Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** Jan - July
Course Name	International Studies		
Credits	3	**Contact Hours**	**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 centres 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 Other Power Centers of Power	• Japan • European Union (EU) • China • Russia	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment/ Class Test/ Quiz)
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.	Appadorai, & Rajan, M. S. (eds.) (1985). *India's Foreign Policy and Relations*. New Delhi: South Asian Publishers.
2.	Baylis, J. & Smith, S. (eds.) (2011). *The Globalization of World Politics: An Introduction to International Relations*. Fifth Edition. Oxford: Oxford University Press,
3.	Calvocoressi, P. (2001). *World Politics: 1945—2000*. Essex: Pearson
4.	Carr, E.H. (2004). *International Relations between the Two World Wars: 1919-1939*. New York: Palgrave
5.	Chatterjee. A (2018). *International Relations Today*. Noida: Pearson
6.	Ganguly, S. (ed.) (2019). *India's Foreign Policy: Retrospect and Prospect*. New Delhi: Oxford University Press
7.	Goldstein, J. and Pevehouse, J.C. (2009). *International Relations*. New Delhi: Pearson
8.	Hobsbawm, E. (1995). *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus
9.	Mewmillians, W.C. and Piotrowski, H. (2001). *The World Since 1945: A History of International Relations*. Fifth edition. London: Lynne Rienner Publishers.
10.	Pant, H.V. (2009). *India's Foreign Policy in the Unipolar World.* Delhi: Routledge

Detailed Syllabus

Course Code	15B19EC891	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session** 2019 -2020 **Month from:** January to June
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**
Mid Sem Viva	20
Final Viva	30
D2D	30
Thesis	20
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Subject Code	16BINEC831	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session:** 2019-20 **Month from:** January to June
Subject Name	Sonar system and acoustic imaging		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Kapil Dev Tyagi
	Teacher(s)	Kapil Dev Tyagi

COURSE OUTCOMES - At the end of the course, students will be able to:		**COGNITIVE LEVELS**
C434-5.1	Define and explain sonar terminology and Choose parameters for side scan sonar according to the required azimuth and range resolutions.	Applying Level (C3)
C434-5.2	Select parameters for synthetic aperture sonar (SAS) as per the design requirements.	Applying Level (C3)
C434-5.3	Analyze the continuous time frequency modulation (CTFM) technique for sonar applications.	Analyzing Level (C4)
C434-5.4	Apply and discover signal processing application for ship speed measurement system like JANUS.	Analyzing Level (C4)
C434-5.5	Take part in the development of simple array design for acoustic localization.	Analyzing Level (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	**Side Scan and Sector Scan Sonar**	Introduction to sonar system. Side scan sonar, sector scan sonar, beam-forming methods in sector scans sonar.	6
2.	**Modulation Scanning**	Swept frequency delay line scanning, phase beam-forming, modulation scanning, multistage beam-forming, DFT beam-former.	8
3.	**Synthetic aperture sonar**	Limitation of scanning sonar, Basic of synthetic aperture sonar, matched filtering, Doppler shift aspects, range resolution in synthetic aperture sonar, minimum sampling rate for synthetic aperture sonar, spot lights, and squints in synthetic aperture sonar.	8
4.	**CTFM**	Continuous time frequency modulation technique (CTFM), blind time problem in CTFM, dual demodulator CTFM technique, phase difference radial projection method.	8
5.	**Signal processing for Ship speed measurement**	Estimation of moving target speed in water, GPS, DGPS, SQUID, Doppler log, JANUS, Issues in Doppler log methods, correlation-log,	6

6.	**Acoustic localization**	Localization using time delay estimation, Beacons, Pingers. Localization using three hydrophones, Localization using four hydrophones, Non-planar array using five hydrophones.	6
Total number of Lectures			**42**

Evaluation Criteria

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

List of Simulation Experiments in Sonar system and acoustic imaging

Ex1. Generate the sine wave of 1 kHz with sampling frequency of 10 kHz with constant amplitude and with initial phase of (i) 0 rad, (ii) pi/3 radians, (iii) pi/6 radians. Calculate the FFT of these signals and plot the magnitude and phase of these signals. Scale the frequency axis in Hz/kHz (take the Y scale normalized with maximum amplitude).

Ex2. Linear Chirp signal of with starting frequency of 100 Hz ending frequency of 2 KHz and duration of 1 sec.

Ex3. Generate Sine waves of 1 kHz with sampling frequency of 10 kHz and amplitude decreasing exponentially with different slops.

Ex4.Calculate the FFT of the signal plotted in Q1 a. b. and c. and scale the frequency axis in Hz/kHz (take the Y scale normalized with maximum amplitude).

Ex5.Draw the radiation pattern of a N element uniform array as a function of angle. Reference document is given in the study material.

Ex6.Let Fourier transform corresponding to a signal contains 10 impulses starting at 45 kHz at a gap of 5 kHz. Plot the time domain signal corresponding to this Fourier transform.

Ex7.Generate a signal s(t) consisting of three linear chirp signals. Each chirp signal c(t) has starting frequency of 100 Hz, ending frequency of 2 KHz and duration of 1 sec. In s(t) the first chirp signal c(t) has zero delay, the second has 100 ms delay and the third one has 300 ms delay. Take sampling rate 1 MHz. Correlate this composite signal with the chirp signal c(t) .

Ex8.Generate a signal consisting of the following signals A. a chirp signal c(t) as mentioned above B. a 2 second delayed signal of 50 KHz with duration 20 us. C. Series of 3 second delayed pulses (10) of 65 kHz of duration 31.6 us. Plot the spectrogram take averaging duration of 50 us. Take sampling rate at 1 MHz.

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.	Lawrence J. Ziomek, An Introduction to Sonar Systems Engineering, Taylor & Francis Inc, 2017.
2.	A. D. Waite, Sonar for Practising Engineers, 3rd edition, John Wiley & Sons, 2002.
3.	Authors: Au, Whitlow W.L. The Sonar of Dolphins, Springer-Verlag New York, ISBN 978-1-4612-4356-4, 1993.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	16 B1NHS832	Semester (specify Even)	Semester VIII Session 2019-2020 Month from Jan-June
Subject Name	Service Marketing and Management		
Credits	3-0-0	Contact Hours	3

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand service products, consumers and markets	C2
CO2	Apply 4P's of marketing to service	C3
CO3	Determine and Interpret the customer Interface	C5
CO4	Create and design profitable service strategies	C6

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

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Services	Product to Services—The Challenges • The Gaps Model • The Services Marketing Mix	5
2.	Consumer Behavior In Services	Managing Customer Behavior— The three stage model of Service Consumption	5
3.	Delivering Quality Service	Challenges of Measuring Service Quality • Measures of Service Quality • Dimensions of Service Quality SERVQUAL	5
4.	Positioning Services in Competitive Markets	Focus Strategies Developing effective positioning strategies	4
5.	Creating value in a competitive market and service promotion	Positioning a service in the market Value addition to the service product Planning and branding service products New service development.	6
7	Culture and Service	National Cultures,	5

		Managing and marketing of Service across boundaries	
6.	Technology & Service Strategy	Introduction to e services Electronic Commerce Models, Types of E services Value Chains in E Service	6
7	Planning and managing service delivery	Creating delivery systems in price, cyberspace and time The physical evidence of the service space. The role of intermediaries, enhancing value by improving quality and productivity.	6
		Total number of Lectures	42

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.	Valarie A.Zeithaml & Mary Jo-Bitner: Services Marketing-Integrating Customer Focus Acros the Firm, 7/e, TMH, 2018.
2.	Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2011
3.	Rao, Services Marketing, Pearson Education, 2/e,2011
4.	Thomas J.Delong & Asish Nanda: Managing Professional Servies-Text and Cases, McGraw-Hil International, 2002
5	Roland T. Rust and P.K. Kannan, e-Service New Directions in Theory and Practice, Prentice-Hal of India Pvt. Ltd., 2002

Optimization Techniques (16B1NMA831)

Lecture-wise Breakup

Course Code	16B1NMA831	**Semester** Even		**Semester** VIII **Session** 2019-2020 **Month from** Jan 2020 to June 2020	
Course Name	Optimization Techniques				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Prof. A. K. Aggarwal			
	Teacher(s) (Alphabetically)	Prof. A. K. Aggarwal Dr. Pankaj Srivastava			

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.	06
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	Unimodal function, One Dimensional minimization	08

	Programming	problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	Taha H. A., Operations Research: An Introduction, 7th edition, PHI, 2002.
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., 1975.
4.	Hillier F. and Lieberman G. J., Introduction to Operations Research, 6th edition, McGraw-Hill, 1995.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NEC735	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session:** 2019 -2020 **Month from:** January to June
Course Name	Information Theory and Applications		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Alok Joshi	
	Teacher(s) (Alphabetically)	Dr. Alok Joshi	

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C434-6.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding Level (C2)
C434-6.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyzing Level (C4)
C434-6.3	Analyze the relationship between bandwidth and capacity of communication channels and its importance in real life communication systems.	Analyzing Level (C4)
C434-6.4	Analyze the need for channel coding in digital communication systems.	Analyzing Level (C4)
C434-6.5	Generate error correcting codes for error detection and correction.	Analyzing Level (C4)

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	3
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	5
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon's fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission and storage. Types of codes. Modulation and coding. ML decoding. Performance	3

		measures.	
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and syndrome decoding. Hamming codes.	8
7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes- the Viterbi algorithm.	8
		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**

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.	W.P. HSU: Schaum series-Analog and digital communications, Macgraw Hill 2016
2.	RANJAN BOSE: Information theory, coding and cryptography, Macgraw Hill 2008
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2008
4.	SHU LIN & D.J. COSTELLO: Error Control Coding, 2nd Edn, Pearson, 2004.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus

18B12BT414 Machine Learning tools in Bioinformatics

Semester & Session	**VIII Semester 2019-20**	**Credits**	**3**	**Contact Hours L T P**	**3 3 0 -**

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

NBA Code: C402-13

Code	CO	**Level**
C402-13.1	Explain about the machine learning principle biological complexities and resources	C2
C402-13.2	Apply Pattern Identification methods for motif discovery	C3
C402-13.3	Apply machine learning in solving biological problems.	C3
C402-13.4	Analyzing the use of machine learning in disease-drug discovery	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 data)	8

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-1, Assignment-2, Quiz, Case study)
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, 1056 pages.

CO-PO and CO-PSO Mapping: (Biotech)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
C402-13.1	**2**	**2**		**1**		**1**			**1**			**2**	**2**		
C402-13.2	**2**	**2**	**2**	**1**	**1**	**2**						**2**	**2**		
C402-13.3	**2**	**2**	**3**	**2**	**1**	**2**	**1**		**1**	**1**		**2**	**3**		**1**
C402-13.4	**2**	**2**	**2**	**1**	**1**	**1**	**1**		**1**	**1**		**2**	**1**	**1**	**1**
Avg.	**2**	**2**	**2**	**1**	**1**	**2**	**1**		**1**	**1**		**2**	**2**	**1**	**1**

B Tech CSE

Programme Specific Outcomes:

PSO 1:Able to identify suitable data structures and algorithms to design, develop and evaluate effective solutions for real-life and research problems.

PSO 2:Able to excel in various programming/project competitions and technological challenges laid by professional societies.

CO-PO and CO-PSO Mapping: (B Tech CSE)

COs	PSO1	PSO2
C402-13.1	1	
C402-13.2	1	1
C402-13.3	1	1
C402-13.4	1	1
Avg.	**1**	**1**

B Tech IT

Programme Specific Outcomes:

PSO 1:Able to acquire practical competency with emerging technologies, programming languages and open source platforms.

PSO 2:Able to assess hardware and software aspects necessary to develop IT based solutions.

CO-PO and CO-PSO Mapping: (B Tech IT)

COs	PSO1	PSO2
C402-13.1		
C402-13.2	1	
C402-13.3	2	
C402-13.4	2	
Avg.	**2**	

B Tech (ECE)

Programme Specific Outcomes:

PSO 1: To identify the engineering problems and develop solutions in the area of communication, signal processing, VLSI and embedded systems.

PSO2: To demonstrate proficiency in utilisation of software and hardware tools along with analytical skills to arrive at appropriate solutions.

CO-PO and CO-PSO Mapping: (B Tech ECE)

COs	PSO1	PSO2
C402-13.1		
C402-13.2		1
C402-13.3		1
C402-13.4		1
Avg.		**1**

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC411	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** January to June
Course Name	Introduction to IOT		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Verma (62)
	Teacher(s) (Alphabetically)	Mr. Abhay Kumar (128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-1.1	**Outline the basic concepts of IOT with networking and protocol considerations in IOT scenario.**	Understand (C2)
C433-1.2	**Identify various IOT hardware platforms and their utilization with various sensors and actuators.**	Apply (C3)
C433-1.3	**Experiment the basic concepts of python programming and make use of them in image processing, data analytics and machine learning applications.**	Apply (C3)
C433-1.4	**Examine various case studies and cloud platforms in an IOT scenario for monitoring, control and analysis.**	Analyze (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	IOT Basics and its Importance	Introduction to IOT (People Connecting to Things, Things Connecting to Things, Definition of IOT, History of IOT), IOT Components (Sensors & Actuators, Things, Communications, Networks, The Internet, Protocol Stack), Evolution of Connected Devices, IOT Applications, IOT Companies, Baseline Technologies (Machine to Machine (M2M) Communication, Cyber Physical Systems (CPS), Web of Things (WOT)), Address Crunch in IOT, IOT Terminologies (IOT Node, LAN, MAN & WAN, IOT Gateway & Proxy), IOT Network Configuration (Gateway Prefix Allotment, Impact of Mobility on Addressing, Concept of Tunneling, Multi-homing), IPv4 Versus IPv6.	6
2.	Basics of IOT Networking	Introduction to IOT Networking, Networking Standards and Technologies (Network Access & Physical Layer, Internet Layer, Transport Layer, The application layer), IOT Networking Protocols, Network Access and Physical layer IoT Network Technologies ((LPWAN (Low Power Wide Area Network), Cellular, Bluetooth Low Energy (BLE), RFID, NFC, Zigbee, Wifi, Ethernet), Internet layer IoT network technologies (IPv6, 6LoWPAN, and RPL),	6

		Application layer IoT network technologies (HTTP, HTTPS, MQTT, AMQP, and XMPP), IoT networking considerations and challenges, IoT Platforms Capabilities.	
3.	IoT supported Hardware platforms (Arduino) & data visualization using cloud.	Introduction to Arduino (Different Arduino boards, Arduino Uno board description and its pin configuration, Arduino IDE and program uploading, different functions related to GPIOs and special functions (PWM and Serial communication), Interfacing with Arduino using processing language (LED, Switch, Seven Segment, LCD, DC Motor, Relay, IR, LDR and DHT11 sensor), Interrupts, use of simulator and compiler, basics of HTML, Arduino supported IOT modules (Ethernet & Wifi Shield) and their configuration, Monitoring of sensor data on cloud and Web based controlling of actuators.	12
4.	Introduction to Python, Data Analytics, Machine Learning and Case Studies.	Introduction to python, python IDE, Data types, various programming constructs (loops, if, else etc.), operators, functions, modules, data handling (pandas), file operations, Image operations (PIL-pillow), data plotting in python (Matplotlib), basics of machine learning in python (Scikit) and related case studies.	10
5.	IoT supported Hardware platforms (Raspberry pi) & its Applications	Introduction to Raspberry pi (Raspberry pi different model comparison, Pin Configuration, Raspberry Pi operating system choices, Set up your Raspberry pi, Raspbian OS, Remote Access using SSH, Remote Access using TightVNC), Interfacing with Raspberry pi using python and use of open source libraries (LED, Switch, LCD, DC Motor, Relay, IR, LDR and DHT11 sensor), IOT Applications (Water management system, Weather monitoring station on cloud, Smart Agriculture System, Smart Energy meter, Pollution Monitoring system, Smart Dustbin management system.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance & Quiz)
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.	"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2.	"Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC413	**Semester** Even **(specify Odd/Even)**	**Semester 8**th **Session** 2019 -2020 **Month from** Jan-June
Course Name	Digital Control Systems		
Credits	4	**Contact Hours**	3+2

Faculty (Names)	**Coordinator(s)**	Vijay khare
	Teacher(s) (Alphabetically)	Vijay khare

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-2.1	To represent the systems in both in Z domain and in state space representation.	Remembering Level(C1)
C433-2.2	To analyze transient and steady state behaviors of linear discrete time control systems with modified transfer function.	Analyzing Level (C4)
C433-2.3	To understand and gain knowledge in stability analysis of digital control systems.	Understanding Level (C2)
C433-2.4	To Design Digital Control Systems	Designing Level (C6)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Review of Z transform	z transform and inverse z transform . Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform.	3
2.	Review of state space techniques	Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation-solution to discrete state equations.	5
3.	Introduction to Digital Control System	Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold.	8
4.	Analysis of Digital Control Systems	Digital control systems- Pulse transfer function . z transform	8

		analysis of closed loop open loop systems- Modified z-transfer function- Stability of linear digital control systems and Jury's stability test	
5.	Stability tests	Stability tests- Steady state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and phase margin.	8
6.	State feedback concept	Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback .	5
7.	Digital System Design	Observer Design for digital control, Pole placement design based on input-output models.	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment = 15, Attendance = 10)
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.	B. C. Kuo , "Digital control systems" (Second Edition) , Oxford University Press,2007.
2.	K. Ogatta, "Discrete Time control systems ", 2nd ed. PHI),1995
3.	M. Gopal, "Digital Control and State Variable Methods", 3rd Edition, TMH, Sep-2008.
4.	G. F. Franklin, J. D. Powell, M. Workman, Digital Control of Dynamic Systems, 3rd Edition, Longman, 1998.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC417	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session:** 2019 -2020 **Month from:** January to June
Course Name	Satellite Communication		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Abhishek Kashyap
	Teacher(s) (Alphabetically)	Dr. Abhishek Kashyap, Dr. Ajay Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-4.1	Define Satellite and its historical background, outline the basic concepts of Satellite communications, recall the Kepler's laws of planetary motion	Remembering Level (C1)
C433-4.2	Develop the equations of the orbit, explain the satellite launching and launch vehicles and outline terminology of earth-orbiting Satellites.	Analyzing Level (C4)
C433-4.3	Demonstrate the space segment, antenna subsystem, estimate different parameters and design uplink and downlink.	Creating Level (C6)
C433-4.4	Apply various multiple access techniques for satellite communication and analyze Noise and Bandwidth. Also Interpret applications of various types of satellites established in different earth orbits.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to the Subject and its Importance. Contents. Books and Reading References. Evaluation. Space Environment. Artificial Satellites. Communication Satellites.	4
2.	Satellite Orbits and Frequency Bands	Orbital Mechanics. Orbits Employed for Satellite Communication like LEO, MEO & GEO, their Merits and Demerits. Satellite Launching. Launch Vehicles. Radio Wave Propagation Effects. Communication Window.	8
3.	Communication Satellites and Link Design	Geostationary Communication Satellite-Transponder. Ground Station System. Communication Link-Consideration, Calculation and Design. Power and Bandwidth Limitations and Budget.	10
4.	Modulation Techniques	Modulation and Demodulation Techniques. Performance Analysis- Noise and Bandwidth.	6
5.	Multiple Access	Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA)	8

6.	Different Communication Satellite Systems	VSAT. Navigational Satellites. Broadcasting Satellites. Remote Sensing Satellites. Low and Medium Earth Orbit Satellites. INSAT. INTELSAT.	5
7.	Some Communication Satellite Applications	DBS TV. Multimedia Transmission Related Issues, Advantages& Bit Rates for Digital TV, HDTV, Bandwidth Considerations and Introduction to Compression Standards. Convergence of Communication, Introduction to IPTV.	4
		Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Term Examination	35
TA	25 (Attendance: 10 Marks, Assignment: 10 Marks, Quiz: 5 Marks)
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.	T. Pratt, C.W. Bostian and J.E. Allnut, Satellite Communications, 2 Ed, John Wiley & Sons (Asia), 2003
2.	Dennis Roddy, Satellite Communications, 4 Ed, Tata Mcgraw Hill, 2006
3.	G. Maral & M. Bousquet, Satellite Communications Systems- Systems, Techniques and Technology, 4 Ed, John Wiley and Sons, 2002.
4.	Richard Brice, Newness Guide to Digital TV, 2Ed, 2003.
5.	Gerard O' Driscoll, Next Generation IPTV Services and Technologies, John Wiley & Sons, 2008

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH531	**Semester : ODD**	**Semester: 5th Session:** 2019 -2020 **Month from July 19 to December 19**
Course Name	**Quantum Mechanics for Engineers**		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Vikas Malik and Anuraj Panwar
	Teacher(s) (Alphabetically)	Vikas Malik and Anuraj Panwar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-10.1	Remember basics of Quantum Mechanics and its applications.	Remembering (C1)
C301-10.2	Explain postulates of quantum mechanics, Dirac notation, Schrödinger Equation, Perturbation theory and Qubits.	Understanding (C2)
C301-10.3	Solve various problems related to different quantum systems and construct quantum circuits using quantum gates.	Applying (C3)
C301-10.4	Analyse the results obtained for various physical systems and to establish the advantages of some simple protocols of quantum information processing.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Wave particle duality, quantum physics (Planck and Einstein's ideas of quantized light), postulates of quantum mechanics, time dependent and time independent Schrodinger equation, operators, probability theory, expectation values, and uncertainty principle and its implications, no cloning applications	8
2.	Measurement Theory with Applications	Matrix and linear algebra, Eigen values and eigenfunctions Hilbert space, Kets, Bras and Operators, Bras Kets and Matrix representations, Measurements, Stern Gerlach Experiment, Observables and Uncertainity Relations, No-cloning theorem, Pauli Spin Matrices.	10
3.	Potential problems	1-D, 2-D, and 3-D potential problems (including infinite and finite square well). Tunneling, harmonic oscillator, separation in spherical polar coordinates, hydrogen atom, etc.),	08
4.	Approximation methods	Time independent perturbation theory for nondegenerate and degenerate energy levels.	4
5.	Advanced Applications	Kronig Penny model, Basic ideas of quantum computing, Qubit, Gate model of quantum computing : H, CNOT, Pauli Gates, BB84 protocol, Advantages of quantum computing, Quantum wire, Quantum dot and realization of CNOT using Quantum dot.	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**

T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

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

1.	The new quantum universe by Toney Hey and Patrick Walters, Cambridge University Press.
2.	Quantum mechanics a new introduction by Kenichi Konishi and G Paffuti, OUP., 2009
3.	Quantum physics by Eyvind H Wichman (Berley Physics course Vol 4) Tata McGraw Hill 2008
4.	Elements of quantum computation and quantum communication by A Pathak, CRC Press 2013.
5.	Introduction to Quantum Mechanics by David J. Griffiths, Second Edition, Pearson, 2015.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH535	**Semester: ODD**	**Semester: 5th Session:** 2019 -2020 **Month from July 19 to December 19**
Course Name	NUCLEAR SCIENCE AND ENGINEERING		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Vivek Sajal
	Teacher(s) (Alphabetically)	Vivek Sajal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-14.1	Relate terminology and concepts of nuclear science with various natural phenomenon and engineering applications.	Remembering (C1)
C301-14.2	Explain various nuclear phenomenon, nuclear models, mass spectrometers, nuclear detectors, particle accelerators. and classify elementary particles.	Understanding (C2)
C301-14.3	Solve mathematical problems for various nuclear phenomenon and nuclear devices.	Applying (C3)
C301-14.4	Analyze the results obtained for various physical problems and draw inferences from the results.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nuclear Constituents and their properties, Nuclear Forces	Rutherford scattering and estimation of nuclear size, Constituents of the nucleus and their properties, Nuclear Spin, Moments and statistics, Magnetic dipole moment, Electric quadruple moment. Nuclear forces, Two body problem - Ground state of deuteron, Central and non-central forces, Exchange forces: Meson theory, Yukawa potential, Nucleon-nucleon scattering, Low energy n-p scattering, Effective range theory, Spin dependence, charge independence and charge symmetry of nuclear forces, Isospin formalism.	07
2.	Nuclear Models	Binding energies of nuclei, Liquid drop model: Semi-empirical mass formula, Mass parabolas, Prediction of Nuclear stability, Bohr-Wheeler theory of fission, Shell model, Spin-orbit coupling. Magic numbers, Angular momenta and parities of nuclear ground state, Magnetic moments and Schmidt lines, Collective model of a nucleus.	05
3.	Nuclear decay and Nuclear reactions	Alpha decay, Beta decay, Pauli's Neutrino hypothesis-Helicity of neutrino, Theory of electron capture, Non-conservation of parity, Fermi's theory, Gamma decay: Internal conversion, Multipole transitions in nuclei, Nuclear isomerism, Artificial radioactivity, Nuclear reactions and conservation laws, Q-value equation, Centre of mass frame in nuclear Physics, Scattering and reaction cross sections, compound nucleus, Breit-Wigner one level formula	08

4.	Interaction of nuclear radiation with matter	Interaction of charge particles with matters: Bohr's ionization loss formula and estimation of charge, mass and energy. Interaction of electromagnetic radiation with matter, Linear absorption coefficient. Nuclear particle detectors and neutron counters.	07
5.	Accelerator and reactor Physics	Different types of reactors, tracer techniques, activation analysis. Radiation induced effects and their applications: Accelerators: Linear accelerators, Van de Graff generator, LINAC, Cyclotrons, Synchrotons, Colliders.	06
6.	Cosmic radiation and Elementary Particles	Cosmic radiation: Discovery of cosmic radiation, its sources and composition, Latitude effect, altitude effect and east-west asymmetry, secondary cosmic rays, cosmic ray shower, variation of cosmic intensity and Van Allen radiation belt. Elementary particles: Classification of particles, K-mesons, Hyperons, particles and antiparticles, fundamental interactions, conservation laws, CPT theorem, resonance particles and hypernucleus, Quark model.	07
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	K.S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
2.	I. Kaplan, 1989, Nuclear Physics, 2nd Edition, Narosa, New Delhi.
3.	B.L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi.
4.	R.R. Roy and B.P. Nigam, 1983, Nuclear Physics, New Age International, New Delhi.
5.	H.A. Enge, 1975, Introduction to Nuclear Physics, Addison Wesle, London.
6.	Y.R. Waghmare, 1981, Introductory Nuclear Physics, Oxford-IBH, New Delhi.
7.	R.D. Evans, 1955, Atomic Nucleus, McGraw-Hill, New York.

Detailed Syllabus
Lab-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	15B17EC571	**Semester:** Odd **(specify Odd/Even)**	**Semester** 5th **Session** 2019 -2020 **Month from** June19 **to** Dec 19
Course Name	Digital Communication Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Parul Arora, Reema Budhiraja
	Teacher(s) (Alphabetically)	Akansha Aggarwal, Ankit Garg , Atul Kumar, Bhawna Gupta , Juhi Gupta, Megha Agarwal, Neeti, Neetu Joshi, Pankaj Yadav, Raghvenda Singh, Richa Gupta, Sajal Aggarwal , Yogesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C370.1	Learning about DSO functioning, Function Analyzer, bread board, and circuit connection. Sampling and quantization of an analog signal. Generation & detection of ASK, FSK & PSK using trainer kit.	Understanding Level(C2)
C370.2	Design circuits for Amplitude Shift Keying, Frequency Shift Keying and Phase Shift Keying using IC LF 398. Understanding of the concept of different line coding schemes and draw corresponding waveforms.	Analyzing Level(C4)
C370.3	Understanding the concept of modulation and demodulation.	Understanding Level(C2)
C370.4	Implement Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Quadrature Amplitude Modulation and their demodulation on trainer kit.	Analyzing Level(C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Sampling process	Study of various sampling techniques and the effect of sampling frequency.	C370.1
		Study of various sampling techniques (natural sampling, sample and hold, flat top sampling) using MATLAB	C370.1
2.	Study of Baseband Pulse Transmission	To study various data encoding and decoding techniques.	C370.2
3.	Study of Digital Passband Transmission	Design of Amplitude Shift Keying modulation circuit using IC LF398, to vary the parameters and to study its waveform.	C370.2, C370.3
		Design of Frequency Shift Keying modulation circuit using IC LF398, to vary the parameters and to study its waveform.	C370.2, C370.3
		Design of Phase Shift Keying modulation circuit using IC LF398, to vary the parameters and to study its waveform.	C370.2, C370.3
		Design of Amplitude Shift Keying modulation circuit using IC LF398, to vary the parameters and to study its waveform using MATLAB.	C370.2, C370.3
		To generate and study the Quadrature Amplitude Modulated	C370.2,

		signal and demodulate the same.	C370.3
4.	Study of Waveform coding techniques	Study of Pulse Code Modulator (PCM) and Demodulator.	C370.4
		Study of TDM with different receiver synchronization techniques.	C370.4
		To generate and study the Delta Modulated signals and demodulate the same.	C370.4
		To generate and study the Adaptive Delta Modulated signals and demodulate the same.	C370.4

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Performance	20
End Term Performance	20
Day-to-day performance (Lab record, experiment performance, discipline etc.)	60
Total	**100**

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

1.	H. Taub & D. L. Schilling, Principles of Communication Systems, 2nd edition, McGraw-Hill Higher Education
2.	S. Haykin, Digital Communications, John Wiley & Sons, 2001.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC511	**Semester ODD (specify Odd/Even)**	**Semester** 5th **Session** 2019 -2020 **Month** July 19 to December 19
Course Name	Digital Communication		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Megha Agarwal, Bhawna Gupta
	Teacher(s) (Alphabetically)	Ankit.Garg, Atul Kumar, Parul Arora, Reema Budhiraja, Yogesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C310.1	Understand the concepts of Sampling process, time division multiplexing and GSOP.	Understanding (Level II)
C310.2	Understand the concepts of waveform coding techniques, PSD of different line coding schemes and analysis of ISI Mitigation Techniques	Analyzing (Level IV)
C310.3	Understand the concepts of digital modulation techniques and evaluate their probability of error and bandwidth efficiency.	Evaluating (Level V)
C310.4	Understand the concepts of error control coding schemes.	Understanding (Level II)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Merits and demerits of digital signals, sampling theorem in frequency domain and time domain, Nyquist criteria, reconstruction using interpolation filters, ideal, natural and flat top sampling, aperture effect	8
2.	Waveform coding techniques	PCM generation and detection, quantization, quantization error, non uniform quantization, companding, differential PCM, Delta modulation, Adaptive delta modulation, Data encoding formats, PSD of Line codes, ISI, ISI Mitigation Techniques. GSOP.	8
3.	Digital Modulation Techniques	Binary & M-ary modulation techniques: FSK, PSK, DPSK, M-ary PSK, Minimum Phase Shift Keying (MSK) and Quadrature Amplitude Modulation	10
4.	Performance Analysis of Digital Systems	Probability of error analysis – Optimum filter, Matched filter, Coherent & Non – Coherent Reception, Probability of error for FSK, PSK, DPSK, M-ary PSK, Minimum Phase Shift Keying (MSK). Introduction to bit Vs symbol error probability & Bandwidth	10
5.	Digital Systems and error control	Digital radio, Plesiochronous and Digital Synchronous Hierarchy standards, introduction to error control	4
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	S. Haykin, Digital Communications, John Wiley & Sons, 2013.
2.	H. Taub & D. L. Schilling, Principles of Communication Systems, 2nd edition, McGraw-Hill Higher Education, 2016.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B1NMA531**	**Semester** Odd **(specify Odd/Even)**	**Semester** V **Session** 2018 -2019 **Month from** July 2019- Dec2019
Course Name	**DISCRETE MATHEMATICS**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Anuj Bhardwaj	
	Teacher(s) (Alphabetically)	Dr. Anuj Bhardwaj	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
C301-1.1	explain partial order relations, Hasse diagram, lattices and recursive functions.	Understanding Level (C2)
C301-1.2	solve the difference equations using generating function and Z-transform.	Applying Level (C3)
C301-1.3	explain the propositional and predicate calculus to check the validity of arguments.	Understanding Level (C2)
C301-1.4	demonstrate graphs, digraphs, trees and use it to solve the different problems of graph theory.	Applying Level (C3)
C301-1.5	illustrate various algebraic structures and their properties.	Understanding Level (C2)
C301-1.6	explain the theory of formal languages and solve the related problems of automata.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Relations and Lattices	Relations and their composition. Pictorial representation, matrix and graphical representations. Equivalence relations and partitions. Partial ordered relations and Hasse diagram. Lattices.	5
2.	Functions	Functions and Recursively defined functions, generating functions, solution of recurrence relations by generating function. Z transforms, solution of difference equations by Z transform.	8
3.	Propositional Calculus	Propositions- simple and compound. Basic logical operators. Implication. Truth tables. Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers.	4
4.	Graphs	Graphs and related definitions, subgraphs, isomorphism, paths and connectivity. Eulerian graph and Konigsberg	7

		problem. Hamiltonian graph. Labelled and weighted graphs. Tree Graphs-Minimum spanning Tree (Prim's algorithm). Graph colorings. Four color problem.	
5.	Directed Graphs	Trees, Digraphs and related definitions. Rooted trees. Algebraic expressions and Polish notation. Sequential representation. Adjacency matrix. Path matrix. Shortest path. Linked representation of directed graphs. Binary trees.	5
6.	Algebraic Structures	Groups- definitions and examples, order of elements, subgroup, condition for subgroups. Quotient groups, Lagrange theorem and applications, Rings, integral domains and Fields- definition and examples.	7
7.	Languages and Grammars	Strings (words) and languages, grammars, types of grammars, Finite state machines, finite state automata, regular languages and regular expressions.	6
Total number of Lectures			**42**

Evaluation Criteria

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

Recommended Reading material:

1.	Lipschutz, S. and Lipson, M., Discrete Mathematics, 2nd Edition, Tata McGraw-Hill, 1997.
2.	Rosen, K. H., Discrete Mathematics and its Application, 5th Edition, Tata McGraw-Hill, 2003.
3.	Liu, C. L., Elements of Discrete Mathematics, 2nd Edition, Tata McGraw-Hill, 1985.
4.	Kolman, B., Busby, R. C. and Ross, S., Discrete Mathematical Structures, 3rd Edition, Prentice Hall, 1996.
5.	Deo, N., Graph Theory, Prentice Hall, 1980.
6.	Grimaldi, R.P., Discrete and Combinatorial Mathematics, 4th Edition, Pearson Education, 2005.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	**Semester Even (specify Odd/Even)**	**Semester VIII Session** 2019 -2020 **Month from** January to June
Course Name	Photonics and Applications		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Navneet Kumar Sharma
	Teacher(s) (Alphabetically)	Navneet Kumar Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the fundamental properties of light and the processes involved in the generation of light	Remember Level (C1)
CO2	Interpret the theory of fiber optics	Understand Level (C2)
CO3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Apply Level (C3)
CO4	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Lasers	Review of different types of laser systems. LEDs, Semiconductor lasers, Quantum well lasers, Modes of laser cavity, Q-switching and Mode locking in lasers.	8
2.	Fiber Optics	Numerical aperture, Step and graded index multimode fibers, attenuation and dispersion, modes in optical fibers. Single mode fiber, mode cutoff and mode field diameter. Connector and splice losses, Erbium doped fiber amplifier and Characterization techniques including OTDR.	10
3.	Photo detectors	Semiconductor photo detectors.	5
4.	Optical Electronics	Wave propagation in anisotropic media, Electro-optic effect: phase and amplitude modulation. Acousto-optic effect: modulators, deflectors and tunable filters, Magneto-optic effect: modulators.	4
5.	Optical devices	Electro-optical device, Acousto-optical device, Magneto-optical device, Voice communication, Optical communication.	2
6.	Nonlinear Optics	SHG, Sum and Difference frequency generation, parametric amplification, wavelength converters, Self focusing with lasers.	6
7.	Holography	Recording and Reproduction of Hologram, Applications of holography.	4
8.	Applications of Photons in Memory devices	CD, VCD, DVD.	1
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
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.	R. P. Khare, *Fiber Optics and Optoelectronics*, Oxford University Press.
2.	A. K. Ghatak and K. Thyagarajan, *Optical Electronics*, Cambridge university Press.
3.	A. K. Ghatak and K. Thyagarajan, *An Introduction to Fiber Optics*, Cambridge university Press.
4.	B. B. Laud, *Lasers and Nonlinear Optics*, New Age International.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B12PH812	**Semester: Even**	**Semester 8 Session 2019 -20** **Month from January to June**
Subject Name	**Astrophysics**		
Credits	**03**	**Contact Hours**	**03**
Faculty (Names)	**Coordinator(s)**	**Prof. Anirban Pathak**	
	Teacher(s) (Alphabetically)	**Anirban Pathak**	

S. No.	DESCRIPTION	COGNITIVE LEVEL
CO1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remember Level (C1)
CO2	Explain the models of universe, ideas of stellar astrophysics, life cycles of stars, physical principles that rules galaxies, and general theory of relativity	Understand Level (C2)
CO3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Apply Level (C3)
CO4	Compare different models of universe and decide which one is logically acceptable and why	Analyze Level (C4)

Module No.	Subtitle of the Module	Topics	No. of Lectures
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**
4.	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 mater and dark energy.	**6**
5.	Astrobiology	Drake equation and related questions.	**2**
6.	Conclusion	Review of the present status of Astrophysics and open questions.	**2**

Evaluation Criteria

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

Recommended Reading

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, Baidyanath Basu, 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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH813	**Semester: EVEN**	**Semester: VIII Session** 2019 -2020 **Month from: January to June**
Course Name	Bio-Physics		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Papia Chowdhury
	Teacher(s) (Alphabetically)	Dr Papia Chowdhury

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-5.1	Find the connections between physics and biology of living system, Physical processes in the living organisms	Remember (C1)
C402-5.2	Understand the idea of DNA computing with the construction of different DNA logic gates.	Understanding (C2)
C402-5.3	Apply the idea of different radiation sources to explain radiobiology to understand the effect of radiation on living system	Apply (C3)
C402-5.4	Analyzing the working of different bio-devices: Organic semiconductor, solar cell, OLED, PLED, AMOLED, biosensors.	Analyze (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Biophysics and DNA computation	Connections between physics and biology of living system, Physical processes in the living organisms. The need of study of physical processes in biological systems. Introduction to DNA computing, DNA structure, Hamiltonian path problem, Encoding information in DNA, Biooperations, DNA models of computation, DNA algorithms, Error rates in DNA computing DNA logic gates, Identity, NOT, OR, AND, NAND, XOR, HALF ADDER, FULL ADDER DNA logic gates, truth table, Technology of tic-tac toe game by DNA computation	14
2.	Radiation Biophysics	Atomic structure models: Constituents of atomic nuclei, Isotope, Radioactivity, Ionizing radiation, excitation, radiation sources, Alfa, Beta, Gamma rays, Properties of Electromagnetic radiation, Units of radioactivity, Particle flux, X & Gamma ray interaction with matter, Energy transfer processes, Nonionising radiation, Radiobiology: Radiolysis, Production of free radicals & their interactions, Radiation on living	10

		system, productions of radionuclides, Radio tracer techniques, Radio sensitisation and protection, Target theory, Cellular effects of radiation, Radiation damage, Genetic Effect of radiolysis, Early and late effects of radiation, Effect of Chronic exposure to radiation, Radiation detection, measurement and applications: Principles of radiation detection and measurement, Dosimeters and its Principles, Design & Working.	
3.	Photo Biophysics	Light sources, Molecular structure and excited states, Physical properties of excited molecules, Photophysical processes, fluorescence, phosphorescence, Internal conversion, Intersystem crossing, Optical activity, Photophysical kinetics of bimolecular processes. Optical bio-devices in electronic industry-Organic semiconductor, solar cell, OLED, PLED, AMOLED etc. Alternative energy sources-Hydrogen fuel cell.	6
4.	Bio-sensing systems	Piezoelectric and Luminescent biosensors, Theory, reaction, design and applications; Quantum dots: dimension, exciton, excited bohr radius, colour coding by quantum dots, experimental techniques for trapping quantum dots by micellization.	7
5.	Environmental biophysics	Ozone umbrella, green house effect, global warming.	3
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	Biophysics, an Introduction, Rodney M. J. Cotterill, John Wiley & Sons.
2.	Methods in modern Biophysics, Bengt Nölting, Springer International Edition.
3.	Biophysics. Vasantha Pattabhi, N. Gautham, Narosa Publishing House.
4.	Biophysics. Hoppe W., Lohmann W., Mark H., and Zeigler H. M.(1983) Biophysics, Springer Verlag, Heidelberg.
5.	Conformation of Biological Molecules, Govil G. and Hosur R.V. (1982), Springer Verlag, Berlin, Heidelberg, New York.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	19B12EC412	**Semester** Even	**Semester** 8th **Session** 2019-2020 **Month from** January to June
Subject Name	Advance Topics in Wireless Communications (19B12EC412)		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vivek Dwivedi
	Teacher(s) (Alphabetically)	

Course Objectives: At the end of the course student should be able to

S. No.	Course Outcomes	Cognitive Levels/ Blooms Taxonomy
C434-3.1	Explain basics of MIMO systems and need of diversity schemes	Remembering (Level I)
C434-3.2	Analyze the effect of fading in the wireless medium and mathematical modeling of fading channels	Analyzing (Level IV)
C434-3.3	Analyze channel capacity expression of MIMO systems	Analyzing (Level IV)
C434-3.4	Analyze the MIMO detection system and need of UWB systems	Evaluating (Level V)

Module No.	Subtitle of the Module	Topics	No. of Lectures
1.	Introduction to MIMO	Evolution of wireless generation	8

	systems	technologies and their transition challenges. Need and expectation of next generation of wireless technology. Introduction of Wireless communication systems, diversity-multiplexing, trade-off, and transmit diversity schemes. Concept of SISO, SIMO, MISO and MIMO systems.	
2.	Fading Environments	Wireless Channel Fading and Distribution: Small scale, large scale and multipath fading channels. Rayleigh, Rician, Exponential, Nakagami-m, Lognormal and α-κ-μ distributions.	10
3.	Channel capacity of MIMO systems	Ergodic and deterministic Capacity for SISO and MIMO channels, Capacity of i.i.d., separately correlated and keyhole Rayleigh fading MIMO channels. Power allocation in MIMO systems: Uniform, adaptive and near optimal power allocation.	10
4.	Space time codes and MIMO detection	Space-Time codes: Advantages, code design criteria, Alamouti space-time codes, SER analysis of Alamouti space-time code over fading channels. MIMO detection: ML, ZF, MMSE based detection.	10
5.	UWB Technology	Definition of UWB, FEC mask, properties and limitation of UWB signal. UWB channel Modelling: IEEE 802.15.3a and IEEE 8032.15.4a standards.	4
		Total number of Lectures	42

Evaluation Criteria

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

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	R. S. Kshetrimayum, Fundamentals of MIMO Wireless Communications, Cambridge University Press, 2017.
2.	S. Emami, UWB Communication Systems: Conventional and 60 GHz, 2013
3.	Chung G. Kang, Jaekwon Kim, Wŏn-yŏng Yang, and Yong Soo Cho, MIMO-OFDM Wireless Communications with MATLAB, John Wiley & Sons, 2010.
4.	Mohinder Jankiraman-Space-Time Codes and MIMO Systems, Springer New York, 2004.
5.	B. Kumbhani and R. S. Kshetrimayum, MIMO Wireless Communications over Generalized Fading Channels, 2017.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12EC414	**Semester:** Even **(specify Odd/Even)**	**Semester: 8th Session:** 2019 -2020 **Month from:** January to June
Course Name	Natural Language processing with Deep Learning		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	B Suresh
	Teacher(s) (Alphabetically)	B Suresh

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C433-5.1	Understanding the problems associated with Natural language processing and recent technological developments.	Understanding Level (C2)
C433-5.2	Applying deep learning approaches to improve the performance NLP tasks.	Applying Level (C3)
C433-5.3	Develop the basic concepts of python programming to NNM models which can deal with NLP.	Applying Level (C3)
C433-5.4	Analyzing performance of various neural networks in the NLP applications.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction and Word Vectors	Word2Vec The Skip-Gram Model Efficient Estimation of Word Representations in Vector Space, Distributed Representations of Words and Phrases and their Compositionality Word Vectors 2 and Word Senses	5
2.	Word2Vec - The Skip-Gram Model	Efficient Estimation of Word Representations in Vector, Space Distributed Representations of Words and Phrases and their Compositionality Word Vectors 2 and Word Senses	10
3.	GloVe: Global Vectors for Word Representation	Improving Distributional Similarity with Lessons Learned from Word Embeddings, Evaluation methods for unsupervised word embeddings, A Latent Variable Model Approach to PMI-based Word Embeddings, Linear Algebraic Structure of Word Senses, with Applications to Polysemy On the Dimensionality of Word Embedding. Word Window Classification, Neural Networks, and Matrix Calculus	11
4.	Backpropagation and Computation Graphs	Learning Representations by Backpropagating Errors Derivatives, Backpropagation, and Vectorization understand backprop Linguistic Structure: Dependency Parsing Incrementality in Deterministic Dependency Parsing A Fast and Accurate Dependency Parser using	9

		Neural Networks Dependency Parsing Globally Normalized Transition-Based Neural Networks	
5.	N-gram Language Models	The Unreasonable Effectiveness of Recurrent Neural Networks Sequence Modeling: Recurrent and Recursive Neural Nets On Chomsky and the Two Cultures of Statistical Learning, Vanishing Gradients and Fancy RNNs	10
Total number of Lectures			**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Term Examination	35
TA	25
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.	Deep Learning in Natural Language Processing 1st ed. 2018 Edition by Li Deng (Editor), Yang Liu (Editor)
2.	Neural Network Methods in Natural Language Processing (Synthesis Lectures on Human Language Technologies) Paperback – April 17, 2017 by Yoav Goldberg (Author), Graeme Hirst (Editor)
3.	Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit 1st Edition, Kindle Edition by Steven Bird (Author), Ewan Klein (Author), Edward Loper (Author)Dec 12, 2018

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B1NHS812	**Semester- Even**	**Semester** 8th **Session** 2019 -2020 **Month from** January 2020 to June 2020
Course Name	**International Finance**		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani
	Teacher(s) (Alphabetically)	Dr. Mukta Mani

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-12.1	Explain the global market scenario, its imperfections and risks which affect the multinational businesses trade.	Understanding level (C2)
C402-12.2	Analyze the international transactions of balance of payments and understand their relationship with key macroeconomic indicators	Analyzing level (C4)
C402-12.3	Apply the concepts of foreign exchange market and currency derivatives for making transactions and risk hedging in foreign exchange market	Applying level (C3)
C402-12.4	Analyze the role of parity conditions and other factors in exchange rate determination.	Analyzing level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Financial Globalization and Risk, Global financial Marketplace, Eurocurrency market and LIBOR, Theory of comparative advantage, Globalization process	4
2.	Balance of Payments	BOP transactions, accounting, Accounts of BOP, Capital and Financial Accounts, BOP and key macroeconomic variables	4
3.	Exchange Rates	Foreign Exchange market, functions, participants, types of transactions: spot, forward and swap transactions, Methods of stating exchange rates, quotations and changes in exchange rates	6
4.	Foreign Exchange rate determination and forecasting	Exchange rate determination theories, Currency market intervention, disequilibrium, forecasting, *Article on Recent Downfall of the Indian Rupee	7
5.	Forward Exchange	Forward foreign exchange, premiums and discounts, forward rates vs future spot rates, payoff profile, swaps, forward quotations	6

6.	Currency Futures and options market	Foreign currency futures, Currency options, Forwards, futures and options compared	6
7.	International Parity Conditions	Purchasing Power Parity and Interest Parity Prices and Exchange rates, Exchange rate pass-through, Forward rate, Prices, Interest rates and exchange rates in equilibrium, **Case study on Japanese Yen Carry Trade	6
8.	Transaction Exposure	Types of foreign exchange exposure, understanding of transaction exposure and its hedging	3
		Total	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class test, Assignment, Class participation)
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.	Eiteman, D K., Stonehill, A.I. and Moffett, M.H. (2018), Multinational Business Finance, 14th Ed., Pearson India Education
2.	Levi, M.D. (2009), International Finance, 4th Ed., Routledge Publication.
3.	Jain, P K., Peyrard, J. and Yadav, S.S. (1999), International Financial Management, Macmillan India
4.	Desai, M.A. (2007), International Finance- A Casebook, Wiley India
5.	Shapiro, Alan C. (2003), Multinational Financial Management, 7th Ed., John Wiley and Sons Inc.
6.	Pal, P and Ray, P. (2018), "Recent Downfall of the Indian Rupee", *Economic and Political Weekly*, Vol. 53 No. 41, October.
7.	Eiteman, D K., Stonehill, A.I. and Moffett, M.H. (2018), "Mrs Watanabe and the Japanese Yen Carry Trade", Multinational Business Finance, 14th Ed., Pearson India Education, pp. 187-190.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS814	**Semester (specify Odd/Even):Even**	**Semester: 8th Session:** 2019 -2020 **Month from: January-June**
Course Name	**Digital Transformation in Financial Services**		
Credits	**3**	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr.Sakshi Varshney
	Teacher(s) (Alphabetically)	Dr.Sakshi Varshney

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-31.1	Outline the changes that influence the financial sector in digital age	Understand (Level 2)
C402-31.2	Evaluate the key differences between traditional business management and technology management and the impact it has on business models	Evaluating (Level 5)
C402-31.3	Analyze the new developments in Financial Technology in banking sector.	Analyzing (Level 4)
C402-31.4	Analyze Consumer Behaviors & digital disruptions in Insurance	Analyzing (Level 4)
C402-31.5	Evaluate the limits, risks and broader policy and social implications of digital technology.	Evaluating (Level 5)
C402-31.6	Organising for Digital Innovation and Apply the knowledge of income tax by digital filing of income tax.	Applying (Level3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Financial services, Digitization, Digitalization, Digital Transformation, digital tools in finance, importance and risks. CASE STUDY OF BNP Paribus	**04**
2.	Digital Payment System	Electronic commerce, Advantages & Disadvantages of e commerce, Categories of e commerce, E payment systems, Electronic wallets, Smart Cards, credit cards, debit cards, Advantages and Disadvantages	**04**
3.	Digitization in Banking	Banking: its types, evolution of e banking ,payment mechanisms, RTGS,NEFT, AEPS, UPI, POS, Digital wallets, Future of e banking,challenges in digital era	**06**
4.	Business Models for Digital Financial Services	Revenue stream Distribution strategy Partnership strategy technology Implementation	**05**
5.	Consumer Behaviors in Digital Economy	Analysis of behavior of financial service user, financial service provider, Principles of behavioral finance,	**05**
6.	Digital Disruptions in Insurance	Digital Changes in Life Insurance, Health & Other Insurance	**06**
7.	Digital Financial Services Risk and	Strategic Risk, Regulatory, Operational Risk, Technology,	**08**

	its Management	Financial , Political Risk, Fraud risk, Agent Management Risk, Reputational Risk, Partnership Risk, Risk Management	
8.	Digital/E-Income Tax Filing	Income tax filing, Issues related and suggestions & Organising for digital Innovation	**04**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Presentation, 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.	Scardovi C., Transformation in Investment Management. In: Digital Transformation in Financial Services. Springer, Cham ,2017
2.	Financial-markets-insurance-pensions-digitalisation-and-finance.pdf
3.	Mobile Financial Services Technology Risks, AFI, 2013 (http://www.afi-global.org/ sites/default/files/pdfimages/AFI_MFSWG_guidelinenote_TechRisks.pdf)
4.	DigitalFinancialServicesandRiskManagementHandbook.pdf
5.	Sujitha K, A(2018) Cost benefit analysis of e-Banking services of SBI in Kerala, University of Calicut.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**20B12EC413**	**Semester (Even)**	**Semester VII** **Session – 2019 - 2020** **Month from Jan to May**
Subject Name	**Basics of Antenna and Wave Propagation**		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Monika
	Teacher(s) (Alphabetically)	Monika, Prof. Shweta Srivastava

Course Objectives:

- To introduce the fundamental principles of different types of antennas and their applications.
- Emphasis will be on dipole antennas, loop antennas, antenna arrays, aperture antennas and microstrip patch antennas, their design considerations for use in wireless communication systems.
- Learn how to characterize antennas and use antenna design for communications, radar, remote sensing systems.
- Emphasis on modern antennas like Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and propagation of radio waves

S. No.	Course Outcomes	Cognitive Levels/ Blooms Taxonomy
C434-4.1	Recall the concepts of Electromagnetic field theory, classify different types of antennas, illustrate antenna parameters and demonstrate the effect on antenna parameters due to changes in the physical dimensions.	Understanding (C2)
C434-4.2	Compare Broadband Antennas, Frequency Independent antennas and Aperture antennas. Explain Dipole antenna and their characteristic, loop antenna	Applying (C3)
C434-4.3	Design Array Antennas and identify the E and H fields for the antennas. Design Reconfigurable antenna, Active antenna, Dielectric antennas and measure radiation pattern, polarization and VSWR.	Creating (C4)
C434-4.4	Define terminology relevant to mode of propagation and examine the propagation of radio waves in different atmospheres.	Analyzing (C4)

Module No.	Subtitle of the Module	Topics	No. of Lectures
1.	Radiation Fundamentals & Antenna Parameters	Antenna types, radiation, use of potential functions, radiated fields, far fields, Radiation from current element, Infinitesimal dipole, antenna parameters, radiation pattern, Directivity, numerical evaluation of directivity, Gain, efficiency, impedance, Loss resistance, Polarization, equivalent area, effective area and its relation to gain	8
2.	Linear Antennas Loop Antennas	Linear antennas, current distribution Total power, radiation resistance, Short-dipole, center-fed dipole, Half-wave dipole, dipole characteristics, folded dipole, Small loop antenna, Loop characteristics	7
3.	Antenna Arrays	Antenna arrays, Broadside and end-fire arrays, Hansen-Woodyard array, binomial arrays, Array theory Scan blindness in array theory ,Aperiodic arrays	7
4.	Broadband Antennas, Frequency Independent antennas & Aperture antennas	Yagi-Uda arrays, helical antennas Log-periodic antenna Fields as sources of radiation; Horn antennas, Reflector antennas	7
5.	Modern antennas-	Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications,Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR	6
6.	Propagation of Radio Waves	Modes of propagation , Structure of atmosphere, Ground wave propagation , Free Space Wave Propagation, Ground Reflection, Surface Waves, Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept, Ionospheric propagation, Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation, Electrical Properties of Ionosphere	8

		Total number of Lectures	43

Evaluation Criteria

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

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	John D. Kraus & RJ Marhefka, Antennas for all applications, The McGraw-Hill Companies, 5th edition, 2017
2.	C.A. Balanis, Antenna Theory, Analysis and Design. NY: John Wiley and Sons, 4th edition, 2016.
3.	WL Stutzman& GA Thiele, Antenna Theory and Design , John Wiley and Sons, 2nd edition,1997
4.	Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2015

Detailed Syllabus
Lecture-wise Breakup

Course Code	20B12EC415	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session** 2019 -2020 **Month from:** Jan to June
Course Name	Network Security		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Prakash Chandra Gupta
	Teacher(s) (Alphabetically)	Prakash Chandra Gupta

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C433-6.1	Understand the security requirements of networked information systems and general principles of cryptography.	Understanding Level (C2)
C433-6.2	Apply above concepts for developing security mechanisms used for network access, message confidentiality, message authentication non-repudiation.	Applying Level (C3)
C433-6.3	Apply the above security mechanisms to understand of standard security protocols used in the IP network.	Applying Level (C3)
C433-6.4	Analyze a) network vulnerabilities to adversarial attacks/intrusions, and b) security solutions for preventing such attacks/intrusions.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Security concepts and terminology	General security concepts, need for security & security mechanisms	1
2.	Symmetric-key & Asymmetric-key Cryptosystems	(a) Classical encryption methods (b) Mathematical foundations I – Modular arithmetic (c) Block ciphers, DES, 3 DES, AES (d) Modes of operation of block ciphers (e) Stream ciphers, RC4 (f) Mathematical foundations II – Finite fields (g) Asymmetric-key cryptography, RSA, ElGamal (h) Elliptic curve cryptography	13
3.	Message Authentication & Digital Signatures	(a) Content integrity verification, hash functions, SHA, Whirlpool (b) Message Authentication Code (MAC), HMAC, CMAC (c) Digital signature, RSA and ElGamal, applications of digital signatures	4
4.	Entity Authentication & Security for Remote Access	(a) Fixed and one-time passwords, authentication based on challenge-response. (b) PPP, PAP, CHAP, EAP protocols, RADIUS & L2TP tunneling	3
5.	Key Distribution	(a) Symmetric-key distribution, Diffie-Hellman key exchange, Key Distribution Centre (KDC), Kerberos (b) Public Key distribution, Digital certificates, X.509,	3

		Certification Authority (CA), Public Key Infrastructure	
6.	Security at the Transport and Network Layers	(a) Security at the Transport layer, TLS protocol (b) Security at the IP layer, VPN, IPsec, AH, ESP protocols	3
7.	Security in Wireless Networks	(a) Architecture of wireless LAN (b) WEP, RSN protocols	3
8.	Network Vulnerabilities & Malware	(a) IP attacks, TCP attacks, DOD & DDOS attacks (b) Firewalls – packet filtering, stateful inspection, proxy, circuit level (c) Intrusion Detection Systems (IDS) (d) Malware	7
9.	Security at the Application Layer	(a) Email security, SMIME, PGP (b) Secure Electronic Transaction (SET)	3
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	Gupta, Prakash C., *Cryptography and Network Security*, PHI, 2014
2.	Stallings W., *Cryptography & Network Security,* 6th Ed., Pearson, 2014
3.	Forouzan, BA., *Cryptography & Network Security,* 3rd Ed., McGraw-Hill, 2015

Lecture-wise Breakup

Course Code	**20B12MA411**	**Semester** Even	**Semester** VIII **Session** 2018 -2019 **Month from** Jan 2019 to June 2019
Course Name	**Multi Attribute Decision Making**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh C. S. Bisht	
	Teacher(s) (Alphabetically)	Dr. Dinesh C. S. Bisht	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
CO-1	explain basic steps in decision analysis and decision making environments.	Understanding Level (C2)
CO-2	apply group decision making methods to reach a collective decision.	Applying Level (C3)
CO-3	develop the concept of multi criteria decision making process and attributes.	Understanding Level (C2)
CO-4	apply elementary methods to solve multi attribute decision making problems.	Applying Level (C3)
CO-5	analyze value based and outranking methods to solve multi attribute decision making problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Decision Analysis	Basic Steps in Decision Analysis, Decision-Making Environments, Decision Making Under Uncertainty, Decision Making Under Risk, Utility Theory, Decision Tree.	8
2.	Group Decision Making	GDM Methods, Content-Oriented Methods, and Disadvantages of Non ranked Voting, Preferential Voting System, and Social Choice Functions.	7
3.	Multicriteria Decision Making	Multiattribute Decision Making, Multi Objective Decision Making, Decision Making Process, Structuring Process, Decision Matrix, Attributes, Normalization, Attribute Weight Assignment Methods.	8
4.	Elementary Methods for MADM	Dominance Relation method, Even-Swap method, Lexicographic method Maximax method, Maximin method, Conjunctive method, Disjunctive method,	8

		Median Ranking, Analytic Hierarchy Process, Analytic Network Process.	
5	Value Based and Outranking Methods	Multi Attribute Value Theory, Simple Additive Weighting, Weighted Product, TOPSIS Outranking Methods.	11
Total number of Lectures			**42**

Evaluation Criteria

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

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

1.	Ishizaka, Alessio, and Philippe Nemery. *Multi-criteria decision analysis: methods and software*. John Wiley & Sons, 2013.
2.	Xu, Zeshui. *Uncertain multi-attribute decision making: Methods and applications*. Springer, 2015.
3.	Tzeng, Gwo-Hshiung, and Jih-Jeng Huang. "Multi Attribute Decision Making: Methods and Applications." *USA, CRC Press.* 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12EC415	**Semester Odd (specify Odd/Even)**	**Semester** VIII **Session** 2019-20 **Month from** Jan **to** June
Course Name	**Digital Integrated Circuits in Deep Submicron Technology**		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. Shruti Kalra
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434.1	Recall the important concepts of logic gates, static input-output characteristics, noise margins and propagation delay	Remembering Level (C1)
C434.2	Illustrate the key issues in deep submicron technology node.	Understanding Level (C2)
C434.3	Identify and solve static and dynamic design issues for high speed combinational and sequential circuits.	Applying Level (C3)
C434.4	Analysis and design of VLSI memories	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to deep submicron digital IC Design	Review of digital logic gate design and digital integrated circuit design, MOS transistor operation in deep submicron technology.	6
2.	MOS inverter circuits	Analytical modeling of CMOS inverter in submicron technology node, Pseudo NMOS inverters, sizing inverters.	9
3.	Static MOS gate circuits	Analytical modeling of CMOS gate circuits, complex CMOS gates, Multiplexer circuits, D Flip flop and latches	9
4.	High speed CMOS logic design	Load capacitance calculations, improved delay calculations with input slope, gate sizing for optimal path delay, optimizing paths with logical effort.	7
5.	Transfer gate and dynamic logic design	Pass Transistor, capacitive feedthrough, charge sharing, sources of charge loss, TG logic, Dynamic D-Latch	6
6.	Introduction to semiconductor memory design.	MOS Decoders, Static RAM cell design, SRAM column I/o circuitry.	5
		Total number of Lectures	**42**

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

Recommended Reading material: (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Veendrick, Harry. *Deep-submicron CMOS ICs: from basics to ASICs*. Springer Publishing Company, Incorporated, 2015.
2.	Hodges, David A. *Analysis And Design Of Digital Integrated Circuits, In Deep Submicron Technology (special Indian Edition)*. Tata McGraw-Hill Education, 2005.

Detailed Syllabus
Lecture-wise Breakup

Course Code	20B12EC412	**Semester** EVEN	**Semester VIII, Session** 2019 -2020 **Month from** Jan-June
Course Name	Advanced Microcontrollers and RTOS		
Credits	4	**Contact Hours**	3L+1T

Faculty (Names)	**Coordinator(s)**	Mr. Ritesh Kumar Sharma
	Teacher(s) (Alphabetically)	Mr. Ritesh Kumar Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-2.1	**Understanding fundamentals of ARM7 processor and detailed study of architecture and peripherals of the ARM7 based LPC2148 microcontroller.**	Level (C3)
C434-2.2	**Understanding and study of the complete architecture of the ARM-CORTEX M3/M4 processor and STM32F407 (ARM-CORTEX based microcontroller).**	Level (C2)
C434-2.3	**Experiment and configure different peripherals of STM32 Microcontrollers and Interfacing Sensor and Actuators with the microcontroller**	Level (C4)
C434-2.4	**Understand fundamentals of RTOS and its implementation**	Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	ARM7TDMI Architecture & On Chip Peripherals (LPC2148)	Review of ARM architecture, System Peripherals, Memory Accelerated Module (MAM), Phase Locked Loop (PLL), APB (ARM Peripheral Bus) Divider, Wake up Timer, Pin Connect Block, Interrupt System, Vectored Interrupt Controller (VIC), User Peripherals, General Purpose Input/ Output (GPIO), Timer/Counter, Pulse Width Modulation (PWM), Real Time Clock (RTC), Watch Dog Timer (WDT), ADC & DAC,	10

2.	ARM CORTEX Processor (M3/M4) and Controller (STM32F407)	Features of ARM Cortex Processor, Programmer's Model Operating Modes, Core-Registers, Memory Map, BUS Protocol, Bit Banding, Bus Matrix, Stack and Subroutine, System Exception and Interrupts, System Timers, PIN description, External Oscillators, Clock control and Internal Oscillators.	12
3.	On chip peripherals of STM32F407	Introduction to Different Clock Sources, (PLL), Configuring SYSCLK, HIS Calibration, Phase Locked Loop ,Timers, Capture and Compare mode of Timers, Timer using Interrupts, PWM (Pulse Width modulation), DMA (Direct Memory Access, On Chip Communication Interface, Universal Asynchronous Receiver Transmitter (UART), Inter Integrated Communication (I2C), Serial Peripheral Interface (SPI). Interfacing with sensors and actuators	12
4.	Free RTOS	Understanding RTOS concepts, Task Creation, Deleting of task and scheduling with some examples, synchronization between tasks, Free RTOS Stack Management, Heap memory management, Basics of Queue management	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments and Quiz)
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.	Muhhamad Ali Mazidi, STM32 Arm Programming for Embedded Systems, Pearson, 2018
2.	Richard, Mastering the FreeRTOS™ Real Time Kernel A Hands-On Tutorial Guide, 2016