Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC412	**Semester** Even **(specify Odd/Even)**	**Semester 8th** **Session** 2023 -2024 **Month from** January to June
Course Name	Multimedia Communications		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Richa Gupta
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES Upon completion of the course, the students will be able to		**COGNITIVE LEVELS**
C430-7.1	Recall basic concepts of probability theory and information theory.	Remembering Level (C1)
C430-7.2	Understand the basics of data compression used in the development of various construction algorithms of source coding. Also, learn theoretical and practical requirements for implementation and designing of Error Resilient Codes.	Understanding Level (C2)
C430-7.3	Apply various types of lossless codes to improve efficiency of information. Also, learn the concepts of transform coding and digital image processing on digital images.	Applying Level (C3)
C430-7.4	Analyse the need of Image compression, Audio compression, Video compression and distinguish between different image CODECs.	Analysing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Information Theory	Introduction, Information Measure, Discrete entropy. Joint and conditional entropies.	3
2.	Data Compression	Uniquely Decipherable Codes and Instantaneous Codes. Kraft - McMillan inequality. Noiseless coding Theorem. Data Compression: Lossless Compression and Lossy Compression. Optimal codes. Construction algorithms of source codes – Huffman Codes, Shannon - Fano codes, Arithmetic Codes, Lempel Ziv Welch Code and Run Length Coding.	8
3.	Error Resilient Codes	Reversible Variable Length Codes: Introduction, Types of RVLCs, Construction Algorithms of Symmetrical and Asymmetrical RVLCs. Applications of RVLCs in Multimedia Communications.	8

4.	Multimedia Information Representation and Transform Coding	Introduction, Digital Principles, Representations of text, image, audio and video data. Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	3
5.	Digital Image Processing	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components. Image Enhancement, Image segmentation, Image Restoration and Morphological Image Processing.	12
6.	Image Compression	Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression.	3
7.	Video Compression	Basic principle of video processing, I, P and B pictures in video content, Structure of video frame, Macroblock, Motion Estimation and Compensation, Compression on the block level, Video Coding Standards.	4
8.	Audio Compression	Basics of Audio Signal Processing, Principle of Psychoacoustic and its applications, Audio Compression and Standards for Audio codec.	4
		Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Research Assignment, Assignment, Quiz, Class Tests)
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.	M. Bosi and R. Goldberg, Introduction to Digital Audio Coding and Standards. Kluwer Academic, Boston, 2003.
2.	R. C. Gonzalez and R. E. Woods, Digital Image Processing Using MATLAB, Prentice Hall, 2009.
3.	K. Sayood, Introduction to data compression, Elsevier, 4th edition.
4.	A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12EC415	**Semester Odd (specify Odd/Even)**	**Semester** VIII **Session** 2023-24 **Month from** Jan **to** June
Course Name	**Digital Integrated Circuits in Deep Submicron Technology**		
Credits	3	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434.1	Recall the fundamental concepts of logic gates, including static input-output characteristics, noise margins, and propagation delay.	Remembering Level (C1)
C434.2	Illustrate the complexities inherent in deep submicron technology nodes, demonstrating understanding of their challenges and implications.	Understanding Level (C2)
C434.3	Apply problem-solving skills to identify and address static and dynamic design challenges in high-speed combinational and sequential circuits.	Applying Level (C3)
C434.4	Analyze the architecture and design principles of VLSI memories to develop a comprehensive understanding of their functionality and performance characteristics	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**

Project Based Learning: **The course will teach the technical skill to accomplish as well as enhance project planning. Students will be doing projects (in groups of 2-3) with given specifications, which will result in a designing of digital integrated circuits for deep submicron technology implemented through HSPICE.**

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	21B12EC413	**Semester** Even **(specify Odd/Even)**	**Semester** 8th **Session** 2023-24 **Month** from January-May
Course Name	Solar Engineering		
Credits	3	**Contact Hours**	3L

Faculty (Names)	**Coordinator(s)**	Nisha

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-37.1	Recall the basic concepts of Solar Energy and Global Energy Needs for Solar Engineering	Remembering Level (C1)
C402-37.2	Interpret the Physics of the Sun and Its Energy Transport.	Understanding Level (C2)
C402-37.3	Implement solar thermal and electrical system for performance estimation	Applying Level(C3)
C402-37.4	Differentiate Solar Water-Heating Systems for Commercial/Industrial Applications	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Solar Energy Conversion	Introduction , Environmental Characteristics, Heat transfer concept, Heat Transfer coefficient, Optimization of Heat Losses, Thermal analysis and effect of environment with economic analysis	5
2	Fundamentals of Solar Radiation	The Physics of the Sun and Its Energy Transport, Thermal Radiation Fundamentals, Sun–Earth Geometric Relationship, Extraterrestrial Solar Radiation, Estimation of Terrestrial Solar Radiation, Models Based on Long-Term Measured Horizontal Solar Radiation and Measurement of Solar Radiation	8
3.	Solar Engineering-I: Electrical Aspect	Solar Cell materials, Single crystal solar cell or solar grade, Types of Solar Energy Collectors, Performance of Solar Collectors, Photovoltaic Systems, Design and Modeling of Solar Systems, Solar Energy Analysis	10
4.	Solar Engineering-II: Thermal Aspect	Solar Thermal Power Systems, PVT air/water collectors performance, design and modeling, Thermodynamic Power Cycles, Design of Parabolic Trough–Based Power Plants, Parabolic Dish Systems, Central Receiver Tower Systems	10
5.	Solar Heating Systems and other applications	Solar Water-Heating Systems, Solar Space Heating and Cooling, Industrial Process Heat, Solar Dryers, Solar Desalination Systems, Solar Cooling and Dehumidification and applications of Solar Energy in Electronics and communication engineering Commercial/Industrial Applications	10
		Total number of Lectures	43

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance & Quiz)
Total	**100**

Project based learning: Students will review and prepare report on any one of the discussed application of solar energy. They can implement solar thermal and electrical system for performance estimation.

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.	G.N. Tiwari, Solar Energy : fundamentals, Design, Modelling and applications. Narosa Publishing House, 2016.
2.	Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and applications. Prentice Hall of India, 2015
3.	James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 2012.
4	Juan Bisquert, The Physics of Solar Cell, CRC Press, Taylor & Francis group, 2018

Detailed Syllabus

Lecture-wise Breakup

Subject Code	19B12EC412	**Semester Even**	**Semester:8th, Session:2023-24 Month: Jan to June**
Subject Name	Advance Topics in Wireless Communications		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Bajrang Bansal	
	Teacher(s) (Alphabetically)	Dr. Bajrang Bansal	

Course Objectives: This course gives an insight into wireless MIMO systems and the calculation of their capacity in the presence of fading.

S. No.	Course Outcomes	Cognitive Levels/ Blooms Taxonomy
C433-3.1	Recall the basic concepts of different wireless generations, random variables, multiple-input multiple-output (MIMO) systems, and different diversity schemes.	Remembering Level (C1)
C433-3.2	Explain fading in wireless medium and basics of ultra-wideband (UWB) communication.	Understanding Level (C2)
C433-3.3	Solve different expressions of channel capacity and power allocation for MIMO systems.	Applying Level (C3)
C433-3.4	Examine the performance of space-time codes and different MIMO detection techniques.	Analyzing Level (C4)

Module No.	The subtitle of the Module	Topics	No. of Lectures
1.	Introduction to MIMO systems	Evolution of wireless generation technologies and their transition challenges. Need and expectation of next generation of wireless technology. Basic concepts of random variables. Introduction of Wireless communication systems, diversity-multiplexing, trade-off, and transmit diversity schemes. Concept of SISO, SIMO, MISO, and MIMO systems.	8
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**

Project-based learning: Students will learn about the multiple input multiple output (MIMO) wireless communications systems to improve the system performance. Further, they will study various fading distributions to analyze the effect of the channel over the signal. Additionally, students will study and design the space-time codes and MIMO detectors to mitigate fading in channels.

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	**24B12EC411**	**Semester-** **(specify Odd/Even)**	**Semester -8th / Session 2023-24** **Month from** Jan-Jun
Course Name	Fundamentals of Electric Vehicle		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Ruby Beniwal
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-5.1	Recall the fundamental concepts of Electric Vehicle (EV) technology, including energy efficiency, power electronics, storage units and various types of EVs available in the market.	Remembering Level (C1)
C434-5.2	Illustrate the Electric Vehicle architecture and electrification, Internal Combustion Engine vs. Electric Vehicle drive trains and batteries and Battery Management Systems in Electric Vehicle operation.	Understanding Level (C2)
C434-5.3	Implement Electric Vehicles by subsystems and apply power train models using Simulink software and turn a gasoline-powered 2-wheeler into an electric vehicle as a hardware/software project.	Applying Level (C3)
C434-5.4	Arrange electric Vehicle components, State of Charge (SoC) curves and relate electric Vehicle charging challenges and trends.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Fundamentals of Electrical & Power Electronics**	Basics of EV electrical: Electric Vehicles, Overview of Electiric Vehicles in India, Gravitational Energy Density, Volumetric Energy Density, Energy Efficiency, Essentials of power electronics and storage units, EV Variations in the market, Electric Vehicles and Sustainability	6
2.	**Essentials of Electric Vehicle**	EV Fundamentals: Intro To EV Technology, Automotive Sector In India, EV In India And Globe, EV Mobility In India, Future Of Mobility In India, EV Evolution, EV Vs Gasoline, EV Architecture & Electrification, EV Market, Electric Ecosystem, Types of EVs, EV Subsystems, ICE Drive train, EV Drive train, On-board charger, External charger, Battery & Battery Management System (BMS): EV Fundamentals Battery and BATTERY MANAGEMENT SYSTEM	10
3.	**Mathematical Modeling of an Electric Vehicle**	**Motor and EV Components** Design rules and motor technology: BLDC (Brushless DC) motor, Induction motor and synchronous motor EV components: Electronics for EV, power train suspension system, EV motor controller, inverters and converters related to EV Architecture of the battery electric vehicle, Electric equivalent circuit diagram of a battery cell and Sizing procedure of the battery electric vehicle	12

4.	**Charging infrastructure**	EV components for charging , EV sales & challenges in charging in India, EV charging essentials, EV charging types, Battery swapping, Power rating, EV charging standards, EV chargers, AC charging calculations, State of Charge, Voltage vs SoC curves, Implication of SoC curves	8
5.	**Electric Vehicle Calculations and creation**	Electrical vehicle calculations with case studies, Electric Vehicle Powertrain modelling using Simulink (software Project) Convert the petrol 2-wheeler into an electric vehicle (Hardware Project).	6
		Total number of Lectures	**42**

Project Based Learning: Students will be asked to do the analysis and designing of the electric vehicle technology. Students can model and simulate the electric vehicle power train using MATLAB. Student can design and convert any petrol 2-wheeler into an electric vehicle.

Evaluation Criteria

Components	**MaximumMarks**
T1	20
T2	20
End SemesterExamination	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.	Bimbhra, P.S., *Power Electronics*, Khanna Publishers, **2021**.
2.	Rashid, M. H., *Power Electronics: circuits, devices & applications*,Pearson Education, **2014.**
3.	Schaltz, E., *Electrical Vehicle Design and Modeling*. InTech. doi: 10.5772/20271, **2011**
4.	Otto|Tanaka Bischof (Ted) and Ted Tanaka, *Electric Vehicles: The Automobiles of the Future,* ISBN 1733475524, **2021**
5.	Nick Enge, Per K. Enge, and Stephen Zoepf, *Electric Vehicle Engineering,* **ISBN:** 9781260464078, McGraw Hill, **2021**

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC411	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2023 -2024 **Month from** January to June
Course Name	Introduction to IOT		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Verma (62)
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-4.1	**Outline the basic concepts of IOT with networking and protocol considerations in IOT scenario.**	Understand (C2)
C433-4.2	**Experiment with the concepts of python programming and make use of them in image processing, data analytics and machine learning applications.**	Apply (C3)
C433-4.3	**Analyze various case studies and cloud platforms in an IOT scenario for monitoring and control.**	Analyze (C4)
C433-4.4	**Develop IOT based systems utilizing hardware and software platforms with various sensors and actuators.**	Create (C6)

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), Application layer IoT network technologies (HTTP, HTTPS, MQTT, AMQP), IoT networking considerations and challenges, IoT Platforms Capabilities.	6
3.	IoT supported Hardware platforms	Introduction to Arduino (Different Arduino boards, Arduino Uno board description and its pin configuration, Arduino IDE and program uploading, different functions related to GPIOs	12

	(Arduino) & data visualization using cloud.	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.	
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**

Project Based Learning Component: This course teaches IoT using a building block approach, which allows one to visualize the requirement of an IoT framework and then to design it efficiently. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. The course will teach IoT based system design using IoT boards, namely Arduino, ESP8266, and Raspberry Pi. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will also teach effective embedded programming techniques in python with application to image processing and Machine Learning. It will have a significant practical component, which will be achieved by providing real time demonstrations of various case studies based on IoT.

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), 2017
2.	"Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press), 2016

Detailed Syllabus

Course Code	19B12EC414	**Semester : Even (specify Odd/Even)**	**Semester: 8th Session** 2023 -2024 **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		**COGNITIVE LEVELS**
C433-5.1	Outline the problems associated with natural language processing and recent technological developments.	Understanding Level (C2)
C433-5.2	Utilize deep learning approaches to improve the performance of natural language processing tasks.	Applying Level (C3)
C433-5.3	Explore the basic concepts of python programming to implement neural network models for natural language processing tasks.	Analyzing Level (C4)
C433-5.4	Examine and assess the performance of various neural networks in natural language processing applications.	Evaluate Level (C5)

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	11

		Classification, Neural Networks, and Matrix Calculus	
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 Neural Networks Dependency Parsing Globally Normalized Transition-Based Neural Networks	9
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 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.	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

Course Code	20B12EC415	**Semester:** Even **(specify Odd/Even)**		**Semester: 8** **Session:** 2023 - 2024 **Month from** January to June	
Course Name	Network Security				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Khanna			
	Teacher(s) (Alphabetically)	Dr. Gaurav Khanna, Mr. P C Gupta			

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-4.1	Recall the basics of modular arithmetic, GCD and prime numbers along with introduction to different types of attacks, data privacy and integrity needs.	Remembering Level (C1)
C434-4.2	Discuss the security requirements of networked information systems and general principles of cryptography.	Understanding Level (C2)
C434-4.3	Examine the general principles of security and cryptography for illustrating – security mechanisms used for network access, standard security protocols used in the IP network, message confidentiality, authentication and non-repudiation.	Applying Level (C3)
C434-4.4	Classify the network vulnerabilities to adversarial attacks/intrusions, and 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.	2
2.	Symmetric-key & Asymmetric-key Cryptosystems	Classical encryption methods, Mathematical foundations I – Modular arithmetic, Block ciphers (DES, 3 DES, AES), Modes of operation of block ciphers, Stream ciphers, RC4, Mathematical foundations II – Finite fields, Asymmetric-key cryptography, RSA, ElGamal, Elliptic curve cryptography	14
3.	Message Authentication & Digital Signatures	Content integrity verification, hash functions, SHA, Message Authentication Code (MAC), HMAC, CMAC, Digital signature, RSA and ElGamal, applications of digital signatures.	3
4.	Key Distribution	Symmetric-key distribution, Diffie-Hellman key exchange, Key Distribution Centre (KDC) , Public Key distribution, Digital certificates, X.509, Certification Authority (CA), Public Key Infrastructure.	2
5.	Entity Authentication & Security for Remote Access	Fixed and one-time passwords, authentication based on challenge-response, Kerberos, PPP, PAP, CHAP, EAP protocols, RADIUS.	3
6.	Security at the Transport and Network Layers	Security at the IP layer, VPN, IPsec, AH, ESP protocols, Security at the Transport layer, TLS protocol.	6

7.	Security in Wireless Networks	Architecture of wireless LAN, WEP, RSN protocols.	2
8.	Network Vulnerabilities & Malware	IP attacks, TCP attacks, DOD & DDOS attacks, Firewalls – packet filtering, stateful inspection, proxy, circuit level, Intrusion Detection Systems (IDS), Malware.	7
9.	Security at the Application Layer	Secure Electronic Transaction (SET), Email security, SMIME, PGP.	3
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning: Part of final grade of this course is assigned to research project(s). Students will read different papers and write short summaries of each paper. Students will undertake a significant research project. At the end of the term, students will present projects (along with computer simulation) in class and prepare a written project report. Grading will be based on a weighted combination of class participation, paper summaries, the final project presentation, the project report and final exam.

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*, 8th Ed., Pearson, 2020
3.	Forouzan, BA., *Cryptography & Network Security*, 3rd Ed., McGraw-Hill, 2015

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC417	**Semester** Even **(specify Odd/Even)**	**Semester** 8th **Session** 2023 -2024 **Month from** Jan to June
Course Name	Satellite Communication		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Abhishek Kashyap, Dr. Jasmine Saini
	Teacher(s) (Alphabetically)	Dr. Abhishek Kashyap, Dr. Jasmine Saini

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	Illustrate the equations of the orbit, explain the satellite launching and launch vehicles and outline terminology of earth-orbiting Satellites.	Understanding Level (C2)
C433-4.3	Make use of the space segment, antenna subsystem, estimate different parameters and design uplink and downlink.	Applying Level (C3)
C433-4.4	Analyze 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.	Analyzing Level (C4)

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.	8
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	7

		Multiple Access (CDMA)	
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	**42**

Evaluation Criteria

Components	**Maximum Marks**
T-1	20
T-2	20
T-3 (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.	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	21B12EC413	**Semester** Even **(specify Odd/Even)**	**Semester** 8th **Session** 2023-24 **Month** from January-June
Course Name	Solar Engineering		
Credits	3	**Contact Hours**	3L

Faculty (Names)	**Coordinator(s)**	Nisha

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-37.1	Recall the basic concepts of Solar Energy and Global Energy Needs for Solar Engineering	Remembering Level (C1)
C402-37.2	Interpret the Physics of the Sun and Its Energy Transport.	Understanding Level (C2)
C402-37.3	Implement solar thermal and electrical system for performance estimation	Applying Level(C3)
C402-37.4	Differentiate Solar Water-Heating Systems for Commercial/Industrial Applications	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Solar Energy Conversion	Introduction , Environmental Characteristics, Heat transfer concept, Heat Transfer coefficient, Optimization of Heat Losses, Thermal analysis and effect of environment with economic analysis	5
2	Fundamentals of Solar Radiation	The Physics of the Sun and Its Energy Transport, Thermal Radiation Fundamentals, Sun–Earth Geometric Relationship, Extraterrestrial Solar Radiation, Estimation of Terrestrial Solar Radiation, Models Based on Long-Term Measured Horizontal Solar Radiation and Measurement of Solar Radiation	8
3.	Solar Engineering-I: Electrical Aspect	Solar Cell materials, Single crystal solar cell or solar grade, Types of Solar Energy Collectors, Performance of Solar Collectors, Photovoltaic Systems, Design and Modeling of Solar Systems, Solar Energy Analysis	10
4.	Solar Engineering-II: Thermal Aspect	Solar Thermal Power Systems, PVT air/water collectors performance, design and modeling, Thermodynamic Power Cycles, Design of Parabolic Trough–Based Power Plants, Parabolic Dish Systems, Central Receiver Tower Systems	10
5.	Solar Heating Systems and other applications	Solar Water-Heating Systems, Solar Space Heating and Cooling, Industrial Process Heat, Solar Dryers, Solar Desalination Systems, Solar Cooling and Dehumidification and applications of Solar Energy in Electronics and communication engineering Commercial/Industrial Applications	10
		Total number of Lectures	43

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance & Quiz)
Total	**100**

Project based learning: Students will review and prepare report on any one of the discussed application of solar energy. They can implement solar thermal and electrical system for performance estimation.

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.	G.N. Tiwari, Solar Energy : fundamentals, Design, Modelling and applications. Narosa Publishing House, 2016.
2.	Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and applications. Prentice Hall of India, 2015
3.	James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 2012.
4	Juan Bisquert, The Physics of Solar Cell, CRC Press, Taylor & Francis group, 2018

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**16BINEC831**	**Semester: Even (specify Odd/Even)**	**Semester 8th** Even **Session** 2023-24 **Month** from Jan. to June
Subject Name	**Sonar system and acoustic imaging**		
Credits	3	**Contact Hours**	3-0-0

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

S. NO.	**DESCRIPTION**	**COGNITIVE LEVEL (BLOOMS TAXONOMY)**
C434-5.1	Demonstrate programming platform usage for sonar signal processing. Explain sonar terminology and the fundamental aspects of array design for acoustic localization.	Understanding Level (C2)
C434-5.2	Select parameters for side-scan sonar and synthetic aperture sonar based on the specified design resolution requiremets.	Applying (C3)
C434-5.3	Analyze the continuous time frequency modulation technique for sonar applications.	Analyzing (C4)
C434-5.4	Determine signal processing techniques for ship speed measurement system.	Evaluating Level (C5)

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**	Estimation of moving target speed in water,	6

	for Ship speed measurement	GPS, DGPS, SQUID, Doppler log, JANUS, Issues in Doppler log methods, correlation-log,	
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 Semester Examination	35
TA	25
Total	**100**

Practical implementation of theory based learning: On each topic covered in the course an experiment is designed and assigned to the students, so that the concept/algorithm covered can be written in the code form in MATLAB software.

Project based learning: Group of 3 students are formed to solve simulation based coding problems. This helps in deeper understating of the theory and motivate students to think on real world applications and problems. Practical knowledge acquired by the students during this course will boost their confidence and clarity on various topics and this ultimately help them in placement interviews and further motivate them to be an entrepreneur. After schemes like "Atmanirbhar Bharat" many project in the area of sonar will provide many entrepreneurial opportunities to the students specialized in the sonar system.

List of Simulation Experiments in Sonar system and acoustic imaging course

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

Course Code	15B19EC891	**Semester:** Even **(specify Odd/Even)**	**Semester:** 8th **Session** 2023 -2024 **Month from:** January to June
Course Name	Project Part-2		
Credits	12	**Contact Hours**	----

Faculty (Names)	**Coordinator(s)**	Megha Agarwal, Vishal Narain
	Teacher(s) (Alphabetically)	Abhishek Kashyap, Jyosmita Chatterjee, Megha Agarwal, Rahul Kaushik, Vishal Narain

COURSE OUTCOMES- At the completion of the course, students will be able to,		**COGNITIVE LEVELS**
C451.1	Understand the scholarly literature, identify the gaps and define project objectives in the area of Electronics and Communication Engineering.	**Understanding** (C2)
C451.2	Apply the available resources to obtain the solution of project objectives within stipulated time and following ethical and professional norms.	**Applying** (C3)
C451.3	Evaluate the outcomes of the project and find the applications based on analysis.	**Evaluating** (C5)
C451.4	Develop the skills to communicate technical and scientific findings effectively in verbal and written forms.	**Creating** (C6)

Evaluation Criteria

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

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

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

Detailed syllabus
Lecture-wise Breakup

Subject Code	**21B12HS411**	**Semester: EVEN**	**Semester 8th Session 2023-24** **Month from Jan to June**
Subject Name	**URBAN SOCIOLOGY**		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**	**Dr Yogita Naruka**	
	Teacher(s) (Alphabetically)	**Dr Yogita Naruka**	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401 - 25.1	Understand the concepts and theories of urban sociology	Understanding Level (C2)
C401 – 25.2	Apply and analytical framework to understand the structural characteristics of cities students are residing in	Applying Level (C3)
C401 – 25.3	Analyze the role of agencies and actors in shaping the process of urbanization	Analyse Level (C4)
C401 – 25.4	Evaluate importance of good governance and urban planning	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Urban Sociology	Basic Concepts and terminologies of the urban sociology, Origin of urban societies, Rural-Urban Continuum	**2**
2.	Theories of Urban Sociology	The classical theories – Simmel, Weber, Tonnies, Louis Wirth, Durkheim & Engels; Ecological Theories – Chicago School, Concentric Zone theory, Sector theory, Multiple Nuclei theory	**5**
3.	Contemporary Urban Processes	Industrialisation, Colonialism, Class-Conflict theories (Marxism), Neo-liberalism	**5**
4.	Urbanisation in India	Development of urban sociology in India, Evolution of urban structures, Spatial Structures and Classification of cities	**4**
5.	Urban Planning	Concept of urban planning – History, need and relevance, Principles of Urban planning, Urban planning in India – Agencies and Stakeholders, Strategies and techniques of urban planning – Social area analysis, mapping and zoning, role of cooperatives	**7**

6.	Urban Governance	Urban governance – Concept and need, Urban Governance in India, Urban decentralization – agencies and role of local bodies	**4**
7.	Urban Issues in India	Urban Poverty, Informality & Exclusion, Urban Environment Lessons from Pandemic	**4**
8.	Technology and urbanisation	Smart cities, Case studies of smart cities and use of digital technologies in urban	**5**
9.	Sustainable urban Development	Sustainable urban development – concept, need, tenets and strategies Sustainable development goals (SDGs) in relation to urban	**4**
10.	Global perspectives on urban	Neo-liberalism and urban, Globalization and urban, Emergence of megacities	**5**
Total number of Hours			**45**

Evaluation Criteria

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

Project Based Learning: The students would be divided into a group of 4-5. They would be asked to map and discuss the different parts of their cities. The lectures and readings on the process of urbanization and models of urbanization will form the basis for this exercise. Students would be required to critically analyse the urban spaces using sociological perspectives and theories. The students would be needed to make a presentation and also submit a report.

Recommended Reading material:

1. Gottdiener, M., Budd, L., &Lehtovuori, P. *Key concepts in urban studies*. Sage. (2015)
2. Lin Jan and Mele Christopher, ed. *The Urban Sociology Reader*. London: Routledge. (2005)
3. Rao, M. S. A., ed. *Urban Sociology in India: Reader and Source Book*. New Delhi: Orient Longman. (1974)
4. Savage, M., and Warde, A. *Urban sociology, capitalism and modernity*. Macmillan International Higher Education. (1993)
5. Sivaramakrishnan, K.C., Kundu, Amitabh & Singh, B.N. *Handbook of Urbanization in India*. Oxford University Press (2007)
6. Wirth, Louis. *Urbanism as a Way of Life*. American Journal of Sociology. (1938)
7. Sharma, A.K. and Misra, B.D. *Urbanization in India: Issues &Challenges.*New Delhi: Ane Books Pvt. Ltd.(2018)

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS831**	**Semester: EVEN (specify Odd/Even)**	**Semester: VIII Session** 2023 -2024 **Month: JAN 2024 –JUNE 2024**
Course Name	Gender Studies		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Prof Alka Sharma
	Teacher(s) (Alphabetically)	Prof Alka Sharma Shikha Kumari

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-19.1	Demonstrate knowledge of the construct of gender and the way itintersects with other social and cultural identities ofrace, class, ethnicity andsexuality	Understand(C2)
C401 - 19.2	Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity andmasculinity	Apply (C3)
C401- 19.3	Analyze the ways in which societal institutions and power structures such as the family, workplace impact the material and social reality of women‟s lives	Analyze (C4)
C401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporarysettings	Evaluate (C5)
C401- 19.5	Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introducing Gender Issues**	• Sex andGender • Types ofGender • Gender Roles • Gender Division ofLabor • Gender Stereotyping and GenderDiscrimination	9
2.	**Gender Perspectives of Body & Language**	• Biological, Phenomenological and Socio-Cultural Perspectives ofbody • Body as a Site and Articulation of PowerRelations • Cultural Meaning of Female Body andWomen‟s Lived Experiences • The Other andObjectification	6
3.	**Social Construction of Femininity &Feminism**	• Bio-Social Perspective ofGender • Gender as AttributionalFact • Feminine &Feminist • Major Theorists of Feminism Challenging Cultural Notions of Femininity • Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyberfeminism • Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism&	9

		Celebrating Womanhood • Analysis of role women have played acrosscultures	
4.	**Social Construction of Masculinity**	• Definition and Understanding ofMasculinities • Sociology of Masculinity& itsTypes • Social Organization of Masculinity and Privileged Position ofMasculinity • Politics of Masculinity andPower • Major Theorists ofMasculinity • Masculine Identities in Literature, Cinema & Media.	9
5.	**Gender Sensitization Empowerment &Gender Inclusivity**	• Women & Women Rights InIndia • From Women's Studies to Gender Studies:A ParadigmShift • Gender Sensitization & Gender Inclusivity • Gender Studies & Media: Creating NewParadigms in Gender &Culture	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	**MaximumMarks**
T1	20
T2	20
EndSemesterExamination	35
TA	25 (Project/ Assignment)
Total	**100**

Students will be given a project on the construction of gender and how does the major institution of the society have shaped their gender.

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	Davis K., et al, "*Handbook of Gender and Women's Studies*. London: Sage. (2006)
2	Helgeson, Vicki S., "*The Psychology of Gender"*, Pearson(2012)
3	Friedan B., "*The Feminine Mystique"*, Penguin. (1971/1992)
4	DebeauvoirS. , "*The Second Sex"*, Vintage (1953/1997)
5	Wharton Amy S., "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell (2005)
6	Pachauri G.," *Gender, School & Society*", R.Lall Publishers(2013)
7	Connell R.W, "*Masculinities*", Cambridge: Polity. (1985)
8	MacInnes J., "The *End of Masculinity"*. Buckingham: Open University Press. (1998)
9	Kaul A.& Singh M., *"New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012)

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NHS732**	**Semester: Even**	**Semester:8th Session: 2023 -2024 Month: January to June**
Subject Name	**INDIAN FINANCIAL SYSTEM**		
Credits	**3**	**Contact Hours**	**3 (3-0-0)**

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

NBA Code	Course Outcomes	Cognitive Level
C402-31.1	Understand the interlinkage of components of the financial system and financial instruments of the Money market and Capital market.	Understanding (Level 2)
C402-31.2	Apply knowledge of Mutual Funds and Insurance products in personal investment portfolio	Applying (Level 3)
C402-31.3	Apply knowledge of Income tax for the estimation of the tax liability of an individual.	Applying (Level 3)
C402-31.4	Compare the ways of fundraising in domestic and international markets	Analyzing (Level 4)
C402-31.5	Understand the functioning of the Stock market and evaluating the securities for investment.	Evaluating (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Hours
1.	Introduction to Financial System	Meaning, Importance, and functions of Financial system. Informal and Formal financial systems, Financial markets, Financial Institutions, Financial Services and Financial instrument	3
2.	Introduction to financial markets	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 Features of Capital market instruments: Equity shares, Bonds.	6
3.	Fund raising in financial markets	Fundraising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO-Intermediaries in IPO, Book building process and allotment of shares	6

		Fundraising from the foreign market through Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	
4.	Stock Market	Trading in the secondary market- Stock exchanges, regulations, demutualization, broker, a listing of securities, dematerialization, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
5.	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	6
6.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in the selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
7.	Overview of Income Tax	Basics of Income tax Concept of the previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary, Gratuity, Pension, Allowances and Perquisites; Income from Capital Gain, Deductions under sections 80C to 80U.	12
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-BasedLearning: The students will form groups of 4-5 students. They will carry outa 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 the stock.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, 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*, 5th Ed, Vikas Publication, 2019
4	Bhole L M and Mahakud, J., *Financial Institutions and Markets*, 5th ed. Tata McGraw Hill Publication, 2017.

5	Singhania & Singhania, Students Guide to Income Tax, 67th Edition, Taxmann Publication, August 2022.
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	AshiwiniKumar,Sharma,' De-jargoned: Book building process,Live Mint,2015.
9	Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28th June 2009.
10	Kaul, Vivek, "Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel", The Economic Times, July 1, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS814	**Semester** Even	**Semester** VIII **Session** 2023 -2024 **Month from** Jan to June
Course Name	Knowledge Management		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Anshu Banwari	
	Teacher(s) (Alphabetically)	Dr. Anshu Banwari	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-30.1	Understand the way knowledge is embedded in an organization and the behavioral aspects involved in managing it.	Level-2- (Understanding)
C402-30.2	Identify appropriate methods or techniques to be used for capturing, sharing and managing knowledge.	Level-3 (Apply)
C402-30.3	Analyze the role of knowledge management for attaining organization goals.	Level-4 (Analyze)
C402-30.4	Assess the legal ramifications arising from knowledge sharing and an insight into the ethical concerns faced by individuals and organizations.	Level-5 (Evaluate)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Knowledge Management	Cognition and Knowledge Management, Data, Information and Knowledge, Types of Knowledge, Reasoning and Heuristics, Expert Knowledge, Human thinking and Learning, Knowledge Management myths	4
2.	Life Cycle of a knowledge Management System	Challenges in building Knowledge Management Systems, Conventional V/S Knowledge Management System Lifecycle, Knowledge Management System Life Cycle, System Justification, Role of Rapid Prototyping, Selecting an expert, Role of Knowledge developer	6
3.	Knowledge Creation and Knowledge Architecture	Models of Knowledge Creation and Transformation, Knowledge Architecture, The people Core, Identifying Knowledge centers, The technical core	5
4.	Capturing Tacit Knowledge	Evaluating the expert, Developing a Relationship with expert, Fuzzy reasoning and the quality of Knowledge capture, Interview as a tool, Knowledge capture techniques	6
5.	Knowledge	Codification Tools and Procedures, The knowledge	6

	Codification and System Implementation	Developer's Skill set, Quality assurance, Approaches to Logical testing and Acceptance testing, Issues related to deployment	
6.	Knowledge Transfer and Knowledge Sharing	Transfer strategies, Inhibitors of Knowledge transfer, Role of Internet in Knowledge Transfer	5
7.	Managing Knowledge Workers	Business Roles in the Learning Organizations, Work adjustment and the Knowledge Worker, Technology and the Knowledge worker, Role of the CKO, Managing Considerations, Managing Knowledge Projects	5
8.	Ethical, Legal and Managerial Issues	Knowledge Owners, Legal Issues, Ethical Decision cycle, Major threats to Ethics, The Privacy factor	5
Total number of Lectures			**42**

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

Project based learning: Students have to form a group (maximum 5 students in each group) andhave to identify an organization who has successfully implemented knowledge management. Students have to analyze techniques, tools and methods adopted by organization to preserve, nurture, share and manage knowledge. Understanding of different methods, processes and techniques used by organizations for successful KM implementation enhances the students practical understanding on how knowledge management is integrated into different business functions.These days most of the organizations are using knowledge management in their various endeavors. This subject surely enhances student's employability in all those organizations where knowledge management has been implemented or where they are planning to implement knowledge management.

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	**D. Hislop,** Knowledge Management in Organizations, Oxford University Press, 2013
2.	**E. M. Awad and H. M. Ghaziri,** Knowledge Management, Pearson Education, 2007
3.	**S. Warier**, Knowledge Management, Vikas Publishing House, 2011
4.	**Tan, H., Carrillo, P. and Anumba, C.J**., Case study of knowledge management implementation in a medium-sized construction sector firm. Journal of Management in Engineering, 28 (3), pp. 338 – 347, 2012
5.	**RagsdelL, G., OrtollEspinet, E. and Norris, M.,** Knowledge management in the voluntary sector: a focus on sharing project know-how and expertise. Knowledge Management Research and Practice, 12(4), pp.351–361, 2014
6.	**K. North and G. Kumta,** Knowledge Management, 2nd ed. 2018 ed., Springer, 2018

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	**Semester Even (specify Odd/Even)**	**Semester VIII Session** 2023 -2024 **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**
C402-3.1	Recalling the fundamental properties and the processes involved in the generation of light	Remember Level (C1)
C402-3.2	Thorough understanding of fiber optics and holography	Understand Level (C2)
C402-3.3	Ability to apply the fundamentals of various nonlinear optical effects in technology and interpret applications of photons	Apply Level (C3)
C402-3.4	Analysis of characteristics, 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 [Attendance (05 M), Class Test, Quizzes *etc* (06 M), Assignments in PBL mode (10 M) and Internal assessment (04 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.	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.

Project based learning: Each student in a group of 4-5 students will opt a topic and will do the theoretical study in detail. The students will submit their report. To make the subject application based, the students analyze the optical fiber applications, holography applications and use of photons in memory devices. This shall improve the skills and employability of the students in laser and photonic industries.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH812	**Semester: Even**	**Semester: 8**, **Session :** 2023 -2024 **Month from: January to June**
Course Name	**Astrophysics**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Anirban Pathak
	Teacher(s) (Alphabetically)	Anirban Pathak

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remembering (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	Understanding (C2)
CO3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Applying (C3)
CO4	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	**6**

		related to big bang, cosmological constants, dark matter and dark energy.	
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
	(a) Quizes /class tests (06 M), (b) Attendance (05 M) (c) Internal Assessment (04) (d) Assignments in PBL mode (10 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, 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.

Project based learning: Project report (5-7 pages in pdf format indicating Name, Enroll No. and Batch) is to be uploaded in google class room before starting of End Term Exam. Max 5 students can work on one topic given in the list (Dark Matter, Dark Energy, Expanding Space time, Merger of Black holes, Failed stars, Detection of Gravitational Waves, Light cone in GTR, Particle production radiation era, Did big bang happened ?, Discover life: ET etc.**), however, they may prepare different reports. Report should include introduction, definition, mathematics, principle, working, figures, applications etc.**

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH814	**Semester: Even**	**Semester:** VIII **Session:** 2023 -2024 **Month: January to June**
Course Name	Plasma Physics		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Anuraj Panwar
	Teacher(s)	Dr. Anuraj Panwar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-34.1	Define terminology and concepts of plasma physics with various natural phenomena and engineering applications.	Remembering Level (C1)
C402-34.2	Summarize plasma and explain its electric, magnetic, dielectric and thermal properties.	Understand Level (C2)
C402-34.3	Develop magneto-hydrodynamic fluid and kinetic models to explain various phenomena taking place in homogeneous, isotropic and anisotropic plasma conditions.	Apply Level (C3)
C402-34.4	Analyze and formulate mathematical / analytical expressions for various nonlinear processes in plasmas.	Analyze Level (C4)
C402-34.5	Evaluate physical problems, estimate their numerical solutions and draw inferences from the results.	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to the Plasma State**	Elementary concepts, definition of temperature Debye Shielding, plasma parameters, applications of Plasma Physics, Production of Plasmas in the laboratory, Drifts of charged particles under the effect of different combinations of electric and magnetic fields and Mirror Machine.	10
2.	**Fluid description of plasmas**	Relations of Plasma Physics to ordinary electromagnetics, dielectric constant of a plasma, collisions, equation of continuity, macroscopic parameters of plasma, two and one fluid equations for plasma.	04
3.	**Nonlinear Waves in Plasmas**	Plasma oscillations, space charge waves of warm plasma, ion-acoustic waves and electromagnetic waves in magnetized plasma.	08
4.	**Diffusion and Resistivity**	Decay of Plasma by diffusion, diffusion across a magnetic field, single fluid MHD equations, Diffusion in fully ionized Plasmas, Bohm diffusion and Neoclassical diffusion.	06
5.	**Stability of fluid plasma**	The equilibrium of plasma, classification of plasma instabilities, stability analysis: Two stream instability and Gravitational instability or Rayleigh Taylor instability (Plasma supported against gravity by magnetic field).	04
6.	**Nonlinear effects**	Ponderomotive force, Parametric instabilities, decay instability, two plasmon decay, stimulated Raman scattering and stimulated Brillouin scattering, non linear Landau damping.	06
7.	**Controlled thermo-nuclear fusion**	Magnetic and inertial confinement schemes, ITER, TOKAMAK.	02
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+PBL+Attendance+class performance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	F. F. Chen., *Introduction to Plasma Physics*, Springer (2016).
2.	Krall and Trievelpiece, *Principles of Plasma Physics*, McGraw-Hill (1973).
3.	W. L. Kruer, *The Physics of laser plasma interactions*, Addison Wesley (1988).
4.	Liu and Tripathi, *Interaction of electromagnetic waves with electron beams and plasmas*, World Scientific (1994).

Project based Learning (PBL): Students groups may be formed to submit project reports on natural and engineering applications of plasma physics. Students may be asked to make presentations on topics like mirror machine, plasma diffusion, Raman scattering and plasma fusion devices. Students may be asked to present recent published articles on plasma applications. Students may be asked to solve plasma physics problems by using their expertise computer language

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH813	**Semester: EVEN**	**Semester: VIII Session** 2023 -2024 **Month from: January to June**
Course Name	Bio-Physics		
Credits	3	**Contact Hours**	3

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

S.N.	DESCRIPTION	COGNITIVE LEVEL (BLOOMS TAXONOMY)
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 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,	10

		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 (6M), Attendance (5M), project (10M), Class performance (4 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.

Project based Learning (PBL): In whole Biophysics course applications of physics in biology have been discussed. The course also deals with the working of fundamental biophysical techniques depending on their applicability in Industry like sensors, OLED, AMOLED, DNA Logic gates, drug designing etc. Throughout the course Students will make some individual projects on selected Topics of application of Biophysics on todays biomedical and electronic industry. Students will also do some project work on drug designing. Example: For drug designing different software based techniques are used like molecular docking, MD simulation etc., piezoelectric materials are used for the making of biosensors, optical sensors, viewers which are applied in defense purpose and in medical science. Each project work will describe the detail about the specific applied field. Students will take help from available internet sources, current research papers, Text books for preparing the project. Throughout the preparation of the whole project and by presenting the project work students will gather deep learning about the applicability of Biophysics for the requirement of current medical and electronic Industry. The overall knowledge will help them to prepare themselves as an efficient Engineer according to the requirements of current Industry.

Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2023-24 **Month from** Jan - June
Course Name	International Studies		
Credits	3	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr. Ila Joshi (62), Dr Gaurika Chugh (128)
	Teacher(s) (Alphabetically)	

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C402-8.1	Demonstrate an understanding of the basic concepts and theoriesin the area of international studies	Understanding (C2)
C402-8.2	Demonstrate an understanding of the contemporary world issues.	Understanding (C2)
C402-8.3	Compare the changes in India's foreign policy in the Cold War era and the post-Cold War era	Applying (C3)
C402-8.4	Analyze the major political developments and events since the 20th century	Analyzing (C4)
C402-8.5	Analyze the working of various international and regional organizations and their influence in international relations.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Concepts	• Approaches to the Study of International Relations:Idealist, Realist, Neo-Realist Theory • Key Concepts in International Relations: 1) National interest and its instruments, 2) Power: Hard and Soft Power 3) Balance of power and Collective Security	8
2.	An Overview of Twentieth Century International Relations History	• World War I: Causes and Consequences • Fascist / Nazi Ideology • World War II: Causes and Consequences • Diplomacy after World Wars: Old and New	4
3	Cold War Politics	• Origin and Phases of the Cold War • Causes of the End of the Cold War • Non-Alignment Movement (NAM)	6
4	United Nations and World Politics	• League of Nations: Brief Introduction • United Nations and its Organs: Structure and Powers.	8

		• Chapter VI: United Nations and Peaceful Settlementof Disputes: Inquiry, Negotiation, Mediation, Conciliation and Arbitration • Chapter VII: United Nations and Collective Security Mechanism (Case study of Korean War). • United Nations and Reforms	
5.	India's Foreign Policy	• Basic Determinants (Historical, Geo-Political,Economic, Domestic and Strategic) • India - Look East Policy and Act East Policy • India - SAARC, ASEAN • India – QUAD, G20	8
6	Contemporary Global Concerns	• Human Rights • Role of Diaspora • Terrorism • Nuclear Proliferation	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 AsianPublishers.
2.	Baylis, J. & Smith, S. (eds.) (2011). *The Globalization of World Politics: An Introduction to InternationalRelations*. 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 UniversityPress
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 InternationalRelations*. Fifth edition. London: Lynne Rienner Publishers.
10.	Pant, H.V. (2009). *India's Foreign Policy in the Unipolar World.* Delhi: Routledge

Course Description

Course Code	20B12MA411	**Semester-** Even	**Semester VIII Session** 2023 -2024 **Month from** Jan 2024 to June 2024
Course Name	**Multi Attribute Decision Making**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Pankaj Kumar Srivastava and Dr. Dinesh C. S. Bisht	
	Teacher(s) (Alphabetically)	Dr. Dinesh C. S. Bisht and Dr. Pankaj Kumar Srivastava	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C402-6.1	explain the concepts of decision analysis and decision-making.	Understanding (C2)
C402-6.2	develop the concept of group and multi criteria in decision making problems.	Applying (C3)
C402-6.3	categorize decision making approaches to handle multi attribute problems.	Analyzing (C4)
C402-6.4	estimate value and outranking based methods in decision making problems.	Evaluating (C5)

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, Median Ranking, Analytic Hierarchy Process, Analytic Network Process.	8

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**

Project Based Learning: Students will be divided in a group of 4-5 to collect literature and submit a report on estimation of value and outranking based methods in decision making 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.	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.

Course Description

Course Code	18B12MA811	**Semester** Even	**Semester** VIII **Session** 2023-2024 **Month from** Jan 2024 to June 2024		
Course Name	Fuzzy Optimization and Decision Making				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Lakhveer Kaur			
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C402-24.1	Explain the concept of fuzzy sets, fuzzy numbers along with their types, generalized fuzzy sets and fuzzy relations.	Understanding Level (C2)
C402-24.2	Apply the concept of fuzzy relations to approximate reasoning.	Applying Level (C3)
C402-24.3	Utilize the concept of fuzzy sets and their generalizations in various decision-making processes.	Applying Level (C3)
C402-24.4	Analyze various ranking techniques for solving fuzzy transportation problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fuzzy sets and fuzzy numbers	Fuzzy sets and fuzzy numbers, basic operations, operations on [0, 1] – fuzzy negation, triangular norms, t-conorms, fuzzy implications, aggregation operations, fuzzy functional equations.	7
2.	Fuzzy and generalized fuzzy operations	Type - 1 and Type - 2 fuzzy sets, intuitionistic fuzzy sets. triangular fuzzy numbers, trapezoidal fuzzy numbers, bell shaped fuzzy numbers, fuzzy numbers with a flat, piecewise quadratic fuzzy numbers.	7
3.	Fuzzy relations and approximate reasoning	Fuzzy binary and n-ary relations, composition of fuzzy relations, fuzzy equivalence relations, fuzzy compatibility relations -fuzzy relational equations, applications of fuzzy relations in approximate reasoning.	8

4.	Decision making in fuzzy environment	Decision making in a fuzzy environment, individual decision making, multiperson decision making, multicriteria decision making, multistage decision making, fuzzy zero-based budgeting, fuzzy averaging for decision making.	10
5.	Ranking techniques in fuzzy transportation problems	Fuzzy ranking methods, fuzzy linear programming, fuzzy transportation, basic definitions associated with fuzzy transportation, algorithms for solution of fuzzy transportation problem.	10
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**

Project based learning: Students are divided in a group of 4-5 to do a survey on utilization of fuzzy sets and their generalizations for various decision-making processes in their respective branches. The students recognize decision making problems in fuzzy environment, arising in practical situations and solve these problems with the aid of different techniques, learnt in this course.

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.	**Bhargava, A. K.,** Fuzzy Set Theory, Fuzzy Logic and Their Applications, S. Chand & Company Pvt. Ltd., 2013.
2.	**Zimmermann, H. J.**, Fuzzy Set Theory and its Applications, 4th Edition, Allied Publishers, New Delhi, 1991.
3.	**Ross, T.J.**, Fuzzy logic with engineering applications, 2nd Edition, John Wiley and Sons, Ltd, 2004.
4.	**Baczynski, M. and Jayaram, B.**, Fuzzy Implications, Springer Verlag, Heidelberg, 2008.
5.	**Klir, G. J. & Yuan, B.**, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall NJ, 1995.

Course Description

Course Code	16B1NMA831	**Semester** Even		**Semester** VIII **Session** 2023-2024 **Month from** Jan 2024 to June 2024	
Course Name	Optimization Techniques				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Ram Surat Chauhan			
	Teacher(s) (Alphabetically)	Dr. Ram Surat Chauhan			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C402-2.1	explain the basics of linear, dynamic and non-linear programming.	Understanding (C2)
C402-2.2	apply optimization techniques to solve problems related to linear programming, game theory, queuing and inventory models.	Applying (C3)
C402-2.3	analyze the problems related to dynamic programming, sensitivity analysis, sequencing and scheduling.	Analyzing (C4)
C402-2.4	determine numerical solutions of one dimensional and multidimensional nonlinear problems.	Evaluating (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 method, simplex method and its variants, revised simplex method, Duality theory, dual simplex method, sensitivity analysis.	08
2.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and m×n Games, Solution of games using LPP technique.	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 waiting space. Inventory Models: Deterministic and Probabilistic models.	08
4.	Sequencing & Scheduling	Processing of Jobs through Machines: Processing of n jobs through two machines, two jobs through m machines and n jobs through m machines. Project Scheduling: Network diagram, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT).	07
5.	Dynamic Programming	Discrete and Continuous Dynamic Programming: Bellman's principle of optimality, linear and nonlinear dynamic programming problems, Simple Illustrations.	06

6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem: Newton's method, Golden section method, Fibonacci search method, Bisection method. Multidimensional minimization problem: Steepest descent method, Multidimensional Newton's method.	07
		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 collect literature on dynamic programming to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with aforementioned topic.

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.