

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	17B11EC732	<b>Semester</b> Even (specify Odd/Even)	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Cognitive Communication Systems		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Vivek Dwivedi
	<b>Teacher(s) (Alphabetically)</b>	...

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C431-2.1</b>	Understand the concepts of various generation of wireless communication and spectrum scarcity.	Understanding Level (C2)
<b>C431-2.2</b>	Understand the concepts of radio (CR) architecture, functions of cognitive radio	Understanding Level (C2)
<b>C431-2.3</b>	Analyzing the Spectrum sharing and management and Spectrum sensing methods	Analyzing Level (C4)
<b>C431-2.4</b>	Evaluating the performance of optimization of dynamic spectrum access and management	Evaluating Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction of various generation of wireless communication, Spectrum scarcity, cognitive radio (CR) architecture, functions of cognitive radio, Fundamental challenges and issues in designing cognitive radio	8
2.	Spectrum sharing and management	Spectrum access models,dynamic spectrum access (DSA), underlay, overlay and hybrid cognitive radio, Potential applications of cognitive radio	8
3.	Spectrum sensing	Interference temperature/channel estimation , Detection of spectrum holes, Practical spectrum sensing approaches, Collaborative sensing, External Sensing	12
4.	Techniques for optimization of dynamic spectrum access and management	Optimization techniques, Constrained optimization, Lagrangian method, Optimality, Primal-dual algorithm, Linear programming and the simplex algorithm, Non-linear programming , applications of cognitive radio	14
<b>Total number of Lectures</b>			42

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (...)

<b>Total</b>	<b>100</b>
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<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	E. Hossain, D. Niyato, and Z. Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, 2009 (ISBN: 978-0-521-89847-8)
2.	Cognitive radio networks, Kwang-Cheng Chen, Ramjee Prasad, John Wiley & Sons Ltd
3.	Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Huseyin Arslan, Springer.
4.	Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education Low Price Edition

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12EC411	<b>Semester Even</b> <b>(specify Odd/Even)</b>	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Course Name</b>	Introduction to IOT		
<b>Credits</b>	3	<b>Contact Hours</b>	4

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Mr.Abhay Kumar (128)
	<b>Teacher(s)</b> <b>(Alphabetically)</b>	Dr. Gaurav Verma (62)

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C434-7.1</b>	<b>Outline the basic concepts of IOT with networking and protocol considerations in IOT scenario.</b>	Understanding Level (C2)
<b>C434-7.2</b>	<b>Identify various IOT hardware platforms and their utilization with various sensors and actuators.</b>	ApplyingLevel (C3)
<b>C434-7.3</b>	<b>Experiment the basic concepts of python programming and make use of them in image processing, data analytics and machine learning applications.</b>	Applying Level (C3)
<b>C434-7.4</b>	<b>Examine various case studies and cloud platforms in an IOT scenario for monitoring, control and analysis.</b>	Analyzing Level (C4)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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, and XMPP), 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	12

	(Arduino) & data visualization using cloud.	IDE and program uploading, different functions related to GPIOs and special functions (PWM and Serial communication), Interfacing with Arduino using processing language (LED, Switch, Seven Segment, LCD, DC Motor, Relay, IR, LDR and DHT11 sensor), Interrupts, use of simulator and compiler, basics of HTML, Arduino supported IOT modules (Ethernet & Wifi Shield) and their configuration, Monitoring of sensor data on cloud and Web based controlling of actuators.	
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
<b>Total number of Lectures</b>			<b>42</b>

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance & Quiz)
<b>Total</b>	<b>100</b>

**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)
2.	"Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madiseti (Universities Press)

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12EC412	<b>Semester</b> Even (specify Odd/Even)	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Multimedia Communications		
<b>Credits</b>	4	<b>Contact Hours</b>	3-1-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Richa Gupta
	<b>Teacher(s) (Alphabetically)</b>	

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
Upon completion of the course, the students will be able to		
<b>C430-7.1</b>	familiarize with basics of data compression used in the development of various construction algorithms for source codes.	Applying Level (C3)
<b>C430-7.2</b>	identify theoretical and practical requirements for implementation and designing of Error Resilient Codes.	Applying Level (C3)
<b>C430-7.3</b>	learn fundamentals of transform coding, digital image processing and its applications.	Applying Level (C3)
<b>C430-7.4</b>	analyze the need of image compression & video compression and distinguish between different image CODECs.	Analyzing Level (C4)
<b>C430-7.5</b>	familiarize with psychoacoustic principle used in the development of audio codec standards.	Analyzing Level (C4)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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
<b>Total number of Lectures</b>			<b>45</b>

### Evaluation Criteria

#### Components

#### Maximum Marks

T1	20
T2	20
End Semester Examination	35
TA	25 (Research Assignment, Assignment, Quiz, Class Tests)
<b>Total</b>	<b>100</b>

**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, 4 <sup>th</sup> edition.
4.	A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12EC417	<b>Semester</b> Even (specify Odd/Even)	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Satellite Communication		
<b>Credits</b>	4	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Ajay Kumar
	<b>Teacher(s) (Alphabetically)</b>	Dr. Ajay Kumar

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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 Multiple Access (CDMA)	7

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
<b>Total number of Lectures</b>			<b>42</b>

#### Evaluation Criteria

Components	Maximum Marks
T-120	
T-2 20	
T-3 (End Semester Examination)	35
TA	25
<b>Total</b>	<b>100</b>

**Project based learning:** Each student in a group of 3 students select a topic related to latest development in the technology of satellite communication. This method of learning will help students to understand latest development in the industry like ISRO, once they land into entry it will be a simple task to design and implement any given task. Knowledge acquired during this course will boost their confidence and clarity while attending any Interview related to placement activities and establishment of their own application-based startup company related with latest and cutting-edge technologies.

**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**

<b>Subject Code</b>	19B12EC412	<b>Semester: Even</b>	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Subject Name</b>	Advance Topics in Wireless Communications		
<b>Credits</b>	3	<b>Contact Hours</b>	3+1
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Bajrang Bansal, Dr. SamritiKalia	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Bajrang Bansal, Dr. SamritiKalia	

**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
<b>C434-3.1</b>	Explain basics of MIMO systems and need of diversity schemes.	Remembering Level (C1)
<b>C434-3.2</b>	Analyze the effect of fading in the wireless medium and mathematical modeling of fading channels.	Analyzing Level (C4)
<b>C434-3.3</b>	Analyze channel capacity expression of MIMO systems.	Analyzing Level (C4)
<b>C434-3.4</b>	Evaluate performance of the MIMO detection system and need of UWB systems.	Evaluating Level (C5)

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	Wireless Channel Fading and Distribution: Small scale, large scale, and multipath fading	10

	Environments	channels. Rayleigh, Rician, Exponential, Nakagami-m, Lognormal and $\alpha$ - $\kappa$ - $\mu$ distributions.	
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
<b>Total number of Lectures</b>			42

#### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
<b>Total</b>	<b>100</b>

**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.

<b>Recommended Reading</b> (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**

<b>Course Code</b>	20B12EC412	<b>Semester</b> EVEN	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Advanced Microcontrollers and RTOS		
<b>Credits</b>	3	<b>Contact Hours</b>	3L

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Mr. Ritesh Kumar Sharma (62)
	<b>Teacher(s) (Alphabetically)</b>	Mr. Ritesh Kumar Sharma

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>CO1</b>	<b>Understanding fundamentals of ARM7 processor and detailed study of architecture and peripherals of the ARM7 based LPC2148 microcontroller.</b>	Applying Level (C3)
<b>CO2</b>	<b>Understanding and study of the complete architecture of the ARM-CORTEX M3/M4 processor and STM32F407 (ARM-CORTEX based microcontroller).</b>	Understanding Level (C2)
<b>CO3</b>	<b>Experiment and configure different peripherals of STM32 Microcontrollers and Interfacing Sensor and Actuators with the microcontroller</b>	Analyzing Level (C4)
<b>CO4</b>	<b>Understand fundamentals of RTOS and its implementation</b>	Understanding Level (C2)

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

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

**Evaluation Criteria**

**Components Maximum Marks**

T1 20

T2 20

End Semester Examination 35

TA 25 (Assignments and Quiz)

**Total 100**

**Project Based Learning Component: Configuring Different on-chip peripherals of ARM7TDMI-S architecture based Microcontroller (LPC2148) , GPIO programming, PWM generation, Serial Communication using I2C protocol etc. Sysclk configuration of STM32F407 microcontroller, Timer and PWM configuration, serial communication using different on chip interfaces such as I2C, SPI, USART, Interfacing different sensors and actuators with the Microcontroller**

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

1. Muhhamad Ali Mazidi, STM32 Arm Programming for Embedded Systems, Pearson, 2018

2. Richard, Mastering the FreeRTOS™ Real Time Kernel A Hands-On Tutorial Guide, 2016

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	20B12EC415	<b>Semester:</b> Even (specify Odd/Even)	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Network Security		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	P C Gupta
	<b>Teacher(s) (Alphabetically)</b>	P C Gupta

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
<b>1.</b>	Security concepts and terminology	General security concepts, need for security & security mechanisms	2
<b>2.</b>	Symmetric-key & Asymmetric-key Cryptosystems	(a) Classical encryption methods (b) Mathematical foundations I – Modular arithmetic (c) Block ciphers, DES, 3 DES, AES (d) Modes of operation of block ciphers (e) Stream ciphers, RC4 (f) Mathematical foundations II – Finite fields (g) Asymmetric-key cryptography, RSA, ElGamal (h) Elliptic curve cryptography	14
<b>3.</b>	Message Authentication & Digital Signatures	(a) Content integrity verification, hash functions, SHA (b) Message Authentication Code (MAC), (c) HMAC, CMAC (d) Digital signature, RSA and ElGamal, applications of digital signatures	4
<b>4.</b>	Entity Authentication & Security for Remote Access	(a) Fixed and one-time passwords, authentication based on challenge-response. (b) PPP, PAP, CHAP, EAP protocols, RADIUS & L2TP tunneling	3

5.	Key Distribution	(a) Symmetric-key distribution, Diffie-Hellman key exchange, (b) Key Distribution Centre (KDC), Kerberos (c) Public Key distribution, Digital certificates, X.509, Certification Authority (CA), Public Key Infrastructure	3
6.	Security at the Transport and Network Layers	(a) Security at the Transport layer, (b) TLS protocol (c) Security at the IP layer, VPN, IPsec, AH, ESP protocols	3
7.	Security in Wireless Networks	(a) Architecture of wireless LAN (b) WEP, RSN protocols	3
8.	Network Vulnerabilities & Malware	(a) IP attacks, TCP attacks, DOD & DDOS attacks (b) Firewalls – packet filtering, stateful inspection, proxy, circuit level (c) Intrusion Detection Systems (IDS) (d) Malware	7
9.	Security at the Application Layer	(a) Secure Electronic Transaction (SET) (b) Email security, SMIME, PGP	3
<b>Total number of Lectures</b>			<b>42</b>

#### Evaluation Criteria

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

**Project Based Learning:** Assignment component of the evaluation is project-based. Groups of 3 students will be assigned on projects that will be application oriented and will be extension of the concepts learn in the classroom.

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

1.	Gupta, Prakash C., <i>Cryptography and Network Security</i> , PHI, 2014
2.	Stallings W., <i>Cryptography &amp; Network Security</i> , 6 <sup>th</sup> Ed., Pearson, 2014
3.	Forouzan, BA., <i>Cryptography &amp; Network Security</i> , 3rd Ed., McGraw-Hill, 2015

## Detailed Syllabus

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

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Megha Agarwal, Rahul Kaushik
	<b>Teacher(s) (Alphabetically)</b>	Megha Agarwal, Rahul Kaushik, Sajai Vir Singh, Shivaji Tyagi

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

<b>Evaluation Criteria</b>	
<b>Components</b>	<b>Maximum Marks</b>
Mid Sem Viva	20
Final Viva	30
Day to Day	30
Project Report	20
<b>Total</b>	<b>100</b>

**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

<b>Course Code</b>	15B1NHS832	<b>Semester</b> Even (specify Odd/Even)	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	International Studies		
<b>Credits</b>	3	<b>Contact Hours</b>	<b>3(3-0-0)</b>

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Chandrima Chaudhuri
	<b>Teacher(s) (Alphabetically)</b>	Dr. Chandrima Chaudhuri

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	Basic Concepts	Balance of power and Collective security National Interest and its instruments	4
2.	An Overview of Twentieth Century International Relations History	World War I: Causes and Consequences Significance of the Bolshevik Revolution Rise of Fascism / Nazism World War II: Causes and Consequences	8
3.	Cold War Politics	Origin of the Cold War Evolution of the Cold War Collapse of the Soviet Union Causes of the End of the Cold War	8
4.	India's foreign policy during the Cold War era	Basic Determinants (Historical, Geo-Political, Economic, Domestic and Strategic) India's Policy of Non-alignment	6
5.	India's foreign policy in the Post-Cold War era	India and SAARC India and the Look East policy Impediments to regional co-operation: river water disputes; illegal cross-border migration; ethnic conflicts and insurgencies; border disputes	8
6.	Emergence of Other Power Centres	European Union Rise of Asia Powers- Russia, China and Japan	8
<b>Total number of Lectures</b>			<b>42</b>



### Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project/ Quiz/Attendance)
<b>Total</b>	<b>100</b>

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

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

1.	A. Chatterjee, <i>International Relations Today</i> . Noida, India: Pearson, 2019
2.	Appadorai, &M.S.Rajan, <i>India's Foreign Policy and Relations</i> . New Delhi, India: South Asian Publisher, 1985
3.	E.H. Carr, <i>International Relations between the Two World Wars: 1919-1939</i> . New York, USA: Palgrave, 2009
4.	J. Baylis &S. Smith, Ed. <i>The Globalization of World Politics: An Introduction to International Relations</i> . Oxford, UK: Oxford University Press, 2011
5.	P. Calvocoressi, <i>World Politics: 1945—2000</i> . Essex, UK: Pearson,2009
6.	P.Zelikow, <i>The Road less travelled: The secret battle to end the great war,1916-17</i> . New York, USA: Public Affairs, 2021
7.	R,Cooper, <i>The Ambassadors: thinking about diplomacy from Machiavelli to modern times</i> . London,UK: Weidenfeld & Nicolson, 2021

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Subject Code</b>	<b>16BINEC831</b>	<b>Semester: Even</b> (specify Odd/Even)	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Subject Name</b>	<b>Sonar system and acoustic imaging</b>		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Kapil Dev Tyagi
	<b>Teacher(s)</b>	Kapil Dev Tyagi

<b>S. NO.</b>	<b>DESCRIPTION</b>	<b>COGNITIVE LEVEL (BLOOMS TAXONOMY)</b>
<b>C434-5.1</b>	define and explain sonar terminology and choose parameters for side scan sonar according to the required azimuth and range resolutions.	ApplyingLevel (C3)
<b>C434-5.2</b>	select parameters for synthetic aperture sonar (SAS) as per the design requirements.	ApplyingLevel (C3)
<b>C434-5.3</b>	analyze the continuous time frequency modulation (CTFM) technique for sonar applications.	AnalyzingLevel (C4)
<b>C434-5.4</b>	apply and discover signal processing application for ship speed measurement system like JANUS.	AnalyzingLevel (C4)
<b>C434-5.5</b>	take part in the development of simple array design for acoustic localization.	AnalyzingLevel (C4)

<b>Module No.</b>	<b>Subtitle of the Module</b>	<b>Topics in the module</b>	<b>No. of Lectures for the module</b>
1.	<b>Side Scan and Sector Scan Sonar</b>	Introduction to sonar system. Side scan sonar, sector scan sonar, beam-forming methods in sector scans sonar.	6
2.	<b>Modulation Scanning</b>	Swept frequency delay line scanning, phase beam-forming, modulation scanning, multistage beam-forming, DFT beam-former.	8
3.	<b>Synthetic aperture sonar</b>	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	8

		aperture sonar, spot lights, and squints in synthetic aperture sonar.	
4.	CTFM	Continuous time frequency modulation technique (CTFM), blind time problem in CTFM, dual demodulator CTFM technique, phase difference radial projection method.	8
5.	Signal processing for Ship speed measurement	Estimation of moving target speed in water, GPS, DGPS, SQUID, Doppler log, JANUS, Issues in Doppler log methods, correlation-log,	6
6.	Acoustic localization	Localization using time delay estimation, Beacons, Pingers. Localization using three hydrophones, Localization using four hydrophones, Non-planar array using five hydrophones.	6
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25	
<b>Total</b>		<b>100</b>	
<p><b>Practical implementation of theory based learning:</b> 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.</p> <p><b>Project based learning:</b> 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.</p>			
<p><b>List of Simulation Experiments in Sonar system and acoustic imaging</b></p> <p>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) <math>\pi/3</math> radians, (iii) <math>\pi/6</math> 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).</p> <p>Ex2. Linear Chirp signal of with starting frequency of 100 Hz ending frequency of 2 KHz and duration of 1 sec.</p>			

<p>Ex3. Generate Sine waves of 1 kHz with sampling frequency of 10 kHz and amplitude decreasing exponentially with different slopes.</p> <p>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).</p> <p>Ex5. Draw the radiation pattern of a N element uniform array as a function of angle. Reference document is given in the study material.</p> <p>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.</p> <p>Ex7. Generate a signal <math>s(t)</math> consisting of three linear chirp signals. Each chirp signal <math>c(t)</math> has starting frequency of 100 Hz, ending frequency of 2 KHz and duration of 1 sec. In <math>s(t)</math> the first chirp signal <math>c(t)</math> 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 <math>c(t)</math>.</p> <p>Ex8. Generate a signal consisting of the following signals A. a chirp signal <math>c(t)</math> 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.</p>	
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<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
<b>1.</b>	Lawrence J. Ziomek, <b>An Introduction to Sonar Systems Engineering</b> , Taylor & Francis Inc, 2017.
<b>2.</b>	A. D. Waite, <b>Sonar for Practising Engineers</b> , 3 <sup>rd</sup> edition, John Wiley & Sons, 2002.
<b>3.</b>	Authors: <b>Au</b> , Whitlow W.L. <b>The Sonar of Dolphins</b> , Springer-Verlag New York, ISBN 978-1-4612-4356-4, 1993.

### Course Description

<b>Course Code</b>	16B1NMA831	<b>Semester</b> Even	<b>Semester VIII Session</b> 2021-2022 <b>Month from</b> Jan 2022 to June 2022
<b>Course Name</b>	Optimization Techniques		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Shruti	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Shruti	
<b>COURSE OUTCOMES</b>			<b>COGNITIVE LEVELS</b>
After pursuing the above mentioned course, the students will be able to:			
<b>C402-2.1</b>	apply generalized, revised and dual simplex method for linear programming problems (LPP).		Applying Level (C3)
<b>C402-2.2</b>	apply graphical, algebraic and linear programming techniques for pure and mixed strategy problems in game theory.		Applying Level (C3)
<b>C402-2.3</b>	classify and solve the problems on queuing and inventory models.		Analyzing Level (C4)
<b>C402-2.4</b>	solve and analyze the network scheduling and sequencing problems.		Analyzing Level (C4)
<b>C402-2.5</b>	make use of dynamic programming technique to solve complex linear programming problems.		Applying Level (C3)
<b>C402-2.6</b>	determine numerical solution of nonlinear multidimensional problems.		Evaluating Level (C5)
<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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 $2 \times n$ , $3 \times n$ , $m \times 2$ , $m \times 3$ and $m \times n$ 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,	06

		linear and nonlinear dynamic programming problems, Simple Illustrations.	
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
		<b>Total number of Lectures</b>	<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz, Assignments)	
<b>Total</b>		<b>100</b>	
<b>Recommended Reading material:</b> 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, 2 <sup>nd</sup> edition, Prentice Hall of India Pvt. Ltd., 1980.		

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Subject Code</b>	<b>17B1NHS732</b>	<b>Semester: Even</b>	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Subject Name</b>	<b>INDIAN FINANCIAL SYSTEM</b>		
<b>Credits</b>	<b>3</b>	<b>Contact Hours</b>	<b>3 (3-0-0)</b>

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	1. Dr. Mukta Mani (Sec 62) 2. Dr.Sakshi Varshney (Sec 128)
	<b>Teacher(s) (Alphabetically)</b>	2. Dr. Mukta Mani 2. Dr.Sakshi Varshney

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

Module No.	Subtitle of the Module	Topics in the module	No. of Hours
<b>1.</b>	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	3
<b>2.</b>	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	3
<b>3.</b>	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO- Intermediaries in IPO, Book building process and allotment of shares	3

4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	3
5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualization, broker, listing of securities, dematerialization, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
6.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis- Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	7
7.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
8.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary, Gratuity, Pension, Allowances and Perquisites; Income from Capital Gain, Deductions under section 80C to 80U.	14
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project, Class participation and Attendance)	
<b>Total</b>		<b>100</b>	

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

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	Pathak Bharti V, <i>Indian Financial System</i> , 5 <sup>th</sup> Edition, Pearson Education, 2018
2	Madura Jeff, <i>Personal Finance</i> , 6 <sup>th</sup> Ed, Pearson Education, 2017.
3	Machiraju H R, <i>Indian Financial System</i> , 4 <sup>th</sup> Ed, Vikas Publication, 2010
4	Bhole L M, <i>Financial Institutions and Markets</i> , 4 <sup>th</sup> ed. Tata McGraw Hill Publication,



	2006.
5	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2019.
6	<i>How to Stimulate the Economy Essay</i> [Online] Available: <a href="https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC">https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC</a>
7	Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007
8	Ashwini Kumar, Sharma, 'De-jargoned: Book building process, Live Mint, 2015.
9	Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28 <sup>th</sup> 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	<b>18B12HS811</b>	Semester: EVEN	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
Course Name	<b>Industrial Sociology</b>		
Credits	3	Contact Hours	(3-0-0)

Faculty (Names)	Coordinator(s)	Shikha Kumari
	Teacher(s) (Alphabetically)	Shikha Kumari

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
<b>1.</b>	Introduction	<ul style="list-style-type: none"> <li>Scope and importance of the study of Industrial Sociology</li> </ul>	3

		<ul style="list-style-type: none"> <li>• Nature and type of industrial society</li> <li>• Study of industrial relations</li> </ul>	
2.	Theoretical Orientation	<ul style="list-style-type: none"> <li>• Functional theory of labour (Durkheim)</li> <li>• Conflict/Marxian theory of labour</li> <li>• Weberian Theory of labour</li> </ul>	5
3.	Social dimensions of work (I)	<ul style="list-style-type: none"> <li>• Types of work: Unpaid Domestic and Volunteer work/ Service sector work/ managerial and white collar work/ blue collar work- Sectors of employment</li> </ul>	5
4.	Social dimensions of work (II)	<ul style="list-style-type: none"> <li>• Gendered Organization: Feminization of Labour and Poverty</li> <li>• Discrimination and Harassment (gender, racial, ethnic)</li> <li>• Caste system as a tool to stratify the labour force</li> </ul>	8
5.	Industrialization in India	<ul style="list-style-type: none"> <li>• Trade Union: Concept, Functions and Types, History of Trade Union Movement in India Trade</li> <li>• Socialism- LPG era India</li> <li>• Unions and Challenges of Privatization, risks and hazards, Law and work, Decline of Trade Unions, Disputes &amp; Conciliation.</li> </ul>	8
6.	Contemporary Issues	<ul style="list-style-type: none"> <li>• Globalization and Technology: Criteria for measuring Globalization</li> <li>• Automation of work and its Impact (Reference: AI technologies)</li> <li>• Employment trends</li> </ul>	8
7.	New initiatives in India	<ul style="list-style-type: none"> <li>• Indian Endeavors- Make in India/ Start up India, Skills India programme</li> </ul>	5
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20 (Project based)	
T2		20	
End Semester Examination		35	

TA	25 (project/movie review/quiz)
<b>Total</b>	<b>100</b>

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

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Bhattacharjee. S. (2016). <i>Industrial Sociology</i> . Aavishkar Publications. Jaipur
2.	Edgell, S. (2006). “Unpaid Work-Domestic and Voluntary work”. <i>The Sociology of Work: Continuity and Change in Unpaid Work</i> .NewDelhi:Sage
3.	Freeman. C. (2009). 'Feminity and Flexible labour: Fashioning Class through gender on the global assembly line'. Massimiliano Mollona, Geert De Neev and Jonathan parry (eds.) <i>Industrial Work And life:An Anthropological Reader</i> .Berg: Oxford
4.	Grint, K.( 2005).“Classical Approaches to Work: Marx, Durkheim and Weber”. <i>The Sociology of Work: An Introduction</i> . Polity Press. Cambridge.
5.	Mishra. R (2016). <i>Industrial Sociology</i> . Laxmi Publications. New Delhi
6.	Prasad. J (2013). <i>Industrial Sociology</i> .Vayu Education of India: Delhi
7.	Singh. Y. & Sharma. R (2016). <i>Industrial Sociology</i> . AITBS Publishers: Delhi
8.	Sinha, P.N.R. (2006). <i>Industrial relations, Trade Unions and Labour legislations</i> . Pearson: New Delhi
9.	Watson, T.J. (2003). <i>Sociology, Work and Industry</i> . Routledge: London and New York

## Detailed Syllabus

### Lecture-wise Breakup

<b>Course Code</b>	18B12HS814	<b>Semester</b> Even	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	Knowledge Management		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Anshu Banwari	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Anshu Banwari	

COURSE OUTCOMES		COGNITIVE LEVELS
<b>C402-30.1</b>	Demonstrate the way knowledge is embedded in today's organization and behavioral aspects involved in managing it	Understanding Level (C2)
<b>C402-30.2</b>	Compare and contrast different methods of KM to preserve, nurture, share and manage knowledge	Understanding Level (C2)
<b>C402-30.3</b>	Identify appropriate methods for knowledge integration to gain competitive advantage	Applying Level (C3)
<b>C402-30.4</b>	Identify the legal ramifications arising from knowledge sharing and an insight into the ethical concerns faced by individuals and organizations	Applying Level (C3)

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 and System Implementation	Codification Tools and Procedures, The knowledge Developer's Skill set, Quality assurance, Approaches to Logical testing and Acceptance testing, Issues related to deployment	6
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
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Assignments, Project)	
<b>Total</b>		<b>100</b>	

**Project based learning:** Students have to form a group (maximum 5 students in each group) and have 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.

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	<b>D. Hislop</b> , Knowledge Management in Organizations, Oxford University Press, 2013
2.	<b>E. M. Awad and H. M. Ghaziri</b> , Knowledge Management, Pearson Education, 2007
3.	<b>S. Warier</b> , Knowledge Management, Vikas Publishing House, 2011
4.	<b>Tan, H., Carrillo, P. and Anumba, C.J.</b> , 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.	<b>Ragsdell, G., Ortoll Espinet, E. and Norris, M.</b> , 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.	<b>K. North and G. Kumta</b> , Knowledge Management, 2nd ed. 2018 ed., Springer, 2018
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## Course contents and plan

<b>Subject Code</b>	18B12HS815	<b>Semester Even</b>	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Subject Name</b>	QUALITY ISSUES IN ENGINEERING		
<b>Credits</b>	3 (3-0-0)	<b>Contact Hours</b>	3-0-0

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Akarsh Arora
	<b>Teacher(s) (Alphabetically)</b>	Dr. Akarsh Arora

### Course Objectives:

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

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

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



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

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

Evaluation Criteria	
Components	Maximum Marks
T1 20 (Written)	
T2	20 (Written)
End Term	35 (Written)
TA	25 (Project Assignment, Quiz)
<b>Total</b>	<b>100</b>

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

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12PH811	<b>Semester Even</b> (specify Odd/Even)	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Course Name</b>	Photonics and Applications		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Navneet Kumar Sharma
	<b>Teacher(s)</b> (Alphabetically)	Navneet Kumar Sharma

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
<b>C402-3.1</b>	Recall the fundamental properties of light and the processes involved in the generation of light	Remembering Level (C1)
<b>C402-3.2</b>	Interpret the theory of fiber optics	Understanding Level (C2)
<b>C402-3.3</b>	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Applying Level (C3)
<b>C402-3.4</b>	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyzing Level (C4)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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
<b>Total number of Lectures</b>			<b>40</b>

<b>Evaluation Criteria</b>	
<b>Components</b>	<b>Maximum Marks</b>
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance (07 M), Class Test, Quizzes, etc (07 M), Assignments in PBL mode (06 M) and Internal assessment (05 M)]
<b>Total</b>	<b>100</b>

**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, <i>Fiber Optics and Optoelectronics</i> , Oxford University Press.
2.	A. K. Ghatak and K. Thyagarajan, <i>Optical Electronics</i> , Cambridge university Press.
3.	A. K. Ghatak and K. Thyagarajan, <i>An Introduction to Fiber Optics</i> , Cambridge university Press.
4.	B. B. Laud, <i>Lasers and Nonlinear Optics</i> , 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**

<b>Course Code</b>	18B12PH812	<b>Semester: Even</b>	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Course Name</b>	Astrophysics		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Sandeep Chhoker
	<b>Teacher(s) (Alphabetically)</b>	Sandeep Chhoker

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

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
<b>1</b>	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.	<b>8</b>
<b>2.</b>	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.	<b>8</b>
<b>3.</b>	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.	<b>6</b>
<b>4.</b>	Our galaxy	The shape and size of Milky way and its interstellar mater	<b>2</b>
<b>5.</b>	Extragalactic astrophysics	Normal galaxies, active galaxies, cluster of galaxies, large-scale distribution of galaxies.	<b>6</b>
<b>6.</b>	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	<b>6</b>

		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
<b>Total number of Lectures</b>			<b>40</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 [2 Quizes (10 M), PBL (10 M) and Class performance (5 M)]	
<b>Total</b>		<b>100</b>	

**PBL Assignment Astrophysics 2022: 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.**

<b>Recommended Reading material:</b> 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.

**Detailed Syllabus**  
**Lecture-wise Breakup**

<b>Course Code</b>	18B12PH814	<b>Semester:Even</b>	<b>Semester: 8th Session: 2021 -2022</b> <b>Month: February – June</b>
<b>Course Name</b>	Plasma Physics		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Anuraj Panwar
	<b>Teacher(s)</b>	Dr. Anuraj Panwar

<b>COURSE OUTCOMES</b>		<b>COGNITIVE LEVELS</b>
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.	Understanding 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.	Applying Level (C3)
C402-34.4	Analyze and formulate mathematical / analytical expressions for various nonlinear processes in plasmas.	Analyzing Level (C4)
C402-34.5	Evaluate physical problems, estimate their numerical solutions and draw inferences from the results.	Evaluating Level (C5)

<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
1.	<b>Introduction to the Plasma State</b>	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.	<b>Fluid description of plasmas</b>	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.	<b>Nonlinear Waves in Plasmas</b>	Plasma oscillations, space charge waves of warm plasma, ion-acoustic waves and electromagnetic waves in magnetized plasma.	08
4.	<b>Diffusion and Resistivity</b>	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.	<b>Stability of fluid plasma</b>	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.	<b>Nonlinear effects</b>	Ponderomotive force, Parametric instabilities, decay instability, two plasmon decay, stimulated Raman scattering and stimulated Brillouin scattering, non linear Landau damping.	06
7.	<b>Controlled thermo-nuclear fusion</b>	Magnetic and inertial confinement schemes, ITER, TOKAMAK.	02
<b>Total number of Lectures</b>			<b>40</b>

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

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

## Course Description

<b>Course Code</b>	<b>20B12MA411</b>	<b>Semester</b> Even	<b>Semester:</b> 8th <b>Session:</b> 2021 -2022 <b>Month:</b> February – June
<b>Course Name</b>	<b>Multi Attribute Decision Making</b>		
<b>Credits</b>	3	<b>Contact Hours</b>	3-0-0
<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	Dr. Pankaj Kumar Srivastava	
	<b>Teacher(s) (Alphabetically)</b>	Dr. Dinesh C. S. Bisht and Dr. Pankaj Kumar Srivastava	
<b>COURSE OUTCOMES</b>			<b>COGNITIVE LEVELS</b>
After pursuing the above mentioned course, the students will be able to:			
<b>CO-1</b>	explain basic steps in decision analysis and decision-making environments.		Understanding Level (C2)
<b>CO-2</b>	apply group decision making methods to reach a collective decision.		Applying Level (C3)
<b>CO-3</b>	develop the concept of multi criteria decision making process and attributes.		Understanding Level (C2)
<b>CO-4</b>	apply elementary methods to solve multi attribute decision making problems.		Applying Level (C3)
<b>CO-5</b>	analyze value based and outranking methods to solve multi attribute decision making problems.		Analyzing Level (C4)
<b>Module No.</b>	<b>Title of the Module</b>	<b>Topics in the Module</b>	<b>No. of Lectures for the module</b>
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	Multi-attribute Decision Making, Multi Objective Decision Making, Decision Making Process, Structuring Process, Decision Matrix, Attributes, Normalization, Attribute Weight Assignment Methods.	8
4.	Elementary Methods for	Dominance Relation method, Even-Swap method, Lexicographic method Maximax method, Maximin	8



	MADM	method, Conjunctive method, Disjunctive method, Median Ranking, Analytic Hierarchy Process, Analytic Network Process.	
5	Value Based and Outranking Methods	Multi Attribute Value Theory, Simple Additive Weighting, Weighted Product, TOPSIS Outranking Methods.	11
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz and Assignments)	
<b>Total</b>		<b>100</b>	
Project based learning: Students are divided in a group of 4-5 to do a survey on the applications of classical and recent multi attribute decision making techniques in their respective branches. The student recognizes the multi attribute decision making problems arising in real life and solves these problems with the help of MADM techniques learnt in this course.			
<b>Recommended Reading material:</b> 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. <i>Multi-criteria decision analysis: methods and software</i> . John Wiley & Sons, 2013.		
2.	Xu, Zeshui. <i>Uncertain multi-attribute decision making: Methods and applications</i> . Springer, 2015.		
3.	Tzeng, Gwo-Hshiung, and Jih-Jeng Huang. "Multi Attribute Decision Making: Methods and Applications." <i>USA, CRC Press</i> . 2016.		

### Detailed Syllabus

<b>Course Code</b>	18B12BT414	<b>Semester</b> Even	<b>Semester VIII<sup>th</sup> Session 2021-2022</b> <b>Month from Jan - June</b>
<b>Course Name</b>	Machine Learning tools in Bioinformatics		
<b>Credits</b>	3	<b>Contact Hours</b>	3

<b>Faculty (Names)</b>	<b>Coordinator(s)</b>	1. Dr. Chakresh Kumar Jain
	<b>Teacher(s) (Alphabetically)</b>	1. Dr. Chakresh Kumar Jain

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

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

		data)	
4.	Basics of ANN and HMM	Fundamental of ANN, Back propagation algorithm, kNN, ANN model, Biological tools like PHD, Intron identifier, splice site prediction etc. Basics of HMM Stochastic algorithm, profile generation, Pfam, protein families, Gibbs sampling, Viterbi algorithm, tools evaluation	10
5.	SVM	Introduction to SVM. Feature selection, kernel methods, case studies(Bioinformatics application ; protein structure and function prediction , data mining in drug discovery etc.)	5
6.	Applications and tools	SVM_light, GIST server, applications of SVM, QSAR prediction, ADMET predictions, case studies, Protein coding region prediction, gene identification, folding problems in protein sequences, network analysis, RNAi Designing, PSORT, Genscan, HMMTOP, DAS, Genemark , Glimmer, etc., case studies	8
<b>Total number of Lectures</b>			<b>42</b>
<b>Evaluation Criteria</b>			
<b>Components</b>		<b>Maximum Marks</b>	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Assignment, Quiz, Case study, Project based evaluation)	
<b>Total</b>		<b>100</b>	
<b>PBL:</b> The course covers fundamentals of machine learning methods and tools with its applications into the biological problem. Further PBL component is helping students to familiarise the methods and tools with more explorations towards understanding the disease behaviour			

<b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)	
1.	Baldi, Pierre and Brunak, Søren “Bioinformatics: The Machine Learning Approach” , 2nd edition, Rajkamal Electric Press, Delhi, Pp 452. 2003.
2.	Cormen , Thomas H. “Introduction to Algorithms” , 2nd edition McGraw-Hill Science,Pp 1056, 2001
3	Yang, Zheng Rong, “ Machine :Learning Approaches to Bioinformatics”, New Delhi world Scientific, Pp 336, 2017
5	Research papers and manuals