Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester:** 8th **Session:** 2021 -2022 **Month:** February – June
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 Level (C2)
C402-8.2	Compare the changes in India's foreign policy in the Cold War era and the post Cold War era	Applying Level (C3)
C402-8.3	Analyze the major political developments and events since the 20th century	Analyzing Level (C4)
C402-8.4	Demonstrate an understanding of the rise of new power centres in the changing world order	Understanding Level (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 conflicts and insurgencies; border disputes	8
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**

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.

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
6.	P.Zelikow, *The Road less travelled: The secret battle to end the great war,1916-17*. New York, USA: Public Affairs, 2021
7.	R,Cooper, *The Ambassadors: thinking about diplomacy from Machiavelli to modern times*. London,UK: Weidenfeld & Nicolson, 2021

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NHS732**	**Semester: Even**	**Semester:** 8th **Session:** 2021 -2022 **Month:** February – June
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)	2. Dr. Mukta Mani 2. Dr.Sakshi Varshney

NBA Code	Course Outcomes	Cognitive Level
C402-31.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	Understanding Level (C2)
C402-31.2	Analyze ways of fund raising in domestic and international markets	Analyzing Level (C4)
C402-31.3	Understand functioning of Stock market and evaluate securities for investment.	Evaluating Level (C5)
C402-31.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	Applying Level (C3)
C402-31.5	Apply knowledge of Income tax for calculation of tax liability of individual.	Applying Level (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, demutualization, broker, listing of securities, dematerialization, 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

Course Code	**18B12HS811**	Semester: EVEN	**Semester:** 8th **Session:** 2021 -2022 **Month:** February – June
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	UnderstandingLevel (C2)
C402-38.2	Analyzing the contemporary issues related to industry in the post-LPG era	AnalyzingLevel (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 Level (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	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introductio n	• Scope and importance of the study of Industrial Sociology	3

		• Nature and type of industrial society • Study of industrial relations	
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

Course contents and plan

Subject Code	**18B12HS815**	**Semester Even**	**Semester:** 8th **Session:** 2021 -2022 **Month:** February – June
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	Applying Level (C3)
C402-32.2	Determine the effectiveness of acceptance sampling using single and double sampling plans and operating characteristic curves	Evaluating 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	Evaluating Level (C5)
C402-32.4	Examine the importance of six sigma, various quality standards, awards, certifications	Analyzing 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

Subject Code	**19M13HS111**	**Semester: Even**	**Semester: VIII Session 2021-22** **Month from Feb to June 2022**
Subject Name	**English Language Skills for Research Paper Writing**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**	Ms. Rashmi Jacob	
	Teacher(s) (Alphabetically)	Ms. Rashmi Jacob	

Course Outcomes:

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

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 Lecturesand 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 RemovingRedundancy Avoiding Ambiguity and Vagueness	**4**
3.	Paraphrasing & Writing	Highlighting Your Findings Hedging andCriticising Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	**6**
4.	Process of Writing	Review of Literature Methods Results Discussion	**4**

		Conclusion The Final Check	
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

Detailed Syllabus

Course Code	15B19EC891	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session:** 2021 -2022 **Month:** February – June
Course Name	Project Part-2		
Credits	12	**Contact Hours**	----

Faculty (Names)	**Coordinator(s)**	Megha Agarwal, Rahul Kaushik
	Teacher(s) (Alphabetically)	Megha Agarwal, Rahul Kaushik, Sajai Vir Singh, Shivaji Tyagi

COURSE OUTCOMES- At the completion of the course, students will be able to,		**COGNITIVE LEVELS**
C451.1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding level (C2)
C451.2	Analyze/Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time	Analyzing level (C4)
C451.3	Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating level (C5)
C451.4	Develop the skill in student so that they can communicate effectively in both verbal and written form.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid Sem Viva	20
Final Viva	30
Day to Day	30
Project Report	20
Total	**100**

Project based learning: Project part II is the continuation of Project part 1 done in the previous semester. The Project work is by far the most important single piece of work in the B. Tech programme. It provides the opportunity for student to demonstrate independence and originality, to plan and organize a large Project over a long period and to put into practice some of the techniques, student have been taught throughout the course.In Project work initially, first all students are advised to make groups having 2-3 students in each group and also to select the supervisor of their own choice and research field. The students are also advised to choose a Project that involves a combination of sound background research, software skill, or piece of theoretical work. Interdisciplinary Project proposals and innovative Projects are encouraged and more appreciable. Objective of project part II is for the students to learn and experience all the major phases and processes involved in solving "real life engineering problems related to electronics and communication or Interdisciplinary area. The major outcome of this project work must be well-trained the students. More specifically students must have acquired:

- System integration skills
- Documentation skills
- Project management skills
- Problem solving skills
- Team work skill.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC125	**Semester:** Even 2022	**Semester: 8th Session:** 2021-22 **Month from** February to June 2022
Course Name	Detection and Estimation Theory		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Khanna
	Teacher(s) (Alphabetically)	Dr. Gaurav Khanna

COURSE OUTCOMES		**COGNITIVE LEVELS**
C115.1	The course aims to familiarize student with stochastic processes and its properties.	Understanding Level (C2)
C115.2	The course helps students to analyze probabilistic models and estimate the parameters of the model parameters.	Analyzing Level (C4)
C115.3	The course helps students evaluate the observations of the noise-corrupted functions and determine the best estimate of the state.	Evaluating Level (C5)
C115.4	The course helps student compute the optimality criteria to quantify best estimates or detection decisions and limits on performance.	Analyzing Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Review of Random Variables**	Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of random variables, Schwarz Inequality, Orthogonality principle in estimation, Central limit theorem, Random Process, Stationary process, autocorrelation and auto-covariance functions, Spectral representation of random signals, Wiener Khinchin theorem, Properties of power spectral density, Gaussian Process and white noise.	6
2.	**Parameter Estimation theory**	Principal of estimation and applications, Properties of estimates, unbiased and consistent estimators, MVUE, CR bound, Efficient estimators; Criteria of estimation: The methods of maximum likelihood and its properties; Bayesian estimation: Mean Square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.	8
3.	**Estimation of signal in the presence of White Gaussian Noise (WGN)**	Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation FIR Wiener filter, Causal IIR Wiener filter, Non-causal IIR Wiener filter, Linear prediction of signals, Forward and	8

		Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.	
4	**Complexity Computations**	Principle and Application, Steepest Descent Algorithm, Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm; Applications of Adaptive filters; RLS algorithm, derivation, Matrix inversion Lemma, Initialization, tracking of non-stationarity.	8
5.	**Kalman Filtering**	Principle and application, Scalar Kalman filter, Vector Kalman filter.	4
6.	**Detection Theory**	Hypothesis testing, Bayesian, Neyman-Pearson and Minimax detection, Composite Hypothesis testing, Generalized LRT, Sequential and Distributed Detection, Non-parametric detection, Detection in Gaussian noise.	9
		Total number of Lectures	43

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 Attendance)
Total	**100**

Project Based Learning: After studying the contents of this Course students will be able to design Least Mean square estimators, Biased and Unbiased estimators, and optimal estimators. These estimators find widespread applications in the area of Communication and Signal Processing applications especially adaptive systems. Students shall also learn the techniques to design and analyse detectors for various applications.

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.	An Introduction to Signal Detection and Estimation by H. Vincent Poor, Springer, 1994.
2.	Linear Estimation by Thomas Kailath, Ali H sayed, Babak Hassibi, Prentice Hall, 2000.
3.	Fundamentals of Statistical Signal Processing: Detection theory by Steven M. Kay, Pearson, 2010.
4.	Fundamentals of Statistical Signal Processing: Estimation theory by Steven M. Kay, Pearson, 2010.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC128	**Semester**: Even **(specify Odd/Even)**	**Semester** 8th **Session** 2021 -2022 **Month from Feb 2022 – June 2022**
Course Name	Software Defined Radio and Cognitive Radio Networks		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Samriti Kalia
	Teacher(s) (Alphabetically)	Dr. Samriti Kalia

COURSE OUTCOMES		**COGNITIVE LEVELS**
C122.1	Understand the concepts of Software Defined Radio (SDR) and its architecture	Understanding Level (C2)
C122.2	Understand the concepts of radio (CR) architecture, functions of cognitive radio	Understanding Level (C2)
C122.3	Analyzing the Spectrum sharing and management and Spectrum sensing methods	Analyzing Level (C4)
C122.4	Evaluating the performance of Next Generation Wireless Networks	Evaluating Level (C5)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	**Software Defined Radio (SDR)**	Essential functions of the SDR, SDR architecture, design principles of SDR, traditional radio implemented in hardware and SDR, transmitter architecture and its issues, A/D & D/A conversion, parameters of practical data converters, tech-niques to improve data converter performance, complex ADC and DAC architectures, digital radio processing, reconfigura-ble wireless communication systems.	8
2.	**Cognitive Radio (CR) features and architecture**	Cognitive Radio (CR) features and capabilities, CR functions, CR architecture, components of CR, CR and dynamic spectrum access, interference temperature, CR architecture for next generation networks, CR standardization.	8
3.	**Spectrum sensing**	Spectrum sensing and identification, primary signal detection. energy detector, cyclostationary feature detector, matched filter, cooperative sensing, spectrum opportunity, spectrum opportunity detection, fundamental trade-offs: performance versus constraint, sensing accuracy versus sensing overhead.	10

4.	**Spectrum management of cognitive radio net-works**	Spectrum decision, spectrum sharing and spectrum mobility, mobility management of heterogeneous wireless networks, Cooperation and cognitive systems and research challenges in CR	10
5.	**Next Generation Wireless Networks**	Control of CRN, Self-organization in mobile communication networks, security in CRN	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning: Students will learn about the design and implementation of cognitive radio using SDR. Additionally, students in group sizes of three-four required to prepare a review of SDR and cognitive radio using one or more research publications including interfacing softwares.

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.	Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & Sons, Ltd, 2009.
2.	Alexander M. Wyglinski, Maziar Nekovee, and Y. Thomas Hou, "Cognitive Radio Communications and Networks - Principles and Practice", Elsevier Inc., 2010.
3.	Jeffrey H. Reed "Software Radio: A Modern Approach to radio Engineering", Pearson Education Asia.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC129	**Semester: Even**	**Semester: 8th Session:** 2021-22 **Month from** Feb to Jun, 2022
Course Name	Selected Topics in Communication		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Khanna
	Teacher(s) (Alphabetically)	Dr. Gaurav Khanna

COURSE OUTCOMES At the end of the semester, students will be able to		**COGNITIVE LEVELS**
C150.1	Learn how to find the moments of random distribution with the help of Moment Generating Function (MGF).	Understanding [Level II]
C150.2	Develop the ability to study different wireless fading channels/distributions and explore transmit and receive diversity.	Applying [Level III]
C150. 3	Analyze the performance of different fading channels in terms of BER, Outage Probability, Channel capacity etc., both without diversity and with diversity techniques.	Analyzing [Level IV]
C150.4	Demonstrate the ability to comprehend and develop advanced wireless modeling techniques, viz., MIMO, Cooperative communication, OFDM, etc. to test for improved performance.	Analyzing [Level IV]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction, Probability and Random Process**	PDF, CDF, Random variable transformation, Moment Generating function (MGF), order statistics, Gaussian random variable, AWGN, PSD, Autocorrelation.	6
2.	**Fading and Wireless channel modeling**	Generic model for fading Channels, Composite fading channel model, Wireless Channel Fading and Distribution: Small scale, large scale and multipath fading channels. Rayleigh, Rician, Exponential, Nakagami-m, Chi-squared, Diversity modeling for Wireless Communications: Beamforming and MRC.	8
3.	**Performance Analysis of Wireless Communication System and Diversity**	BER/SER Performance in Fading Channels for different modulation techniques, Maximal Likelihood, Zero Forcing and Minimum Mean Square Error Detection techniques, Channel capacity in AWGN, Outage Probability, Channel capacity for fading channel, capacity with channel side information(CSI) at receiver, capacity with CSI both at transmitter and receiver, Asymptotic Analysis, Coding gain, diversity gain.	12

4	**Collocated and Distributed MIMO systems**	Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBCs, Precoding, Introduction to Cooperative Systems: Amplify-and-Forward (AF), Decode-and-Forward (DF) based Cooperative Relaying – BER, Outage Probability and Diversity, Recent developments.	10
5.	**Introduction: OFDM Systems**	Introduction to Multicarrier Modulation, OFDM, Cyclic Prefix, SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues	7
		Total number of Lectures	43

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 Attendance)
Total	**100**

Project Based Learning: Students will learn about the design and analyse the performance of MIMO system over different fading scenario with the help of assignments. Additionally, students in group sizes of two-three required to write a MATLAB codes to implement the different MIMO wireless communication systems.

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.	Arogyaswami Paulraj, Dhananjay Gore, and Rohit Nabar, “Introduction to Space-Time Wireless Communications”, Cambridge University Press, 2007
2.	Erik G. Larsson and Petre Stoica, “Space-Time Block Coding for Wireless Communications”, Cambridge University Press, 2003
3.	Ezio Biglieri, “MIMO Wireless Communications”, Cambridge University Press, 2007.
4.	Aditya K. Jagannatham, “Principles of Modern Wireless Communication Systems”, McGraw-Hill Education, 2017
5.	Marvin Kenneth Simon, Mohamed-Slim Alouini, “Digital Communication over Fading Channels”, Wiley, 2005.
6	K. J. Ray Liu, Ahmed K. Sadek, Weifeng Su, Andres Kwasinski, “Cooperative Communications and Networking”, Cambridge University Press, 2009.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**20M41EC119**	**Semester: EVEN (specify Odd/Even)**	**Semester** : 8th **Session** 2021 -22 **Month from** Feb **to** June
Subject Name	**MIMO-OFDM for Wireless Communications**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	1. Dr. Ashish Goel
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C117.1	To understand OFDM system with its impairments.	Understanding (C2)
C117.2	To understand and analyze the various performance parameters of OFDM system.	Analyzing (C4)
C117.3	To understand and analyze the performance of MIMO systems	Analyzing (C4)
C117.4	To understand the Single Carrier Frequency Division Multiplexing System	Understanding (C2)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Basic principles of orthogonality, Single carrier vs. multi carrier systems, orthogonal frequency-division multiplexing (OFDM): Block diagram, modulation, demodulation, frequency spectrum, need of cyclic prefix. synchronization, peak-to-average power ratio, effect of HPA on OFDM signal,	7
2.	PAPR and PAPR Reduction Schemes	PAPR of Base band and Bandpass OFDM signal, PDF & CCDF of PAPR, Need of PAPR reduction , PAPR reduction techniques: Clipping, Iterative clipping and filtering, Companding schemes, Selective mapping (SLM), Partial transmit sequence (PTS), Tone Reservation (TR), Tone Injection, Active Constellation Extension (ACE).	12
3.	Inter Carrier Interference (ICI) and ICI cancellation Schemes	Effect of Frequency offset, ICI Cancellation Schemes: ICI self cancellation, Symmetric ICI Self-Cancellation Scheme , ICI conjugate cancellation etc.	8
4.	Multiple-input multiple-output (MIMO) Systems	MIMO System model, antenna diversity, MIMO detection algorithms: MIMO Zero-Forcing Receiver, MIMO MMSE Receiver, Singular Value Decomposition of MIMO Channel, MIMO capacity, Space-time coding. V-BLAST, MIMO Beamforming	12
5.	Single Carrier Frequency Division Multiplexing (SC-FDMA)	SC-FDMA, Transmitter and Receiver, Subcarrier Mapping, Advantages and disadvantages	3
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25(Attendance, Performance. Assignment/Quiz)**
Total	**100**

Project based learning: Here, students will learn latest 4G wireless communication technologies, starting from the basics process of modulation, demodulation and its impairment. These schemes are of utmost importance to understand the concepts of current and future generations of communication system and to design the same . Student will be able to design the physical layer of 4G communication and to analyze its implementations issues. Students can perform the some simulation on Matlab to analyze the same. Understating of these techniques will further help to work in any core communication industry.

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.	Aditya K Jagannatham, Principles of Modern Wireless Communication Systems Theory and Practice, TMH, 2/e, 2017
2.	Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung-Gu Kang , MIMO-OFDM Wireless Communications with MATLAB, Wiley, 2013
3.	T. Jiang and Y.Wu, "An Overview: Peak-to-average power ratio reduction techniques for OFDM signals", IEEE Transactions on Broadcasting, vol. 54, no. 2, pp. 257–268, Jun. 2008.
4.	Y. Zhao, S.G. Häggman , "Intercarrier interference self-cancellation scheme for OFDM mobile communication systems" , IEEE Transactions on Communications, 49(7), pp .1185-1191, 2001.
5.	Hyung G. Myung, "Introduction to single carrier FDMA", In Proceedings of 2007 15th European Signal Processing Conference, Poznan, Poland, pp. 2144-48.
6.	Journal articles i.e. IEEE, Springer, NPTEL video lectures.

Detailed Syllabus

Lecture-wise Breakup

Course Code	20M31EC116	**Semester:** Even **(specify Odd/Even)**	**Semester 8th Session 2021-22** Month from Fab 2022 to Jun 2022
Course Name	Hybrid Intelligent System		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Ruby Beniwal	
	Teacher(s) (Alphabetically)	Dr. Ruby Beniwal	

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C114.1	Identify and describe hybrid techniques and their roles in building intelligent system	Understanding Level (C2)
C114.2	Apply Neuro- fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	Applying Level (C3)
C114.3	Effectively use modern software tools to solve real problems using a hybrid approach and evaluate various hybrid computing approaches for a given problem	Evaluating Level(C 5)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction of neural network	Introduction to neural network Single layer and Multilayer neural network and Associative Memory network, Feedback netwok, Support Vector Machine and its application	7
2.	Introduction of fuzzy logic and Genetic algorithm	Introduction fuzzy set theory, membership function and operation fuzzy system fundamental of genetic algorithms and modeling	7
3.	Hybrid system	Introduction of hybrid system, Sequential, Auxiliary and Embedded hybrid system	2
4.	Neuro Fuzzy Modelling:	Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks,	10

		Neuro Fuzzy Spectrum. Introduction to Neuro Fuzzy Control.	
5.	Fuzzy Back propagation Network	LR type Fuzzy numbers and operations on it,fuzzy neuron ,fuzzy BP architecture, learning in fuzzy BP and interference by fuzzy BP and its application	5
6.	Genetic Algorithm based back propagation network	GA based weight determination, coding, weight extraction fitness function, reproduction and convergences and its application	7
7.	Simplified Fuzzy ARTMAP and Associative Memories	Fuzzy ARTMAP and its working, introduction of FAM and Fuzzy Hebb FAM	7
		Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning: Students will learn different type algorithms based on Neuro- Fuzzy logic and Neuro-Genetic algorithm through Assignments in the area of Hybrid Intelligent System. Additionally, students in group sizes of two-three required to implement any one application of Hybrid Intelligent System one or more research publications.

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.	Larry R. Medsker, Hybrid Intelligent Systems 1995th
2.	Simon Hykins, Neural Networks and Learning Machines, Pearson Publishing House, 2016.
3.	S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2018.
4.	Clinton Sheppard, Genetic Algorithms with Python CreateSpace Independent Publishing Platform ,April 29, 2016
5.	S. Rajasekaran and G. A. vijayalakshmi Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications ,PHI-2013

Detailed Syllabus

Course Code	18B12BT414	**Semester** Even	**Semester** VIIIth **Session 2021-2022** **Month from** Jan - June
Course Name	Machine Learning tools in Bioinformatics		
Credits	3	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-13.1	Explain about the machine learning principle biological complexities and resources	Understand Level (C2)
C402-13.2	Apply Pattern Identification methods for motif discovery	Apply Level (C3)
C402-13.3	Apply machine learning in solving biological problems.	Apply Level (C3)
C402-13.4	Analyzing the use of machine learning in disease-drug discovery	Analyze Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Overview of machine learning methods and scope in bioinformatics	Fundamentals of machine learning, algorithms, introduction to biological problem and mapping, gene and genome, Structure, function and organization, biological database, Scope of machine learning in bioinformatics (Genomics, proteomics, transcriptomics etc.)	7
2.	Pattern identification	Pattern and motif, domain, profile in Bioinformatics, Search algorithms, String search, Boyer moore, Robin Karp algorithm KMP algorithm, Dynamics programming and greedy approach etc. case studies	4
3.	Data classification: Clustering and tree algorithm	Gene finding tools, Discrimination analysis ; LDA, Clustering methods: Hierarchical , K mean, Normalization, similarity measure (distances), Basics of tree, suffix tree and its applications in Bioinformatics , validations, statistical inferences and biological interpretation (Gene ontology and microarray	8

		data)	
4.	Basics of ANN and HMM	Fundamental of ANN, Back propagation algorithm, kNN, ANN model, Biological tools like PHD, Intron identifier, splice site prediction etc. Basics of HMM Stochastic algorithm, profile generation, Pfam, protein families, Gibbs sampling, Viterbi algorithm, tools evaluation	10
5.	SVM	Introduction to SVM. Feature selection, kernel methods, case studies(Bioinformatics application ; protein structure and function prediction , data mining in drug discovery etc.)	5
6.	Applications and tools	SVM_light, GIST server, applications of SVM, QSAR prediction, ADMET predictions, case studies, Protein coding region prediction, gene identification, folding problems in protein sequences, network analysis, RNAi Designing, PSORT, Genscan, HMMTOP, DAS, Genemark , Glimmer, etc., case studies	8
		Total number of Lectures	**42**

Evaluation Criteria

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

PBL: The course covers fundamentals of machine learning methods and tools with its applications into the biological problem. Further PBL component is helping students to familiarise the methods and tools with more explorations towards understanding the disease behaviour

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

1.	Baldi, Pierre and Brunak, Søren "Bioinformatics: The Machine Learning Approach" , 2nd edition, Rajkamal Electric Press, Delhi, Pp 452. 2003.
2.	Cormen , Thomas H. "Introduction to Algorithms" , 2nd edition McGraw-Hill Science,Pp 1056, 2001
3	Yang, Zheng Rong, " Machine :Learning Approaches to Bioinformatics", New Delhi world Scientific, Pp 336, 2017
5	Research papers and manuals