (C2)
C305-5.2	Explain set, functions and representation of numbers.	Understanding Level (C2)
C305-5.3	Solve problem on probability theory, quadratic equations and complex numbers.	Applying Level (C3)
C305-5.4	Explain inequalities, mensuration, data interpretation and errors.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Mathematical Aptitude	Fractions, simplification, HCF and LCM, ratio and proportion, percentage, partnership, age, average, profit and losses, simple interest and compound interest, time and work, time and distance.	08
2.	Set Theory and Representation of Numbers	Basics, identities, Venn diagram, addition principle, Pigeon hole principle, Functions- types of functions, some special functions, hashing function, characteristics function, Ackermann's function, Representation of numbers in binary, octal, hexadecimal, floating point representation of numbers.	10
4.	Probability	Probability, binomial theorem, linear equations, quadratic equations, complex numbers, logarithms.	06
5.	Geometry and Data Interpretation	Surds and indices, inequalities, mensuration, geometry, data interpretation, errors- types of errors, error propagation, errors in series approximation.	06
Total number of Lectures			**30**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
TA	30 (Assignments)
Total	**100**

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.	Aggarwal, R.S., Quantitative Aptitude, S. Chand & Co., 2008
2.	Praveen, R. V., Quantitative Aptitude and Reasoning, 3rd Edition, Prentice Hall India, 2016.
3.	Prakasa Rao, B.L.S.,A First Course in Probability and Statistics, World Scientific, 2009.
4.	**Rosen & Kenneth H,** Discrete Mathematics and Its Applications, Tata Mc-Graw Hill, New Delhi, 2007.

Detailed syllabus
Lecture-wise Breakup

Subject Code	16B1NHS632	**Semester:** EVEN	**Semester** VI **Session** 2019-20 **Month** from Jan 2020 to June 2020
Subject Name	COGNITIVE PSYCHOLOGY		
Credits	3	**Contact Hours**	2-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Badri Bajaj, Dr. Ruchi Gautam	
	Teacher(s) (Alphabetically)	Dr. Badri Bajaj, Dr. Ruchi Gautam	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	Applying Level (C3)
304-4.2	Analyze the different models of various cognitive processes	Analyzing Level (C4)
304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	Evaluating Level (C5)
304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Cognitive Psychology	Historical Background: Emergence of modern cognitive Psychology; Approaches: Information Processing and PDP Model; Research Methods	3
3.	Perceptual Processes	Perceptual learning and development; perception of shape, space and movement.	4
3.	Attention	Selective Attention and Divided Attention: Meaning, Definition and Theories.	4
4.	Memory	Short Term Memory	3
5.	Imagery	Properties of mental images; Representation of images and cognitive maps.	3
6.	Language	Structure of language and its acquisition, speech perception, factors affecting comprehension.	4
7.	Thinking and Problem	Types of thinking; Classification of	4

	Solving	problems; Problems solving approaches, Problems space theory by Newell and Simon, Creativity	
8.	Decision Making	Logical reasoning types and errors in reasoning processes. Concept formation and categorization; Judgment and decision making	3
Total number of Hours			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz , Oral Questions)
Total	**100**

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.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2nd Ed., Sage Publishing, 2012
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013
3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NBT632	**Semester** Even	**Semester VI Session** 2019 -2020 **Month from** January- June
Course Name	Antimicrobial resistance		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Vibha Gupta
	Teacher(s) (Alphabetically)	1. Vibha Gupta

Course Outcome:

Upon completion of the course students will be able to:

S. No.	Course Outcomes	Cognitive levels
C331-1.1	Explain the importance of antimicrobials and emerging resistance	**C2**
C331-1.2	Describe the biological mechanisms of antibiotic resistance	**C2**
C331-1.3	Analyze antimicrobial susceptibility tests	**C4**
C331-1.4	Support Antibiotic stewardship	**C5**

Pre-requisite : NA

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Course overview	Basic overview of antibiotic resistance; Importance of optimizing antimicrobial usage for maintaining cost-effective therapies	2
2.	Antimicrobial Classes	Discovery and History of antibiotics, importance of antibiotics, Different classes of antimicrobials (bacterial, Viral & fungal) and their mode of action	6
3.	Mechanisms of Resistance	Molecular mechanisms of Resistance; Emergence and spread of resistance; Microbial resistance – a global issue	6
4.	Techniques for detection of resistance	Antimicrobial susceptibility tests; methods for detecting antimicrobial resistance; Obtaining good results; interpretation of antimicrobial susceptibility results; genomic analysis tools to detect resistance genes	10
5.	New antimicrobial approaches	Alternative therapies to antibiotics – phage therapy, probiotics, vaccines, etc.	7
6.	Antimicrobial Stewardship	Roles and responsibilities of different stakeholders in antimicrobial stewardship (including physician,	10

		pharmacist, microbiologist, hospital administrators); Case studies - Antimicrobial stewardship strategies by WHO, ICMR etc.	
Total number of Contact hours			**41**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment-1&2, Home Assignment, Quiz and case studies)
Total	**100**

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.	Kateryna Kon and Mahendra Rai "Antibiotic Resistance: Mechanisms and New Antimicrobial Approaches" Academic press 2016
2.	CARD - Comprehensive Antibiotic Resistance Database (https://card.mcmaster.ca/) site for information on publicly available resistance genes and related information.
3.	Research papers and Reports provided as per the course content.