INTEGRATED M. TECH BIOTECHNOLOGY

SEMESTER 8

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B12BT411	**Semester:** EVEN	**Semester:** VIII	**Session:** 2023 -2024
Course Name	MARKET RESEARCH IN BIOSCIENCES			
Credits	4	**Contact Hours**	4	
Faculty (Names)	**Coordinator(s)**	ASHWANI MATHUR		
	Teacher(s) (Alphabetically)	ASHWANI MATHUR		

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-3.1	Define basic understanding of market and marketing research	Remembering (C1)
C434-3.2	Interpret the nature of problem and infer the research method to be employed for a given bioproduct related problem	Understanding (C2)
C434-3.3	Make use of statistical and software tools for market research	Applying (C3)
C434-3.4	Analyze and examine market research report based on strategic approaches	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Market Research**	Market and Marketing research, Market research providers, Introduction to databases of market research	**6**
2.	**Market research Process**	Identifying and formulating the problem, Exploratory and Descriptive Research, Causal Research, Methods of Data collection, Data analysis, Nature of Data: primary data, secondary data, big data.	**7**
3.	**Statistical Tool in Market Research**	Descriptive and Inferential research, Use of result tools in hypothesis testing, regression analysis, factor analysis, cluster analysis	**7**
4.	**Software packages for market research**	Introduction to Minitab, Tableau, SPSS	**8**
5.	**Market research in bio-products**	Nature of product, stability, cost estimation, competitor market. consumer perception and demand, price analysis	**5**
6.	**Market research in Food and Agriculture**	Analysis of agricultural and food market, Food consumption and market, Wholesale and retailing, farm and food market	**6**
7.	**Report Preparation**	Design and preparation of report, formats of report	**3**
		Total number of Lectures	**42**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment-1, Assignment-2, Quiz, Case study)
Total	**100**

Project Based Learning: The project involved the involvement of students in pursuing secondary research towards the selected problem statement and plant and execute primary research to explore various types of problem statements. Students will be learning purport preparation and use of software tools like Tableau for data presentation and MINITAB for data analysis based on the nature of Quantitative data collected.

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 concise guide to market research by Marko Sarstedt and Erik Mooi, Springer Publication**
2.	**The market research tool box by Edward F McQuarrie, Sage Publication**
3.	**Marketing in Agricultural Products by Richard L Kohls and Joseph N. Uhl, Pearson Publication**

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B1NBT836	**Semester: Even**		**Semester** VIII **Session** 2022-23	
Course Name	Human Nutrition and Health				
Credits	4		**Contact Hours**	4	
Faculty (Names)	**Coordinator(s)**	Prof. Vibha Rani			
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur			

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Relate roles and functions of principal nutrients and the processes involved in digestion, absorption and metabolism.	Understand Level (C2)
CO2	Apply the knowledge of Dietary Guidelines, Nutrient Reference Values and nutrient content of primary food sources to estimate energy requirements, assess dietary quality and plan a healthy diet.	Apply Level (C3)
CO3	Explain the role of food and nutrients in health and disease processes	Understand Level (C2)
CO4	Evaluate the relationship between diet, lifestyle diseases and their nutritive demands.	Evaluate Level (C5)
CO5	Plan diets to help in the prevention of chronic disease and provide appropriate nutrition during all phases of development	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Nutrition Science**	Basics of nutrition research and some important terms global look at meal planning guides and tools and provides you with an opportunity to determine your own individual nutrient needs	6
2.	**Basic Nutrients**	Macronutrients-I: Carbohydrates and Water Macronutrients-II: Proteins and Lipids, Vitamins, Minerals Food Safety; Nutrition Related Disorders Major Deficiency Diseases Nutrition and Infection'	**6**
3.	**Meal Planning**	Principles of Meal Planning and Meal Planning for the Adult, Food Budgeting, Food Selection Food Storage, Food Preservation and Other Methods of Maximization of Nutritional Benefit	4
4.	**Effective utilization of food resources**	Food safety ; Understand the hazards of food adulteration, and apply laws and standards regarding food quality and safety, protect food from different types of food, contamination,- list substances that are accidentally or intentionally added to food items,	6

5.	**Common food borne diseases.**	Identify the types, causes and spread of diarrhorea, dysentery, cholera, typhoid and infectious hepatitis enumerate their symptoms and complications and describe the factors in the control. prevention and management of these diseases;	6
6.	**Parasitic Infestation of Man**	Identify the common parasitic infestations of man Taeniasis, Hydatidosis, Ascariasis, Ancylostomiasis, Amoebiasis, Giardiasis, Trichuriasis, Oxyuriasis**.**	6
7.	Dietary Management of **Diabetes**	Study the role of nutrition in the prevention and management of pre-diabetes and Types 1, 2 and gestational diabetes	3
8.	Dietary Management of **Cancer**	Diet and cancer are certainly linked diet-related risk factors in cancer development as well as evidence-based guidelines for the nutritional management of cancer and treatment-related side effects	3
9.	Dietary Management of **Obesity and Weight Management**	Explore the complex and interrelated factors that contribute to rising obesity rates, discuss various approaches to weight loss and weight maintenance and strategize for future solutions to this global epidemic	3
10.	Dietary Management of **Disorders of the GI Tract**	Specific GI focus areas include celiac disease and gluten free foods, diverticular disease, peptic ulcer disease, inflammatory bowel disease, dysphagia, gas, constipation and malabsorptive disorders and look at the roles of dietary fiber and probiotics and prebiotics in gut health	3
		Total number of Lectures	**46**

Evaluation Criteria

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

Recommended Reading material:	
1.	Eastwood, M (2010). Principles of Human Nutrition. Blackwell Publishing 2 nd ed.
2.	Gibney, M.J., Lanham, S.A., Cassidy, N.A., Vorster, H.H (2009). Introduction to Human Nutrition. 2nd ed. Wiley-Blackwell.
3.	Dennis M.M, Robert E.C (2013) Advanced Human Nutrition Jones & Bartlet
4.	.Geissler. C, Powers,H (2010) Human Nutrition Churchill Livingstone 12th ed. 5. Whitney E.N, Rolfe S.R (2012) Understanding Nutrition Cengage Learning; 13th ed.

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M11BT113	**Semester:** Even	**Semester** VIII **Session** 2022-23
Course Name	BIOPROCESS & INDUSTRIAL BIOTECHNOLOGY		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		DR. ASHWANI MATHUR DR SONAM CHAWLA

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Relate role of economic principles in biomanufacturing processes	Understanding (C2)
CO2	Apply knowledge of engineering principles in designing of bioreactors for prokaryotic and eukaryotic systems	Applying (C3)
CO3	Analyze the role of bioprocess conditions in eukaryote cell culture	Analyzing (C4)
CO4	Evaluate various strategies used for production of primary and secondary metabolites	Evaluating (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Industrial Bioprocesses	Concept of sustainability and sustainable manufacturing, Economic assessment and concept of cost and Lang factor; Non-ideal systems of cultivating microorganism and economic process scale-up	3
2.	Microbial Process Development: Solid state fermentation	Cell growth kinetics of bacteria and fungi in non-ideal reactors; Concepts of solid state fermentation; mechanism of cell growth and indirect methods of estimating cell growth kinetics, Comparison of solid *versus* submerged fermentation; water activity; bioprocess parameters regulating solid stste fermentation	8
3.	Animal cell fermentation	Animal cell metabolism: Basic understanding of substrate and by-product stoichiometry, Concept of primary cells, cell lines and cancerous cells; growth characteristics and kinetics, methods and reactors for scalable production of animal cells and derived products; Biomaterial properties for anchorage dependent cell lines; Graf reactor; Concept of 2D and 3D culture, Bioreactors in Tissue Engineering, reactor design consideration	7
4.	Plant Cell Fermentation	Importance of plant cell cultivation, Plant cell / hairy root culture, callus and shoot propagation, kinetics of cell growth and product formation, Reactors for plant cell culture- type of reactors, comparison of reactor performance, immobilized plant cell reactor.	8
5.	Algal Fermentation	Basic classification of algae, Morphology and physiology; Algal derived metabolites, methods of studying growth kinetics of chemotropic and phototropic algae, type of reactors; Lab scale photo-bioreactors- Design and engineering principles, Large scale pond reactors	6

6.	Production of Primary & Secondary Metabolites	Isolation, preservation and propagation of microbial culture- An industrial perspective, Process technology for production of organic acids, amino acids, alcohols, antibiotics, vitamins, nucleotide and steroids, flavours; production of industrial enzymes: protease, cellulose, amylase, lipase; Enzyme inhibitors: inhibitors of cholesterol synthesis; biopesticides, biofertilizers, biopreservatives; biopolymers; plant derived therapeutically important metabolites	10
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Tests, Presentation / Report)
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.	P. M. Doran. *Bioprocess Engineering Principles*. Academic Press, USA, 2002
2.	S. J. Pirt. Principles of Microbe and Cell Cultivation. Blackwell Scientific Publications, Oxford Press, London, 1975
3.	P.F. Stanbury, A. Whittakar and S. J. Hall. *Principles of Fermentation Technology*. Butterworth-Heinemann, Oxford Press, London, 1994
4.	S. Aiba, A.E. Humphrey and N. F. Millis. *Biochemical Engineering.* University of Tokyo Press, Toyko, Japan, 1973
5.	A. H. Scragg. *Bioreactors in Biotechnology: A practical approach.* Ellis Horwood Publications, New York, USA, 1991
6.	Wulf Cruger and Anneliese Crueger. *Biotechnology: A Textbook of Industrial Microbiology.* Panima Publishing Corporation, New Delhi, India, 2003

Project based learning: Students will learn the economics attributes that help in designing economically viable biomanufacturing strategies. They will learn the concept, principles of solid state fermentation, an industrially viable process for most microbial metabolites production. Students will be learning the advances in 2D and 3D culture, strategies used for production of scaffolds and implants

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17M11BT114**	**Semester** Even	**Semester** VIII	**Session** 2022-23
Course Name	**Diseases and Healthcare**			
Credits	3	**Contact Hours**	3	
Faculty (Names)	**Coordinator(s)**	Dr. Reema Gabrani		
	Teacher(s) (Alphabetically)	Dr. Reema Gabrani		

COURSE OUTCOMES		**COGNITIVE LEVELS**
C115.1	Explain the etiology, pathogenesis of infectious diseases and genetic disorders.	Understand Level (C2)
C115.2	Choose and apply the strategies of different diagnostic tests.	Apply Level (C3)
C115.3	Utilise expression systems and mutagenesis techniques for biopharmaceuticals production	Apply Level (C3)
C115.4	Appraise biotechnology principles for production of recombinant proteins and nucleic acids as therapeutic agents	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to diseases	Infectious diseases caused by bacteria, viruses, opportunistic fungi and parasites; pathology	3
2.	Genetic diseases	Medical genetics; Genetic mechanisms leading to diseases such as thalassemia, cancer	3
3.	Diagnosis of bacteria and virus	Challenges of pathogen detection; Pathogen Detection using Cytological, biochemical and molecular methods; Molecular cytogenetics, PCR variants	8
4.	Immunodiagnostics	Immuno-diagnostics: immunofluorescence, Chemiluminescence, Microparticle Enzyme immunoassay, Fluorescence polarization immunoassay Applications in bacteriology, medicine, forensic sciences	4
5.	Cancer diagnostics	Cancer cytology analysis, genetic and epigenetic biomarkers	3
6.	Diagnosis in Forensic science	Forensic DNA typing and data analysis, Next generation sequencing technology and applications	3
7.	Engineering of Therapeuticals	Scientific and technological innovations in biopharmaceuticals production, Mutagenesis techniques	3
8.	Manipulating Host systems	Prokaryotes, yeast, baculo-virus and mammalian cells for production of recombinant proteins	5
9.	Therapeutic applications	Recombinant blood related products, hormones, interleukins, Vaccines, Monoclonal antibodies and Therapeutic enzymes	8
10.	Nucleic acid therapeutics	Antisense oligodeoxynucleotides, ribozyme, small interfering RNAs, aptamers as therapeuticals	2

Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments) (PBL 7 marks)
Total	**100**

PBL: Student will choose commercially available protein/ biotechnologically derived product and inspect the synthesis, purification, final product, and its market.

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. Yi-Wei Tang & Charles W Stratton, "Advanced techniques in Diagnostic microbiology", 2nd Ed. Springer 2013
0. G. Walsh, " Biopharmaceuticals: Biochemistry and Biotechnology", 2nd Ed. John Wiley & Sons publication 2013
0. Rodney J. Y. Ho Ph.D., FAAAS, FAAPS, Milo Gibaldi Ph.D. "Biotechnology and Biopharmaceuticals: Transforming Proteins and Genes into Drugs" John Wiley & Sons Inc. 2013
0. Refereed papers from scientific journals for case studies

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12BT127	**Semester :** Even	**Semester: VIII**	**Session:**	2022-23
Course Name	Nutraceuticals				
Credits	3	**Contact Hours**	3		
Faculty (Names)	**Coordinator(s)**	Dr. Smriti Gaur			
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur			

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Compare the traditional and modern trends in the nutraceutical Industry.	**(C2)**
CO2	Evaluate the mechanism of action of micronutrients and phytochemicals in prevention of chronic diseases.	**(C3)**
CO3	Explain the health benefits of microbial and algal nutraceuticals	**(C2)**
CO4	Compare nutraceuticals and health food products in Indian and international market.	**(C4)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Nutraceuticals and Functional Food: An Introduction**	Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals, The link between nutrition and medicine.	**4**
2.	**Nutrient Components of Food**	Bioactive Carbohydrates: Polysaccharides, Soluble Fibers, Insoluble Fiber, Resistant Starch, Prebiotics, Slowly Digestible Starch. Bioactive Lipids: MUFA, PUFA, Omega 3 and 6 Fatty Acid, Conjugated Linoleic Acid(CLA). Bioactive Peptides: Sources, Isolation and Purification methods. Antihypertensive, Antioxidant, Antimicrobial, Anticancer and immunomodulating Peptides.	**10**
3.	**Nutraceuticals of Plant Origin**	Plant secondary metabolites, classification and sub-classification – alkaloids, phenols, Terpenoids, uses and Preventive role in diseases.	**5**
4.	**Nutraceuticals of Animal Origin**	Animal metabolites - Examples: Chitin, Chitosan, Glucosamine, Chondroitin Sulphate, uses and applications in preventive medicine and treatment.	**5**
5.	**Microbial and Algal Nutraceuticals**	Concept of probiotics - principle, mechanism, production and technology involved and health benefits of probiotics. Synbiotics for maintaining good health. Algae as source of omega - 3 fatty acids, proteins, fibers, antioxidants, vitamins and minerals – examples: Chlorella, Haematococcus, Spirulina, Dunaliella	**6**
6.	**Nutraceuticlas and Diseases (specific**	Tea, Garlic, Honey, Flaxseed, Mushroom, Barley, Grape seed extract and Lycopene and their preventive role in	**8**

	foods and food products)	cardiovascular diseases, Metabolic disorders, Cancer, Bone health, skin diseases etc.	
7.	**Nutraceutical Industry and Market Information**	Concept of cosmoceuticals and aquaceuticals, Nutraceutical industries in India and abroad (study of 5 reputed Indian and International industries involved in production and development of nutraceuticals and functional foods).	**4**
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, report and 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.	Wildman, R.E.C. ed. Handbook of Nutraceuticals and Functional Foods, CRCPress, Boca Raton, 2000.
2.	R. E. Aluko, Functional foods and Nutraceuticals, Springer, 2012
3.	Yashwant V Pathak, Handbook of Nutraceuticals, CRC Press, 2010
4.	Shibamoto T. Functional food and health, Oxford University Press, 2008.
5.	Goldberg, I. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals, Chapman & Hall, 1994.
6.	Robert E.C. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman, 2006.

Project based learning: Each student in a group of 2 will study 5 reputed Indian and International industries involved in production and development of nutraceuticals and functional foods. They will prepare the report and give a presentation and will discuss the various products manufactured by the industry, product processing , manufacturing, applications, health benefits, market information, job prospects etc. This will enhance the student's understanding about various Nutraceuticals industries. This would help their employability into the nutraceutical sector.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**18B12HS811**	**Semester: EVEN**	**Semester: VIII**	**Session: 2022-23**
Course Name	**Industrial Sociology**			
Credits	3	Contact Hours	(3-0-0)	
Faculty (Names)	Coordinator(s)	Shikha Kumari		
	Teacher(s) (Alphabetically)	Shikha Kumari		

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-38.1	Understand the scope of industrial sociology and major theories on labour and work	Understand (C2)
C402-38.2	Analyzing the contemporary issues related to industry in the post-LPG era	Analyze (C4)
C402-38.3	Evaluating work in its social aspects such as gender, caste, class and unpaid work, as different from its better known economic dimension.	Evaluating (C5)
C402-38.4	Evaluate and interpret information about emerging issues in the industry through various sources like print and electronic media, film, documentary and other information technologies	Evaluate(C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	● Scope and importance of the study of Industrial Sociology ● Nature and type of industrial society ● Study of industrial relations	3
2.	Theoretical Orientation	● Functional theory of labour (Durkheim) ● Conflict/Marxian theory of labour ● Weberian Theory of labour	5
3.	Social dimensions of work (I)	● Types of work: Unpaid Domestic and Volunteer work/ Service sector work/ managerial and white collar work/ blue collar work- Sectors of employment	5
4.	Social dimensions of work (II)	● Gendered Organization: Feminization of Labour and Poverty ● Discrimination and Harassment (gender, racial, ethnic) ● Caste system as a tool to stratify the labour force	8

5.	Industrialization in India	● Trade Union: Concept, Functions and Types, History of Trade Union Movement in India Trade ● Socialism- LPG era India ● Unions and Challenges of Privatization, risks and hazards, Law and work, Decline of Trade Unions, Disputes & Conciliation.	8
6.	Contemporary Issues	● Globalization and Technology: Criteria for measuring Globalization ● Automation of work and its Impact (Reference: AI technologies) ● Employment trends	8
7.	New initiatives in India	● Indian Endeavors- Make in India/ Start up India, Skills India programme	5
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (project/movie review/quiz)
Total	**100**

PBL- Student in a group of 4-5 will submit a project on New initiative in India- (a)make in India/(b)start up India.

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.	Bhattacharjee. S. (2016). *Industrial Sociology*. Aavishkar Publications. Jaipur
2.	Edgell, S. (2006). "Unpaid Work-Domestic and Voluntary work". *The Sociology of Work: Continuity and Change in Unpaid Work.*NewDelhi:Sage
3.	Freeman. C. (2009). 'Feminity and Flexible labour: Fashioning Class through gender on the global assembly line'. Massimiliano Mollona, Geert De Neev and Jonathan parry (eds.) *Industrial Work And life:An Anthropological Reader*.Berg: Oxford
4.	Grint, K.(2005)."Classical Approaches to Work: Marx, Durkheim and Weber". *The Sociology of Work: An Introduction*. Polity Press. Cambridge.
5.	Mishra. R (2016). *Industrial Sociology*. Laxmi Publications. New Delhi
6.	Prasad. J (2013). *Industrial Sociology*.Vayu Education of India: Delhi
7.	Singh. Y. & Sharma. R (2016). *Industrial Sociology*. AITBS Publishers: Delhi
8.	Sinha, P.N.R. (2006). *Industrial relations, Trade Unions and Labour legislations*. Pearson: New Delhi
9.	Watson, T.J. (2003). *Sociology, Work and Industry*. Routledge: London and New York

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**18B12HS815**	**Semester Even**	**Semester** VIII **Session 2022-23**
Subject Name	**QUALITY ISSUES IN ENGINEERING**		
Credits	3 (3-0-0)	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Akarsh Arora	
	Teacher(s) (Alphabetically)	Dr. Akarsh Arora	

Course Objectives:

1. To implement the principles and concepts inherent in a quality management approach to managing the engineering issues of a manufacturing or service organization.
2. To understand the philosophies of the gurus of quality in order to better evaluate TQM implementation proposals offered by quality management organizations and consultants.
3. To successfully implement process improvement teams trained to use the various quality tools for identifying appropriate process improvements.
4. To assess exactly where an organization stands on quality management with respect to the ISO 9000 quality management standard and various awards criteria.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-32.1	Apply the concepts of quality within quality management systems by understanding various perspectives, historical evolution; and contributions of key gurus in the field of quality	Apply Level (C3)
C402-32.2	Determine the effectiveness of acceptance sampling using single and double sampling plans and operating characteristic curves	Evaluate Level (C5)
C402-32.3	Determine quality by employing a wide range of basic quality tools, lean concepts and process improvement techniques such quality function deployment	Evaluate Level (C5)
C402-32.4	Examine the importance of six sigma, various quality standards, awards, certifications	Analyze Level (C4)

Module No.	**Subtitle Of The Module**	**Topics In The Module**	**No. Of Lectures For The Module**
1.	Fundamentals And Evolution Of Quality	Introduction, Dimensions Of Quality, Fundamentals, History Of TQM, Contemporary Influences	6
2.	Quality Tools And The Improvement Cycle	Various Costs, Juran's Coq Accounting Statement, Voice Of Customers: Kano's Model, House Of Quality, QFD Process, Seven Tools For Quality Management	9
3.	Benchmarking	Meaning, Process, Methods	3
4.	Quality Gurus	Contribution of Quality Gurus	3

5.	Six Sigma	Six Sigma, Capability Of A Process/Product/Service, DMAIC Process	6
6.	Lean Concepts	Kaizen, Poka-Yoke, Andon, Kanban, JIT, 5-S, 7 Mudas	3
7.	Statistical Thinking And Applications	Statistical Process Control, Acceptance Sampling, Specification And Control Limits, Control Charts For Variables, Control Charts For Attributes	6
8.	Quality Awards And Certifications	MBNQA, RGNQA, Deming Prize, ISO Standards	3
9.	Quality Strategy For Indian Industry	India's Quality Journey, Quality Management In India	3
Total Number Of Lectures			42

Project-based Learning: Students are required to visit any business organization to observe the brief about the organization; its products; its suppliers; its operations; its processes, Quality control system and techniques followed by the company, Quality standards met by the company, application of quality tools or lean manufacturing system, Sigma capability of products or processes, DMAIC methodology, application and relevance of the quality concepts studied in the course. Collecting information on quality systems, quality standards, quality certifications or awards received, and sigma capability will upgrade students' knowledge and strengthen their skills to tackle multiple quality engineering issues along with employability.

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Written)
T2	20 (Written)
End Term	35 (Written)
TA	25 (Project Assignment, Quiz)
Total	**100**

Recommended Reading material:

1.	Besterfield D. H., Besterfield-Michna C., Besterfield G. H., Besterfield-Sacre M. *Total quality management*, Prentice Hall, 1999.
2.	Evans, J. R., Dean J. W. *Total quality management, organization and strategy*, Thomson, 2003. 399 p.
3.	Kanji G. K., Asher M. *100 Methods for Total Quality Management*. London: SAGE Publications, 1996.
4.	Oakland G. F. *Total Quality Management*, Oxford, 1995.
5.	Goetsch D. L., Davis S. B. *Quality management. Introduction to TQM for production, processing and services*. New Jersey: Prentice Hall, 2003.
6.	John S. Oakland. *Total Quality Management and Operational Excellence*: Text with cases, Fourth edition, 2014
7.	Dale H. Besterfield. *Total Quality Management*, (Revised Edition). India: Pearson, 2011.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**15B1NHS832**	**Semester** Even	**Semester** VIII	**Session** 2022-23
Course Name	**International Studies**			
Credits	3	**Contact Hours**	**3** (3-0-0)	
Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri		
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri		

CO Code	**COURSE OUTCOMES**	**COGNITIVE LEVELS**
C402-8.1	Demonstrate an understanding of the basic concepts in the area of international studies	Understanding (C2)
C402-8.2	Compare the changes in India's foreign policy in the Cold War era and the post Cold War era	Applying (C3)
C402-8.3	Analyze the major political developments and events since the 20th century	Analyzing (C4)
C402-8.4	Demonstrate an understanding of the rise of new power centers in the changing world order	Understanding (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Concepts	Balance of power and Collective security National Interest and its instruments	4
2.	An Overview of Twentieth Century International Relations History	World War I: Causes and Consequences Significance of the Bolshevik Revolution Rise of Fascism / Nazism World War II: Causes and Consequences	8
3.	Cold War Politics	Origin of the Cold War Evolution of the Cold War Collapse of the Soviet Union Causes of the End of the Cold War	8
4.	India's foreign policy during the Cold War era	Basic Determinants (Historical, Geo-Political, Economic, Domestic and Strategic) India's Policy of Non-alignment	6
5.	India's foreign policy in the Post Cold War era	India and SAARC India and the Look East policy Impediments to regional co-operation: river water disputes; illegal cross-border migration; ethnic	8

		conflicts and insurgencies; border disputes	
6.	Emergence of Other Power Centres	European Union Rise of Asia Powers- Russia, China and Japan	8
Total number of Lectures			**42**

Evaluation Criteria
Components Maximum Marks
T1 20
T2 20
End Semester Examination 35
TA 25 (Project, Quiz, 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.	A. Chatterjee, *International Relations Today*. Noida, India: Pearson, 2019
2.	Appadorai, & M.S.Rajan, *India's Foreign Policy and Relations*. New Delhi, India: South Asian Publisher, 1985
3.	E.H. Carr, *International Relations between the Two World Wars: 1919-1939*. New York, USA: Palgrave, 2009
4.	J. Baylis &S. Smith, Ed. *The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2011
5.	P. Calvocoressi, *World Politics: 1945—2000*. Essex, UK: Pearson,2009

Project Based Learning: Each student would form a group of 3-4 and submit projects on India's foreign policy and rise of new power centres. This project would help the students' research about the India's relations- economic, political and diplomatic and also consider a variety of perspectives and interpretations of current world events.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**15B19BT891**	**Semester** Even	**Semester** VIII **Session** 2022-23
Course Name	**Major Project Part-2**		
Credits	3	**Contact Hours**	**3** (3-0-0)
Faculty (Names)	**Coordinator(s)**	Dr. Chakresh Kumar Jain	
	Teacher(s) (Alphabetically)		

Sl. No.	**DESCRIPTION**	**COGNITIVE LEVEL (BLOOM's TAXONOMY)**
C451.1	Summarize research literature	Understanding Level Level II
C451.2	Develop experimental solutions to resolve the identified problem	Applying Level Level III
C451.3	Evaluate and analyze the experimental results	Evaluating Level Level V
C451.4	Compose and present the scientific findings.	Creating Level Level VI

Major Project: Students research on topic of their interest and define problem statement, figure out probable solution by reviewing the current literature, Plan experimental design to solve the identified problem, Evaluate the experimental results and compare them with published literature and conclude their findings and communicate their scientific findings orally and by writing. This develops independent working and thinking ability, Experimental skills and other set of skills such as research, problem identification, problem solution, Compose and present the scientific findings , etc.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**18M12BT116**	**Semester:** Even	**Semester -VIII Session** 2022-23
Course Name	**IPR in Biotechnology**		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Indira P. Sarethy	
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain and interpret the types of intellectual property rights, related laws and systems	**Understand (C2)**
CO2	Apply specific IPR issues pertaining to medical biotechnology	**Apply (C3)**
CO3	Evaluate plant and traditional knowledge protection	**Evaluate (C5)**
CO4	Appraise commercialization of intellectual property, infringements and laws applicable	**Evaluate (C5)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Intellectual Property Rights - their Relevance, Importance and Business Interest to Industry, Academia, Protection of Intellectual Property, Relationship of IPRs with biotechnology	**2 [CO1]**
2.	Types of Intellectual Property Rights	Patents, Trademarks, Copyrights, Industrial Designs, Geographical Indications, Trade secrets, non-disclosure agreements	**2 [CO1]**
3.	Patents	General Introduction to Patents, Patent Terminology, Patent Claims, Patent Life and Geographical Boundaries, Utilization of Intellectual Patents, Licensing of patents	**4 [CO1, CO2]**
4.	Elements of patentability	Invention/Discovery, What constitutes Patentable subject matter, the Utility, novelty and non-obviousness of an invention, Patentability in Biotechnological Inventions: Case studies	**2 [CO2, CO3]**
5.	Preparation and Process for Patenting	Procedural steps to grant of a patent, Process of filing patents in India, PCT application, protocols of application, pre-grant & post-grant opposition	**3 [CO2, CO3]**
6.	Patent Search	Invention in context of "prior art", Patent Search methods, Patent Databases & Libraries, online tools, Country-wise patent searches (USPTO, EPO, India etc.), patent mapping	**2 [CO2, CO3]**
7.	IPR laws	Basic features of the Indian Patent Act, the Indian Copyright Act, and the Indian Plant Varieties Protection and Farmers'	**2 [CO1, CO2, CO3]**

		Rights Act, A brief overview of other Patent Acts & Latest Amendments of Indian, European & US patent systems	
8.	Patent issues in Drugs and Pharmaceuticals	Generics, Compulsory Licensing, Exclusive Marketing Rights (EMR), Bolar provision, Bayh-Dole act, Second medical use	**2 [CO2, CO3]**
9.	Worldwide Patent Protection, WTO & TRIPS Agreement	Brief Background of different International conventions such as Paris convention, TRIPS, WTO, PCT and Patent Harmonisation including Sui-generis system, The relationship between IPRs and international trade, Overview of WTO& TRIPS Agreement, Enforcement and dispute settlement under the TRIPS Agreement, The implication of TRIPS for developing countries in the overall WTO system	**2 [CO1, CO2, CO3]**
10.	Gene patents	Introduction & overview, what constitutes gene patents, Bayh-Dole Act, ESTs, Cohen-Boyer technology, PCR patents, EPO case, BRCA gene, Types of IPR involved, Genetic Use Restriction Technologies, Patenting of biologics, Hatch Waxman Act	**9 [CO3, CO4]**
11.	Protection of Plant Varieties /Seeds	The interface between technology and IPRs in the context of plants, Key features of UPOV 1978, UPOV 1991 and TRIPS with respect to IPRs on plants, Indian Law on Protection of Plant Varieties, DUS criteria, patenting of genetically modified plants, The significance of IPRs in agricultural biotechnology, Biodiversity, Conventions & Treaties, plant patents, Plant Varieties Protection Act, Plant Breeders' Rights, UPOV, benefit sharing, sui generis systems Case studies	**4 [CO3, CO4]**
12.	Traditional Knowledge and Intellectual Property Rights	The importance and relevance of Traditional Knowledge for developing nations, The various approaches to protecting TK, The local, national and global dimensions of the issues in TK and IPRs, Traditional Medicine & IP Protection, Folklore, Patenting of Health Foods: Case studies	**4 [CO3, CO4]**
13.	Patent Infringement and Commercializing Intellectual Property Rights	What all are considered as patent Infringement: Case studies, defenses to infringement including experimental use, patent misuse, legal considerations, Patent Valuations, Competition and Confidentiality issues, Assignment of Intellectual Property Rights, Technology Transfer Agreements	**4 [CO4]**
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25 (Assignments 1, 2. Presentation 1)**
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.	USPTO Web Patent Databases at: www.uspto.gov/patft

2.	Government of India's Patents Website: patinfo.nic.in
3.	Intellectual property India: www.ipindia.nic.in
4.	"Indian Patent Law : Legal and Business Implications" by AjitParulekar, Sarita D'Souza Macmillan India publication, 2006
5.	"Agriculture and Intellectual Property Rights", edited by: Santaniello,V., Evenson, R.E., Zilberman, D. and Carlson, G.A. University Press publication, 2003
6.	Research papers and Reports provided from time to time

PBL: students will be given keywords to do prior art search from free patent databases like google patents, UPTO and they can analyse the types of patents filed under various domains

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NHS732	Semester: Even	Semester : VIII Session 2022-23
Subject Name	INDIAN FINANCIAL SYSTEM		
Credits	3	Contact Hours	3 (3-0-0)
Faculty (Names)	Coordinator(s).	1. Dr. Mukta Mani (Sec 62) 2. Dr. Sakshi Varshney (Sec 128)	
	Teacher(s) (Alphabetically)	1. Dr. Mukta Mani 2. Dr. Sakshi Varshney	

NBA Code	Course Outcomes	Cognitive Level
C401-31.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	C2
C401-31.2	Analyze ways of fund raising in domestic and international markets	C4
C401-31.3	Understand functioning of Stock market and evaluate securities for investment.	C5
C401-31.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	C3
C401-31.5	Apply knowledge of Income tax for calculation of tax liability of individual.	C3

Module No.	Subtitle of the Module	Topics in the module	No. of Hours
1.	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	3
2.	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	3

3.	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO Intermediaries in IPO, Book building process and allotment of shares	3
4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	3
5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualisation, broker, listing of securities, dematerialisation, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
6.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis- Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	7
7.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
8.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary, Gratuity, Pension, Allowances and Perquisites; Income from Capital Gain, Deductions under section 80C to 80U.	14
		Total number of Lectures	**42**

Evaluation Criteria
Components Maximum Marks
T1 20
T2 20
End Semester Examination 35
TA 25 (Project, Class participation and Attendance)
Total 100

Project Based learning: The students will form groups of 4-5 students. They will carry-out stock analysis of a selected company on the basis of fundamental and technical analysis techniques studied in lecture classes. Finally they will give their recommendation about the performance of stock.

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	Pathak Bharti V, *Indian Financial System,* 5th Edition, Pearson Education, 2018

2	Madura Jeff, *Personal Finance*, 6th Ed, Pearson Education, 2017.
3	Machiraju H R, *Indian Financial System*, 4th Ed, Vikas Publication, 2010
4	Bhole L M, *Financial Institutions and Markets*, 4th ed. Tata McGraw Hill Publication, 2006.
5	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2019.
6	How to Stimulate the Economy Essay [Online]Available: https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC
7	Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007
8	Ashiwini Kumar,Sharma,' De-jargoned: Book building process, Live Mint,2015.
9	Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28th June 2009.
10	Kaul, Vivek, "Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel", The Economic Times, July 1, 2011.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**19M13HS111**	**Semester: Even**	**Semester: VIII Session 2022-23**
Subject Name	**English Language Skills for Research Paper Writing**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**	Dr. Ekta Singh	
	Teacher(s) (Alphabetically)	Dr. Ekta Singh	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Demonstrate an understanding of all the aspects of grammar and language needed to write a paper.	Understand Level (C2)
C204.2	Apply grammatical knowledge & concepts in writing and presentation.	Apply level (C3)
C204.3	Examine each section of a paper after careful analysis of Literature Review.	Analyze Level (C4)
C204.4	Determine the skills needed to write a title, abstract and introduction, methods, discussion, results and conclusion.	Evaluate Level (C5)
C204.5	Compile all the information into a refined research paper after editing and proofreading	Create Level (C6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures and Tutorials for the module**
1.	Grammar & Usage	Structure of English Language Voice, Aspect & Tense SVOCA Sense & Sense Relations in English Enhancing Vocabulary Connotation, Denotation & Collocation	**6**
2.	Elements of Paper Writing	Planning & Preparation Word Order Breaking Long Sentences Structuring Paragraphs Being Concise and Removing Redundancy Avoiding Ambiguity and Vagueness	**4**

3.	Paraphrasing & Writing	Highlighting Your Findings Hedging and Criticising Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	**6**
4.	Process of Writing	Review of Literature Methods Results Discussion Conclusion The Final Check	**4**
5.	Key Skills Needed	Key skills needed when writing a Title Key skills needed whenWriting an Abstract Key skills needed when writing an Introduction Key skills needed when writing a Review of the Literature Key skills needed when writing Methods & Results Key skills needed when writing Discussion & Conclusion	**4**
6.	Refining the Paper	Incorporating useful phrases Editing Proofreading References Annexures Ensuring good quality in submission	**4**
		Total number of Lectures and Tutorials	**28**

Evaluation Criteria	
Components	**MaximumMarks**
Mid Term	30
End Semester Examination	40
TA	30 (Project, Assignment/ Class Test/ Quiz, Class Participation)
Total	**100**

3. Employability/entrepreneurship/skill development

Researchers whose first language is not English write at least two-thirds of published scientific papers. Twenty percent of the comments referees make when reviewing papers for possible publication in international journals regard English language issues. In some disciplines, acceptance rate by journals of papers originating from the US/UK is 30.4%, and is higher than all other countries

Publishing your research in an international journal is key to your success in academia. This course is based on a study of some sample manuscripts and reviewers' reports revealing why papers written by non-native researchers are often rejected due to problems with English usage and poor structure and content. The course prepares the students on how to:

- prepare and structure a manuscript
- increase readability and reduce the number of mistakes you make in English by writing concisely, with no redundancy and no ambiguity
- write a title and an abstract that will attract attention and be read
- decide what to include in the various parts of the paper (Introduction, Methodology, Discussion etc)
- highlight your claims and contribution
- avoid plagiarism
- discuss the limitations of your research
- choose the correct tenses and style
- satisfy the requirements of editors and reviewers

Recommended Reading material:	
1.	Goldbort R. 'Writing for Science', Yale University Press (available on Google Books), 2006
2.	Day R. 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006
3.	Adrian Wallwork. 'English for Writing Research Papers', Springer, New York, Dordrecht Heidelberg, London, 2011
4.	Yadugari M.A. ' Making Sense of English: A Textbook of Sounds, Words & Grammar' Viva Books Private Limited, New Delhi, 2013, Revised Edition
5.	Strauss Jane. 'The Blue Book of Grammar and Punctuation, Josseybass, Wiley, San Francisco, 1999.
6.	Rizvi, A. R. 'Effective Technical Communication' 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018
7.	Eckert, K. 'Writing Academic Paper in English:Graduate and Postgraduate Level', Moldy Rutabaga Books, 2017
8	Barros, L.O, 'The Only Academic Phrasebook You'll Ever Need: 600 Examples of Academic Language' Create Space Independent Publishing Platform; 1st edition,2016
9	Wallwork, A. 'English for Writing Research Papers (English for Academic Research)'.Springer; 2nd ed. 2016 edition.
10	Wallace,M&Wray,A. 'Critical Reading and Writing for Postgraduates (Student Success) SAGE Publications Ltd; Third edition, 2016
11	Butler, L. 'Longman Academic Writing Series 1: Sentences to Paragraphs, with Essential Online Resources', Pearson Education ESL; 2nd edition,2016
12	Saramäki, J. 'How to Write a Scientific Paper: An Academic Self-Help Guide for PhD StudentsIndependently published, 2018