Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NHS732**	**Semester: Even**	**Semester : 8th Session : 2020 -2021 Month:January to 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
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	14

		Gain, Deductions under section 80C to 80U.	
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: M.Tech II & Dual degree VIIISession 2020-21** **Month from January to June 2021**
Subject Name	**English Language Skills for Research Paper Writing**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**	DrMonali Bhattacharya	
	Teacher(s) (Alphabetically)	DrMonali Bhattacharya	

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**

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH812	**Semester: Even**	**Semester: 8**, **Session :** 2020 -2021 **Month from: January to June**
Course Name	**Astrophysics**		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Prof.Anirban Pathak and Dr. Sandeep Chhoker
	Teacher(s) (Alphabetically)	Anirban Pathak Sandeep Chhoker

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-4.1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remembering (C1)
C402-4.2	Explain the models of universe, ideas of stellar astrophysics, life cycles of stars, physical principles that rules galaxies, and general theory of relativity	Understanding (C2)
C402-4.3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Applying (C3)
C402-4.4	Compare different models of universe and decide which one is logically acceptable and why	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Introduction to Astrophysics	Historical development of astrophysics (from mythology to contemporary astrophysics), Mass, length and time scales in astrophysics, sources of astronomical information (effect of discovery of spectroscopes and photography), astronomy in different bands of electromagnetic radiation (e.g. Optical astronomy, infra-red astronomy radio astronomy, X-ray astronomy. Gamma-ray astronomy etc. with specific mention of Hubble space telescope). Kirchoff's law, Doppler effect and Hubble's law.	**8**
2.	Stellar Astrophysics	Classification and nomenclature of stars. Basic equations of stellar structure, main sequence, red giants and white dwarfs, HR diagram, stellar evolution, supernovae, extra solar planets.	**8**
3.	Death of a star	End states of stellar collapse: degeneracy pressure of a Fermi gas, structure of white dwarfs, Chandrasekhar mass limit, neutron stars pulsars and black holes.	**6**
4.	Our galaxy	The shape and size of Milky way and its interstellar mater	**2**
5.	Extragalactic astrophysics	Normal galaxies, active galaxies, cluster of galaxies, large-scale distribution of galaxies.	**6**

6.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas related to big bang, cosmological constants, dark matter and dark energy.	**6**
7.	Astrobiology	Drake equation and related questions.	**2**
8.	Conclusion	Review of the present status of Astrophysics and open questions.	**2**
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quizes (10 M), Attendance (10 M) and Class performance (5 M)]
Total	**100**

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

1.	Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press, Delhi, 2010.
2.	Astrophysics: Stars and Galaxies, K D Abhyankar, University Press, Hyderabad, 2009.
3.	Facts and Speculations in Cosmology, J V Narlikar and G Burbidge, Cambridge University Press, Delhi, 2009.
4.	The Cosmic Century, Malcolm Longair, Cambridge University Press, Cambridge, 2006.
5.	An Introduction to Astrophysics, BaidyanathBasu, Prentice Hall of India, Delhi 1997.
6.	Fundamentals of Equations of State, S. Eliezer, A Ghatak and Heinrich Hora, World Scientific, Singapore, 2002. Only Chapter 15.

Course Description

Course Code	16B1NMA831	**Semester** Even	**Semester** VIII **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Optimization Techniques		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C402-2.1	apply generalized, revised and dual simplex method for linear programming problems (LPP).	Applying Level (C3)
C402-2.2	apply graphical, algebraic and linear programming techniques for pure and mixed strategy problems in game theory.	Applying Level (C3)
C402-2.3	classify and solve the problems on queuing and inventory models.	Analyzing Level (C4)
C402-2.4	solve and analyze the network scheduling and sequencing problems.	Analyzing Level (C4)
C402-2.5	make use of dynamic programming technique to solve complex linear programming problems.	Applying Level (C3)
C402-2.6	determine numerical solution of nonlinear multidimensional problems.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Linear Programming	Convex sets, Linear Programming Problems (LPP), graphical and simplex method, Big-M method, Two phase method, generalized simplex method, revised simplex method, Duality theory, dual simplex method.	08
2.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and mxn Games, Reduction to Linear Programming Problems.	06
3.	Queuing Theory & Inventory Model:	Introduction, Steady-State Solutions of Markovian Queuing Models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited space, M/G/1, Inventory Models.	08
4.	Sequencing & Scheduling	Processing of Jobs through Machines, CPM and PERT.	06
5.	Dynamic Programming	Discrete and Continuous Dynamic Programming, Simple Illustrations.	06
6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	08
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 4-5 will analyse literature on mathematical application of discrete and continuous dynamic programming technique to solve complex linear programming problems. To make the subject application based, the students analyze the

optimized way to deal with dynamic programming problems.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Taha, H. A., Operations Research - An Introduction, Tenth Edition, Pearson Education, 2017.
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3.	Hillier F., Lieberman G. J., Nag,B. and Basu, P., Introduction to Operations Research, 10th edition, McGraw-Hill, 2017.
4.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, 2nd edition, Prentice Hall of India Pvt. Ltd., 1980.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**17M11EC119**	**Semester** …Even **(specify Odd/Even)**	**Semester** Even **Session** 2020 -2021 **Month from** January **to** May
Course Name	**Advanced Wireless and Mobile Communication**		
Credits	03	**Contact Hours**	03

Faculty (Names)	**Coordinator(s)**	Dr. Rahul Kaushik
	Teacher(s) (Alphabetically)	Dr. Rahul Kaushik

COURSE OUTCOMES		**COGNITIVE LEVELS**
C113.1	Relate and recall the concepts of Wireless and Mobile Communication.	RememberingLevel (C1)
C113.2	Understand the Wireless and Mobile Communication Techniques of Mobile wireless Networks.	UnderstandingLevel (C2)
C113.3	Apply theknowledge of Wireless and Mobile CommunicationTechniques in Mobile wireless Networks like (GSM/UMTS/HSPA/LTE)	Applying Level (C3)
C113.4	Analyze the application of 3GPP based techniques in Mobile wireless Networks like (GSM/UMTS/HSPA/LTE)	AnalyzingLevel (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Overview of wireless communications, Evolution mobile networks, Mobile Standards, Spectrum Considerations. Generic wireless network architecture.	**4**
2.	Cellular Concept and Engineering	Problems in mobile communication. Need for Cells. Spectrum and its utilization –frequency reuse. Cell design considerations. Cell Topology. Co-channel and adjacent –channel cells interference. Cell splitting and sectoring. Coverage and capacity of cellular system. Hand-off techniques.	**8**
3.	Propagation of Mobile Radio Signals	Radio wave propagation mechanism. Path loss .Outdoor and Indoor propagation models. Antenna types, size and height. Multipath propagation model .Different types of fading. Doppler effect and mobility.	**7**
4.	Multiple Access Techniques	FDMA, TDMA, CDMA, techniques and their performance. Number of channels. Introduction to OFDM,OFDMA and SC-FDMA in LTE.	**5**
5.	Mobile Wireless Networks	Architectures of GSM, UMTS, HSPA and LTE	**5**
6.	LTE Radio Access Network	LTE Radio Interface ; Logical, Transport and physical Channels; Reference Signals, Physical Cell ID, Time-	**8**

		Domain Structure, Scheduling in LTE, LTE Advanced	
7.	Introduction of 5G	Evolution and characteristics of 5G cellular networks, Enabling technologies for 5G: mm waves, massive MIMO, Small cells, Beamforming, Convergence of cellular and Wi-Fi technologies	**5**
		Total number of Lectures	**42**

Evaluation Criteria

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

a) Attendance and Performance = 10

b) Class Test/Quiz = 5

c) Assignment = 10

Total **100**

Project Based Learning: The students will learn the practical limitations of mobile channels imposed on communication systems with the help of assignments. Further, each student is required to prepare an independent review in the area of wireless communication using one or more research publications. The understanding of recent trends helps students in analyzing practical systems andenhance their employability skills.

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.	T. S. Rappaport, Wireless Communications, PHI, 2002.
2.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
3.	Harri Holma, Antti Toskala, LTE for UMTS: Evolution to LTE-Advanced, John Wiley and Sons, 2011
4.	5G Technology Evolution Recommendations, 4G Americas, 2015
5.	C. Beard, W. Stallings, Wireless Communication Networks and Systems, Pearson, 2016
6.	http://www.3gpp.org/ftp/Specs/html-info/36-series.htm

Detailed Syllabus

Course Code	15B19EC891	**Semester:**Even **(specify Odd/Even)**	**Semester:**8th **Session** 2020 -2021 **Month from:**January to May
Course Name	Project Part-2		
Credits	12	**Contact Hours**	**----**

Faculty (Names)	**Coordinator(s)**	Dr. Sajai Vir Singh, Ms. Shradha Saxena
	Teacher(s) (Alphabetically)	Sajai Vir Singh, Shivaji Tyagi, Shradha Saxena, Varun Goel

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**
MidSem Viva	20
Final Viva	30
D2D	30
Thesis	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 2021	**Semester** 8th **Session** 2020 -2021 **Month from Jan – May 2021**
Course Name	Detection and Estimation Theory		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vikram Karwal
	Teacher(s) (Alphabetically)	Dr. Vikram Karwal

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.	Analyze 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.	Applying 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 autocovariance 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; Baysean estimation: Mean Square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation	8

3.	Estimation of signal in presence of White Gaussian Noise(WGN)	Linear Minimum Mean-Square Error(LMMSE) Filtering: Wiener Hoff Equation FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear prediction of signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.	8
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, Initilization, tracking of nonstationarity.	8
5.	Kalman Filtering	Principle and application, Scalar Kalman filter, Vector Kalman filter	4
6.	Detection Theory	Hypothesis testing, Bayesian, Neyman-Pearson and Minimax detetion, 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 Component: After studying the contents of this Course students will be able to design Least Mean square estimators, Biased and Unbiased estimators, Optimal estimators. These esti- mators find widespread applications in the area of Communication and Signal Processing applications specially 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** :Even2021**(specify Odd/Even)**	**Semester** 8th **Session** 2020 -2021 **Month from Jan2021 – June 2021**
Course Name	Software Defined Radio and Cognitive Radio Network		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Garg
	Teacher(s) (Alphabetically)	Dr. Ankit Garg

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 ofNext GenerationWireless 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, techniques to improve data converter performance, complex ADC and DAC architectures, digital radio processing, reconfigurable 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**	Spectrum decision, spectrum sharing and spectrum mobility, mobility management of heterogeneous wireless networks, Cooperation and cognitive systemsand research challenges in	10

	net-works	CR	
5.	**Next GenerationWireless 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 ofSDR andcognitive 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	20M31EC114	**Semester:** Even 2021 **(specify Odd/Even)**	**Semester:** Even **Session:** 2020-21 **Month from: Jan 2021 to June 2021**
Course Name	Digital Image and Video Processing		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Richa Gupta	
	Teacher(s) (Alphabetically)	Richa Gupta	

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C115.1	familiarize with the concept of digital image formation, image structure and transform coding.	Applying Level (C3)
C115.2	understand the basics of digital image processing with necessary skills to solve practical problems.	Applying Level (C3)
C115.3	Learn fundamentals of digital video processing, motion estimation and compensation.	Applying Level (C3)
C115.4	Identify the need of image & video compression, and image & video applications.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Fundamentals of Digital Image and Image Transform	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components, Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	6
2.	Digital Image Processing	Image Enhancement - Spatial Domain Processing: Digital Negative, Contrast Stretching, Thresholding, Gray Level Slicing, Bit Plane Slicing, Log Transform and Power Law Transform. Neighborhood Processing: Averaging filters, Order statistics filters, High pass filters and High boost filters, Filtering in frequency domain: Smoothing and Sharpening filters, Image Segmentation, Image Restoration & Construction, Morphological Image Processing, Image quality assessments.	10
3.	Digital Video Processing	Digital Video Sampling and Interpolation, Video Frame Classifications, I, P and B frames, Notation, Motion Estimation and compensation, Application of motion estimation in video coding, Video Enhancement and Restoration, Video quality Assessment.	9
4.	Image Compression and Video Compression	Data Compression: Lossless Compression and Lossy Compression, Optimal codes, Construction algorithms of source codes - Huffman Codes, Error Resilient Codes–types, construction and applications,	10

		Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression, Basics of Video Compression, Inter-frame and Intra-frame redundancy, Video Coding Standard – H.263++	
5.	Image and Video Applications	Image and Video Segmentation, Biomedical Image Processing, Image Annotation, Video Annotation, Video surveillance.	8
		Total number of Lectures	**43**

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 are required to prepare a consolidated summary (including approach, limitations, pros and cons, applications, scope etc.) of any recent research paper published in reputed International Conference or International Journal related to Image and Video processing. They will submit this research assignment towards the end of the semester.

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.	Gonzaleze and Woods, "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education, 2010.
2.	K. Sayood, Introduction to data compression, Elsevier, 5th edition, 2017
3.	A Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2015

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**20M41EC119**	**Semester: EVEN (specify Odd/Even)**	**Semester** : 2 **Session** 2020 -21 **Month from** Jan **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

Course Code	18B12BT414	Semester Even	Semester VIIIth Session 2020-2021 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,	8

		statistical inferences and biological interpretation (Gene ontology and microarray 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 evaluation)	25 (Assignment, Quiz, Case study, Project based
Total	**100**

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.	Pierre Baldi and Søren Brunak "Bioinformatics The Machine Learning Approach" , February 1998, 371 pp., 62 illus.,
2.	Thomas H. Cormen "Introduction to Algorithms" , 2nd edition McGraw-Hill Science,2001, 1056 pages.
3	Yang, Zheng Rong, " Machine :Learning Approaches to Bioinformatics", New Delhi world Scientific, Pp 336, 2017
4	Research papers and manuals

Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2020 -2021 **Month from :**Jan - 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 (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 conflicts and insurgencies; border disputes	8
6.	Emergence of OtherPower 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