Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC313	**Semester** Odd **(specify Odd/Even)**	**Semester V, Session** 2022 -2023 **Month from August to December**
Course Name	Microprocessors and Microcontrollers		
Credits	**3**	**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Mrs.Smriti Bhatnagar, Dr. Vimal Kr. Mishra
	Teacher(s) (Alphabetically)	Mrs.Smriti Bhatnagar, Dr. Vimal Kr. Mishra

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-1.1	Recall the basics of digital circuits, specifications and applications.	Remembering Level (C1)
C330-1.2	Familiarize with the basics of 8 bit, 16 bit and 32 bit microprocessor / Microcontroller, and its internal organization.	Understanding Level (C2)
C330-1.3	Use the knowledge of different instructions of 8085 microprocessor/ 8051 Microcontroller to write the various programs in assembly language.	Applying Level (C3)
C330-1.4	Interface the memory chips and peripheral chips, LED, LCD, Keyboard, Motor and Sensors with 8085 microprocessors and Micro controllers.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Digital Electronics & Microprocessor	Digital Circuit Parameters (Open collector outputs, Tristate outputs, I/O source and sink, Fan-in and Fan-out, Propagation delay, Figure of merit), Pipelining & Parallel Processing, Cache Memory, Memory Management, Virtual Memory System, Introduction to Microprocessors, Evolution of Microprocessor, Microprocessor Systems with Bus Organization, Concept of Memory & its internal Organization, Memory Expansion, Classification of Memories & their types.	6L
2.	Detailed Study of Microprocessor 8085	Features of 8085, Microprocessor Architecture in detail, Pin Diagram in detail, De-multiplexing Address & Data Bus, Generation of Control Signals, Interfacing with Memory & I/O Device with timing diagram, Instruction fetching, execution & data transfer operation, Programmer's Model & Instruction Set, Different Formats for Instruction, Opcode & Data, Addressing Modes, Complete Instruction Set (Data transfer, Arithmetic & Logical, Branch & Stack), Assembly language programming, Looping, Counting & Indexing techniques, Interrupt System of 8085, Polling & Interrupt, Basic definition of Interrupts, Interrupt Structure & their types, Masking/Unmasking of Interrupts, Interrupt	15L

		driven I/O, Microprocessor (8086, 80186, 80286, etc.), Architecture Advancement of *Programming Examples*	
3.	Detailed Study of 8051 Microcontroller	Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, Harvard Versus Von-Neumann architecture, 8051/8031/8052 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and I/O ports), Assembly language programming (addressing modes and instruction set), Timers and Interrupts, Serial Communication, *Programming Examples.*	12L
4.	Real World Interfacing with Microcontroller	Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button, LED & 7-segment display, Intelligent LCD Display, Interfacing of intelligent LCD display, Interfacing of Matrix Keyboard to control 7-segment display, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Relay Interfacing, Different Sensor Interfacing, IR & LDR Sensor, DTMF, 8255 PPI Chip (Pin Configuration, Block Diagram, Operating Modes, Memory Mapped I/O & I/O Mapped I/O), Application of 8255 - 7 segment, Traffic Light Controller etc.	10L
		Total number of Lectures	**43 L**

Evaluation Criteria

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

Program Based Learning: Students will be able to design and implement the real time hardware, sensors, keyboards, display devices and DC/AC motors etc with the help of assignments. Additionally, this course is foundation course for Robotics and Embedded system Applications. Students in group sizes of two-three can utilize the knowledge of this course for many Minor and Major Projects.

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.	Muhammad Ali Mazidi, "The 8051 microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education, 2008.
2.	R. S. Gaonkar, "Microprocessor Architecture Programming & Applications", Prentice Hall, 2002.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**17B1NEC735**	**Semester Odd**	**Semester V Session 2022-23** **Month from August- December**
Subject Name	**Information Theory and Applications**		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Bajrang Bansal, Dr. Alok Joshi
	Teacher(s) (Alphabetically)	Dr. Bajrang Bansal, Dr. Alok Joshi, Ms. Jyoti Vyas

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-3.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding Level (C2)
C330-3.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyzing Level (C4)
C330-3.3	Analyze the relationship between bandwidth and capacity of communication channels and its importance in real life communication systems.	Analyzing Level (C4)
C330-3.4	Analyze the need for channel coding in digital communication systems.	Analyzing Level (C4)
C330-3.5	Generate error correcting codes for error detection and correction.	Analyzing Level (C4)

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	3
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	5
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon's fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission and storage. Types of codes. Modulation and coding. ML decoding. Performance measures.	3
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and	8

		syndrome decoding. Hamming codes.	
7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes- the Viterbi algorithm.	8
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning: Students will learn about the design and implementation of compression algorithms as well as error-correcting codes with the help of assignments. Additionally, students in group sizes of two-three will prepare a review on any one application of Information Theory**.**

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.B. ASH: Information Theory, Dover, 1990.
2.	R. BOSE: Information theory, coding and cryptography, Mcgraw Hill 2016.
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2010.
4.	S. LIN & D.J. COSTELLO: Error Control Coding, 2nd Edn, Pearson, 2011.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B11EC312	**Semester** Odd **(specify Odd/Even)**	**Semester V Session 2022-23 Month from August- December**
Course Name	Electromagnetic Field Theory		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Neetu Joshi, Ashish Gupta
	Teacher(s) (Alphabetically)	Bhagirath Sahu, Jasmine Saini, Monika, Raghvendra Kumar Singh, Reema Budhiraja

COURSE OUTCOMES		**COGNITIVE LEVELS**
C312.1	Recall concepts of vector calculus to solve complex problems and relate among different coordinate systems. Explain the basic principles of electrostatics and magnetostatics and relate the electric and magnetic fields using Maxwell's Equations.	Understanding Level (C2)
C312.2	Illustrate the propagation of electromagnetic waves in different medium and their reflection and transmission parameters. Distinguish among different wave polarizations.	Applying Level (C3)
C312.3	Estimate the current, voltage and power for the different types of transmission lines, determine reflection parameters. Demonstrate the Waveguide theory, Wave equations, and evaluate different waveguide parameters.	Evaluating Level (C5)
C312.4	Classify and compare the different parameters associated with the antenna and also interpret the radiation mechanism.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introductory material	Review of scalar, vector fields and coordinate systems (cylindrical and spherical coordinate) Electrostatic and Magneto static Fields	8
2.	Maxwell's Equations	Inconsistency of Amperes law, Continuity equation, Displacement current, Maxwell's equations, Boundary conditions.	4
3.	Electromagnetic Waves	Wave propagation in free space, Conductors and dielectrics, Polarization, Plane wave propagation in conducting and non conducting media, Phase velocity, Group velocity; Reflection at the surface of the conductive medium, Surface Impedance, Depth of penetration.	11
4.	Poynting Vector and Power	Poynting theorem, Poynting Vectors and power loss in a plane conductor.	2
5.	Transmission Lines	Transmission line equations, characteristic impedance, open and short circuited lines, standing wave and reflection losses. Impedance matching.	7
6.	Wave guides	Rectangular wave guides Modes in rectangular coordinates, characteristics, power transmission and losses.	6
7.	Radiation and Antennas	Scalar and vector potentials. Radiation from a current filament, Antenna characterstics, radiation pattern, radiation intensity, directivity and power gain.	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 to derive the wave equations of waveguide which will help them to design the rectangular waveguide for any operating frequency in the X-Band. They will be also able to conduct different experiments based on the waveguide and subsequently design on the EDA tools such as HFSS. They will also study the different antenna parameters which will enable them for design various kind of Antennas on EDA Tools. It will make them enable to make different projects to cope up with the current challenges.

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.N.O. Sadiku, S.V. Kulkarni, *Principles of Electromagnetics*, Oxford Press, 6th Edition, 2016.
2.	W. H. Haytt, J.A. Buck, M. J. Akhtar, *Engineering Electromagnetics*, McGraw Hill Education, 8th Edition, 2014.
3.	S. Salivahanan, S. Karthie, *Electromagnetic Field Theory*, McGraw-Hill Education, 2nd Edition, 2019.
4.	C.A. Balanis, Advanced Electromagnetics, Wiley Publishers, 2nd Edition, 2012.
5.	S.C. Mahapatra, S. Mahapatra, *Principles of Electromagnetic*, McGraw Hill Education, 2nd Edition, 2015.
6.	A.R. Harish, M.Sachidananda, Antennas and Wave Propagation, Oxford University Press, 2015.

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15EC312	**Semester Odd (specify Odd/Even)**	**Semester V Session 2022-23 Month from August- December**
Course Name	Electromagnetic Field Theory Lab		
Credits	**1**	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Reema Budhiraja, Bhagirath sahu
	Teacher(s) (Alphabetically)	Jasmine Saini, Monika,Neetu Joshi, Rahul kaushik,Raghvenda Kumar Singh, Vishal Narain Saxena

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	To observe electromagnetic wave propagation in X-band waveguide and draw the dispersion curves. To simulate a rectangular waveguide and calculate its cut-off frequency.	Understanding (Level II)
CO2	Calculate and evaluate the various parameters such as VSWR and load impedance of transmission lines.	Applying (Level III)
CO3	Measure the microwave power in Gunn oscillator, directional coupler and also measure the radiation patterns of the antenna.	Evaluating (Level V)
CO4	Design and simulate the different antenna parameters using HFSS software and verify with the measured results.	Create (Level VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Rectangular Waveguide Parameters	Study, Design and Modelling of the Rectangular Waveguide on ANSYS Electronics Desktop 2019.	**1**
2.	Rectangular Waveguide Parameters	Plot the different parameters of the designed Rectangular Waveguide and optimize with the help of parametric study for the designed Rectangular Waveguide on ANSYS Electronics Desktop 2019.	**2**
3.	Rectangular waveguide	To determine the frequency and wavelength in a rectangular waveguide working in TE10 mode.	**3**
4.	Rectangular waveguide	Determine experimentally the broader dimension of rectangular waveguide using microwave test bench at X-band of microwave frequency.	**1**
5.	Measurement	Determine experimentally the propagation characteristics of Magic Tee operating in X-band using microwave test bench .	**3**
6.	I-V characteristics of a Gunn-Diode	To study Gunn Oscillator as a source of microwave power and hence to study and plot its I –V characteristics. Gun diode	**3**
7.	Microstrip-feed Rectangular Microstrip Antenna	Study, Design and Modelling of the Microstrip-feed Rectangular Microstrip Antenna on ANSYS Electronics Desktop 2019.	**4**

8.	Microstrip-feed Rectangular Microstrip Antenna	Plot the different parameters of the designed antenna and optimize with the help of parametric study for the designed Rectangular Microstrip Antenna on ANSYS Electronics Desktop 2019.	**4**
9.	Measurement of Input parameters of the antenna	Measurement of Input parameters of an Antenna using Vector Network Analyzer.	**4**
10.	Radiation Pattern	To plot and study the radiation pattern of Dipole and Yagi antenna.	**3**

Evaluation Criteria

Components	**Maximum Marks**
Viva 1(Mid Sem Viva)	20
Viva 2(End Sem Viva)	20
Assessment Components	30
Attendance	15
Lab Record	15
Total	**100**

Project Based Learning: Students will learn to design a rectangular waveguide for a given frequency range and to study the configuration of Electric and Magnetic waves. They can also analyze the different modes for a given rectangular waveguide and operating frequency. They designed microstrip and dipole antenna. They understood parameters optimization of dipole antenna to get good band width.

They will be able to operate and characterize different microwave devices such as Gunn Diode, Directional Coupler, magic tee etc. Students can also plot and measure the radiation patterns of the given antennas. Most importantly students will be able to simulate and characterize the designed antennas and waveguides with the help of ANSYS Electronics Desktop 2019 tool. After designing and subsequent fabrication, antennas can be measured using vector network analyzer available in the lab. Thus, students can make different projects by using the knowledge gained from the mentioned experiments.

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.N.O. Sadiku, S.V. Kulkarni, *Principles of Electromagnetics*, Oxford Press, 6th Edition, 2016.
2.	C.A. Balanis, Advanced Electromagnetics, Wiley Publishers, 2nd Edition, 2012.
3.	A.R. Harish, M.Sachidananda, aAntennas and Wave Propagation, Oxford University Press, 2015.

Detailed Syllabus
Lab-wise Breakup

Course Code	**18B15EC313**	**Semester: Odd**	**Semester: Vth Session** 2022-23 **Month from: August-December**
Course Name	**Embedded Systems and IOT Lab**		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Mr. Abhay Kumar, Dr. Shamim Akhter
	Teacher(s) (Alphabetically)	Dr. Gaurav Verma, Dr. Madhu Jain, Dr. Rachna Singh, Dr. Ruby Beniwal, Dr. Shruti Kalra, Dr. Vimal K.Mishra

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	**Recall** the basic of digital electronics and relate its use in microprocessors and microcontrollers.	Remembering (Level C1)
CO2	**Relate** the architecture of Microprocessors and Microcontrollers and its requirements in the area of embedded system and IOT with the help of algorithm.	Understanding (Level C2)
CO3	**Apply** the skills and proficiency in the programming to demonstrate the use of instructions in microprocessors, microcontrollers and IOT Devices.	Applying (Level C3)
CO4	**Analyze** the use of assemblers, cross compilers and real time hardware to program the microprocessors, microcontrollers, IOT boards and achieve the real time solutions to the problem.	Analyzing (Level C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	8085 Microprocessors	To perform addition and subtraction of two 8-bit numbers using 8085 microprocessor.	1,2,3
2.	8085 Microprocessors	To perform multiplication & division of two 8-bit numbers using 8085 microprocessor.	1,2,3
3.	8051 Microcontrollers	Familiarization with 8051 Software Tools (Proteus & Keil) through examples of: a. LED Blinking. b. Varying square wave generation on any pin (without timers).	2,4
4.	8051 Microcontrollers	Design a token display system that has a seven segment display and switches. Whenever any switch is pressed the corresponding number is displayed on the segment.	3,4
5.	8051 Microcontrollers	Design a traffic light controller system that has three LEDs – RED, YELLOW, GREEN. The sequence in which the LEDs are turned on is as follows: RED for 10 count, YELLOW for 5 count, GREEN for 10 count. Interface a light-dependent resistor (LDR) to select manual and automatic mode using interrupt.	3,4
6.	8051 Microcontrollers	Display a) JIIT on LCD b) Sum of two 8 bit numbers on LCD.	3,4
7.	8051 Microcontrollers	Design an IOT based system using ESP8266 for controlling of home appliances	3,4
8.	8051 Microcontrollers	Familiarization with NodeMcu /ARDUINO board/ESP8266 through examples of LED Blinking.	3,4
9.	8051 Microcontrollers	Design an IOT based system to sense the humidity and temperature using DHT11 sensor and send it to cloud.	3,4

10.	8051 Microcontrollers	Controlling of different household devices using an Android based application through bluetooth communication and microcontroller.	3,4
11.*	8085 Microprocessors	To find out the smallest & largest number in an array of 'N' 8-bit numbers using 8085 microprocessor.	1,2,3
12.*	8051 Microcontrollers	Establish the serial communication between PC and microcontroller using RS232 protocol to send and receive the data.	3,4
13.*	8051 Microcontrollers	Interface a DC motor and two IR sensors with the microcontroller. The IR sensors are used to control the direction of rotation of the motor.	3,4
14.*	8051 Microcontrollers	Design a RFID based attendance system using LCD and microcontroller.	3,4
15.*	8051 Microcontrollers	Design a DTMF based wireless system using microcontroller for controlling of home appliances.	3,4
Project Based Learning Component: The lab will teach IoT based system design using boards like Arduino and ESP8266. The lab will introduce interfacing techniques for sensors, display devices e.t.c. It will also teach effective embedded programming techniques in C using Keil cross compiler.			

Evaluation Criteria

Components	**Maximum Marks**
Viva 1(Mid Sem Viva)	20
Viva 2(End Sem Viva)	20
Assessment Components	20
Attendance	15
Lab Record	15
Virtual Lab Exps.	10
Total	**100**

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

1.	Manish k. Patel, "The 8051 Microcontroller Based Embedded Systems", 1st Edition, McGraw Hill Education, 2014.
2.	DivyahBala, ESP8266: Step by Step Tutorial for ESP8266 IOT, Arduino Nodemcu Dev Kit, 2018.

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15EC314	**Semester: Odd (specify Odd/Even)**	**Semester V Session 2022-23 Month from August to December**
Course Name	Python for Signal processing and Communication		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Richa Gupta, Jyoti Vyas
	Teacher(s) (Alphabetically)	Vivek Dwivedi, Alok Joshi, Kapil Dev Tyagi, Pankaj Kumar Yadav, Juhi Gupta, Parul Arora, Garima Kapur.

COURSE OUTCOMES: At the completion of the course, students will be able to:		**COGNITIVE LEVELS**
C310. 1	Understand applications of Python in signal processing and communication.	Understanding Level (C2)
C310.2	Apply Python for implementing signal operations and transformations on 1-D signals.	Applying Level (C3)
C310.3	Apply Python for implementing signal operations and transformations on images.	Applying Level (C3)
C310.4	Analyze the different blocks of communication systems using Python.	Analyzing Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Python	Introduction to Python and its various applications.	C310.1
2.	Signals	Generating Continuous and Discrete time signals.	C310.1
3.	DT Convolution	To calculate the convolution sum of two discrete time signals.	C310.2
4.	Signal Transformations	Writing codes to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	C310.2
5.	Signal Operations	Writing codes for generating various signal operations.	C310.2
6.	Data Wrangling	To transform raw data to a clean and organized format ready for use.	C310.1
7.	Image Data	To read, write, display and explore image data.	C310.3
8.	Image Enhancement	To perform image enhancement in spatial domain.	C310.3
9.	Sampling	Analysis of sampling techniques.	C310.4
10.	Pulse Code Modulation	To perform pulse code modulation and demodulation.	C310.4
11.	Digital Modulation Techniques	Analysis of digital modulation techniques.	C310.4
12	Linear and Logistic Regression	To implement Linear Regression for prediction and Logistics Regression for classification.	C310.2

13.	Virtual Lab 1	To learn file operations in Python	C310.1
14.	Virtual Lab 2	To learn the concepts of Constructor and Inheritance in Python programming language. To implement those concepts in solving a simple problem in the simulator.	C310.1

Evaluation Criteria

Components	**Maximum Marks**
Viva 1(Mid Sem Viva)	20
Viva 2(End Sem Viva)	20
Assessment Components	30
Attendance and Discipline	15
Virtual Lab	05
Report	10
Total	**100**

Project based learning: Students will learn handling of digital images which can be extended in exploring different modules of digital image processing like image enhancement, image segmentation, morphological image processing and applications, and these fundamentals can be used in minor and major projects.

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.	J. UNPINGC310.: Python for Signal Processing, Springer International Publishing Switzerland, 2014.
2.	M. WICKERT: Signal Processing and Communications: Teaching and Research Using IPython Notebook, In Proc. of the 14th python in science conf., (scipy. 2015).
3.	B. P. LATHI: Modern Digital and Analog Communication System: Python textbook Companion, Oxford University Press Inc.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**20B12EC211**	**Semester Odd**	**Semester V Session 2022-23** **Month from August to December**
Subject Name	**Introduction to Digital Image and Video Processing**		
Credits	**3**	**Contact Hours**	**3**

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

COURSE OUTCOMES Upon completion of the course, the student will be able to:		**COGNITIVE LEVELS**
C330-2.1	Understand the image formation model, digital image display science and storage formats.	Understanding [C2]
C330-2.2	Apply and analyse image transformations for the processing in different domains.	Analysing [C4]
C330-2.3	Apply image enhancement or image restoration to improve or restore the quality of the image for various applications such as bio-medical image processing.	Analysing [C4]
C330-2.4	Analyse video and apply processing on Videos for enhancement and restoration.	Analysing [C4]
C330-2.5	Apply compression algorithms and analyse the effect of compression on various parameters of image and video.	Analysing [C4]

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Human visual system and Image perception	Image sensing and acquisition visual perception, Noise in images,	3
2.	Image digitization, Display and Storage	Image sampling and quantization, Pixel connectivity	3
3.	Image Transforms	Unitary transforms, 2D DFT, DCT, KL and Harr transform.	5
4.	Image analysis	Edge and line detection, Hough transform, segmentation, feature extraction, classification image texture analysis, Color models and color image processing.	7
5.	Image Enhancement	Gray level transformation, histogram processing, Smoothing and sharpening spatial Filters, Smoothing and sharpening frequency domain filters.	7

6.	Image Restoration	Linear degradation model, inverse and Wiener filtering.	5
7.	Video Display and Storage	Principle of color video camera, video camera, digital video, Sampling of video Signals, Video Frame classifications, I, P and B frames, Digital Video formats	3
8.	Video Processing	Introduction to Video analysis, enhancement and restoration.	5
9.	Image and Video Compression	Lossless and Lossy compression standards, Image/Video Quality parameters	4
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning – This course provides practical exposure to digital image and video processing methods such as enhancement, restoration, noise reduction, compression and transformation etc. The students are trained for various methods of image transformation and their characteristics. Students are thereby able to apply the concepts in practical applications like motion blurring and compression.

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.C. GONZALEZ & R.E. WOODS: Digital Image Processing, 3rd ed. Pearson Education Ltd, 2008.
2.	W.K. PRATT: Digital image processing: PIKS scientific inside, John Wiley, 2007.
3.	A. K. JAIN: Fundamentals of Digital Image Processing, Information and System Sciences Series, Prentice Hall, 1989.
4.	A. M. TEKALP: Digital Video Processing, Signal Processing Series, Prentice Hall, 1995.
5.	J.W. WOODS: Multidimensional Signal, Image and Video Processing and Coding, 2nd ed. Academic Press, 2012.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B19EC591	**Semester** Odd **(specify Odd/Even)**	**Semester:** 5th **Session:** 2022 -2023 **Month:** Aug 22- December 22
Course Name	Minor Project - I		
Credits	2	**Contact Hours**	NA

Faculty (Names)	**Coordinator(s)**	Mr. Ankur Bhardwaj, Dr. Bhartendu Chaturvedi, Mr. Ritesh kr. Sharma
	Teacher(s) (Alphabetically)	Mr. Ankur Bhardwaj, Dr. Bhartendu Chaturvedi, Mr. Ritesh kr. Sharma

COURSE OUTCOMES: At the completion of the course, students will be able to:		**COGNITIVE LEVELS**
C350.1	Identifying, planning and initiation of the individual projects in the domain selected by them, respectively.	Applying Level (C3)
C350.2	Analyze the potential research areas in the field of Embedded Systems, Signal Processing, VLSI, Communication, Artificial Intelligence and Machine Learning/Deep Learning etc.	Analysing Level (C4)
C350.3	Survey the available literature and gain knowledge of the State-of-Art in the chosen field of study.	Analysing Level (C4)
C350.4	Evaluate the existing algorithms of the domain selected and improvise the algorithm so that it yields better results than the existing metrics.	Evaluating Level (C5)
C350.5	Design and implement a working model, using various hardware components, which works as a prototype to showcase the idea selected for implementation.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid Semester Evaluation	40
End Semester Evaluation	40
Report	20
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI518	**Semester:** ODD	**Semester:** V **Session:** 2022-2023 **Month from** Aug '22 to Dec '22
Course Name	Data Structures & Algorithms		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shardha Porwal(62), Akanksha Mehndiratta(128)
	Teacher(s) (Alphabetically)	Dr. Raju Pal, Dr. Manju

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Apply fundamental operationson data structures such as linked-lists, trees, binary search trees, AVL trees, heap trees, graphs, and hash-tables.	Apply Level (Level 3)
CO2	Analyze and compare different sorting and searching algorithms	Analyze Level (Level 4)
CO3	Identify suitable data structure and develop solution for the given problem.	Apply Level (Level 3)
CO4	Formulate solutions for programming problems or improve existing code using algorithms such as, Backtracking, Branch and Bound, Greedy algorithm and Dynamic programming.	Apply Level (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to data structures, lists, Doubly linked list, circular linked list, multi linked list, Applications - sparse matrix representation, Stacks – implementation (array and linked list based) and applications, Queues: linear, and queue applications, circular, deque – implementation and applications;	11
2.	Algorithm Complexity	Abstract data type, Growth of function, Space-Time tradeoffs, Complexity analysis of algorithms - Asymptotic analysis	2
3.	Sorting & Searching	Searching – Linear, and binary search; Sorting – bubble, insertion, and selection, Merge Sort, Quick sort, Count sort, Bucket Sort	6
4.	Trees	Binary Tree, Binary Search tree, AVL Tree	7
5.	Heaps	Introduction to heaps, Binary heap	2
6.	Graph	Introduction to graphs, Representation – adjacency list, adjacency matrix, Traversal – BFS, DFS, Minimum spanning tree – Prims and Kruskal's algorithm,	4
7.	Hashing	Introduction to hashing, Collision resolution – open and closed hashing methods	3
8.	Algorithm	Introduction to Backtracking Algorithm (N-Queen), Branch and Bound, Greedy algorithm, Problems on Greedy	7

		algorithm (Fractional Knapsack), Dynamic programming, Problems on Dynamic Programming (0-1 Knapsack, Longest Common Subsequence) Graph Algorithms- Shortest path using Dijkstra algorithm and Floyd–Warshall algorithm	
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = 07, Class Test/Quiz= 07, Internal assessment = 05
Assignments in PBL mode = 06)	
Total	**100**

Project based learning: In project based learning students are required to make group of 4 in which they will implement application of any or combination of data structures and apply a suitable algorithm that they have learned during the course of semester. Application of data structure on any given problem not only enhance comprehensive understand but also improves problem solving aptitude. As a consequence employability of student increases in IT sector

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.

Text Books

1.	Data Structures and Algorithms in C++, Adam Drozdek, Cengage Learning; 4th edition (2012)
2.	Data Structures and Algorithms Made Easy, by NarasimhaKarumanchi, CareerMonk Publications; 5th edition (2016)
3.	An Introduction to Data Structures with Application, by Jean-Paul Tremblay , Paul Sorenson, McGraw Hill Education; 2 edition (2017)

References

1.	YedidyahLangsam, Moshe J., Augenstein and Aaron M. Tenenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2001
2.	Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984
3.	Dinesh P Mehta, SartajSahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004
4.	Mark Allen Weiss: Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson
5.	Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005
6.	Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002
7.	Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003
8.	Cormen et al: Introduction to Computer Algorithms, 2nd edition , PHI New Delhi 2003
9.	Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001
10.	Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000
11.	Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition , Pearson Education Asia (Adisson Wesley), New Delhi, 2002

Detailed Syllabus
Lecture-wise Breakup

Subject Code	15B17CI578	**Semester:** ODD	**Semester:** V **Session:** 2022-2023 **Month from** Aug'22 to Dec'22
Subject Name	Data Structures & Algorithms Lab		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Manju, Dr. Raju pal
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati, Dr Akansha Bhardwaj, Dr.Ankita Verma, Dr. Manju, Dr. Raju pal, Dr. Surendra Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C371.1	Demonstrate the use of basic data structure and algorithm design such as Linked lists, Stacks, Queues, and others, for various applications.	Understand Level (C2)
C371.2	Interpret the complexity of algorithms for given problems.	Understand Level (C2)
C371.3	Apply Searching, Sorting, and Trees and use their properties for abstractions and defining modules for implementing functionalities.	Apply Level (C3)
C371.4	Examine case-study specific application of Heaps, Graphs, and Hashing methods.	Apply Level (C3)
C371.5	Model algorithmic solutions for small real-life problems using Backtracking, Greedy algorithm and Dynamic programming, Branch and Bound, and others	Apply Level (C3)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction & Algorithm Complexity	**Lab Assignment 1:** Conversion from one number system to another; Manipulation with arrays and strings, structures; **Lab Assignment 2 and 3:** Manipulation with a single , circular and double Linked lists of integers; **Lab Assignment 4:** Stacks and Queues Finding Complexity: Big O, Big Omega Cost Analysis	CO1, CO2, Understanding Level (C2)

2.	Sorting, Searching & Trees	**Lab Assignments 5 and 6**: Sorting, Searching, Application based. **Lab Assignments 7, 8, 9**: Binary Tree, Binary Search Trees, AVL Tree, Case-study: Priority Queue with Binary Trees	CO1 Understanding Level (C2) CO3 Apply Level (C3)
3.	Heaps, Graph	**Lab Assignments 10:** Heaps **Lab Assignment 11 and 12**: Directed and undirected graphs, weighted graphs, etc.	CO4 Apply Level (C3)
4.	Hashing & other Algorithms	**Lab Assignments 13:** Hashing, Backtracking, Branch and Bound, Greedy Algorithms, Dynamic Programming.	CO5 Apply Level (C3)

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
Day-to-Day Evaluations	15
Mini-Project	15
Day-to-Day - Attendance	15
Assignment	15
Total	**100**

Project Based Learning: The students in a group of 3- 4 are required to submit a project based on either real-world data or a real-time application. For the data or application chosen, the students need to analyze appropriate data structure for the arrangement of data so that it can be accessed and worked on with specific algorithms more effectively. Selecting the appropriate setting for your data is an integral part of the programming and problem-solving process. Data structures organize abstract data types in concrete implementations. To attain that result, they make use of various algorithms, such as sorting, searching, etc. The project typically incorporates various data structure concepts to enable the synthesis of knowledge from real-life experiences.

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	Data Structures and Algorithms in C++, Adam Drozdek, Cengage Learning; 4th edition (2012)
2	Data Structures and Algorithms Made Easy, by Narasimha Karumanchi, CareerMonk Publications; 5th edition (2016)
3	An Introduction to Data Structures with Application, by Jean-Paul Tremblay , Paul Sorenson, McGraw Hill Education; 2 edition (2017)
4	Yedidyah Langsam, Moshe J., Augenstein and Aaron M. Tenenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2001
5	Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984

6	Dinesh P Mehta, Sartaj Sahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004
7	Mark Allen Weiss: Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson
8	Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005
9	Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002
10	Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003
11	Cormen et al: Introduction to Computer Algorithms, 2nd edition , PHI New Delhi 2003
12	Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001
13	Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000
14	Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition , Pearson Education Asia (Adisson Wesley), New Delhi, 2002
15	Heileman: Data Structures, Algorithms and Object Oriented Programming, Tata Mc-Graw Hill, New Delhi, 2002
16	Sorenson and Tremblay: An Introduction to Data Structures with Algorithms, 2nd Edition, Tata Mc-Graw Hill, New Delhi, 2003

Detailed syllabus
Lecture-wise Breakup

Subject Code	**16B1NHS432**	**Semester: ODD**	**Semester V Session 2022-2023 Months: from August to December**
Subject Name	**POSITIVE PSYCHOLOGY**		
Credits	**3**	**Contact Hours**	**(3-0-0)**
Faculty (Names)	**Coordinator(s)**	**Dr. Badri Bajaj**	
	Teacher(s) (Alphabetically)	**Dr. Badri Bajaj**	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Demonstrate an understanding of the various perspectives of positive psychology and apply them in day-to-day life	Apply Level (C3)
CO2	Examine various theories and models of happiness, well-being and mental health	Analyze Level (C4)
CO3	Recommend possible solutions for enhancing happiness, well-being and mental health	Evaluating Level (C5)
CO4	Evaluate interventions/strategies for overall positive functioning	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Positive Psychology	Overview, Perspectives, Classification and Measures: Human Strengths and Positive Outcomes.	**6**
2.	Prosocial Behavior	Empathy and Egotism; Altruism, Gratitude, and Forgiveness.	**6**
3.	Positive Emotions and Wellbeing	Emotional and Cognitive States; Focus on Application: Finding the positive in the Negative; Positive Emotions & Well-Being; Positive Emotions & Flourishing; Flow Experiences	**6**
4.	Happiness	Happiness and its Traditions; Determinants- Subjective Well-Being Hedonic Basis of Happiness; Life Satisfaction; Self –Realization: The Eudaimonic Basis of Happiness Happiness and Emotional Experiences; Other Facts of Life-Work & Unemployment; Intelligence; Education; and Religion.	**6**

5.	Mental Health	Mental Health and Behavior; Prevent the Bad and Enhance the Good.	**6**
6.	Positive Environments	Positive Schooling, Good at Work, Balance Between ME and WE.	**6**
7.	Living Well	Mindfulness; Contours of a Positive Life: Meaning & Means; Cultural Context, Every Stage of Life, Resilience, Positive Youth Development, Life Tasks of Adulthood, Successful Aging.	**6**
Total number of Hours			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Oral Questions, Attendance)
Total	**100**

Project based learning: Each student will think of some personal and professional goals. The student will apply the learnings from the course topics from the first four modules and make and execute plan for achievement of their goals. Each student can take help from any other student in the class. Each student will make a presentation in the class and will also submit a project report.

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.	Snyder, C.R., Lopez, S. J., & Pedrotti, J.T. *Positive Psychology: The Scientific and Practical Explorations of Human Strengths*, 4th Ed., Sage Publications, 2018.
2	Steve, B., & Marie, C. *Positive psychology*, 1st Ed., Pearson Education India, 2014.
3.	Boniwell, I., & Tunariu, A. D., *Positive Psychology: Theory, Research and Applications*, 2nd Ed., McGraw-Hill Education, 2019.
4.	Zelenski, J., *Positive Psychology: The Science of Well-being*, 1st Ed., Sage Publications, 2019.
5.	Snyder, C. R., Lopez, S. J., Edwards, L. M., & Marques, S. C. (Eds.), *The Oxford handbook of positive psychology*. 1st Ed., Oxford university press, 2020.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS433**	**Semester: Odd**	**Semester: V Session** 2022-2023 **Month from: August to December**
Course Name	Financial Management		
Credits	3	**Contact Hours**	3 (3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr.SakshiVarshney, Dr.Shirin Alavi
	Teacher(s) (Alphabetically)	Dr.SakshiVarshney, Dr.Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-3.1	Understand the fundamental concepts of Financial Management and Analyze the time value of money in taking investment decisions.	Analyze (Level 4)
C303-3.2	Contrast the various forms of business organizations, evaluate the sources of funds and measure their financial performance through ratio analysis.	Evaluate (Level5)
C303-3.3	Evaluate investment projects using capital budgeting techniques.	Evaluate (Level5)
C303-3.4	Apply the concept of cost of capital into evaluation of investment projects	Apply (Level 3)
C303-3.5	Evaluate the leverage capacity of a business and its application in selection of Longterm sources of finance.	Evaluate (Level5)
C303-3.6	Understand the practical considerations for managing working capital requirement in a firm.	Understand (Level 2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Basic financial concepts-Meaning of Accounting, Accounting Concepts and Conventions, Introduction to Double Entry system and Accounting equation, Definition and Objectives of Financial management,	4
2.	Time value of Money	Compounding, Discounting, Annuity, Perpetuity, Loan Amortization	5
3.	Analysis of Financial Statements	Understanding of Balance Sheet and Income Statements, Ratio Analysis, Interpretation, Importance and limitations	5
4.	Capital Budgeting: Principle Techniques	Nature of Capital Budgeting, Evaluation Techniques: Discounting (NPV, IRR etc.) and Non-discounting Techniques (payback, ARR etc)	6
5.	Long Term Sources of Finance	Definition, types, advantages and disadvantages	4
6.	Concept and measurement of cost of capital	Definition, measurement of specific costs, computation of Overall Cost of Capital,	5
7.	Cash Flows for Capital Budgeting	Identification and determination of relevant cash flows	5
8.	Leverages and Capital structure decision and Working Capital Management	Break Even Analysis, Operating, Financial and combined leverage, Capital structure EBIT- EPS analysis, Concept ofworkingcapitalmanagement,PracticalConsiderations in Working capital management, Evils of Excess or Inadequate Working Capital, Cash Management – Receivables Management – Inventory Management	8

		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project+ Quiz+ Class participation)
Total	**100**

Project based learning: Each student in a group of 4-5 will opt a company which is listed in at least one of the stock exchanges of India.To make subject application based, the students analyze latest financial data and other information of last two years of chosen company by the financial tool of Ratio analysis and use this financial data for decision making. UnderstandingBalance Sheet and financial statements of the business firm enhances the student's knowledgeon organisational structure of the firm and financial analysis helps theiremployability into financial sector.

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.	Chandra, P., *Financial Management Theory and Practice*, 7th ed., Tata McGraw Hill, 2007.
2.	Horne, J.C.V. and Wachowicz, J.M. Fundamentals of Financial Management, 13th ed., Pearson Publication, 2009. Accessed online: https://wps.pearsoned.co.uk/ema_uk_he_wachowicz_fundfinm an_13/106/27149/6950308.cw/-/6950310/index.html
3.	Khan, M.Y. and Jain, P.K. Financial Management: Text, Problems and Cases, 8th ed., McGraw Hill Education, 2019.
4.	Kishore, R.M., *Financial Management*, 6th ed, Taxmann, 2007.
5.	Mukherjee,M and Hanif.M., Financial accounting, 8th ed., Tata McGraw Hill,2008.
6.	Pandey, I.M., Financial management, 11th ed, Vikas Publishing House Pvt Ltd, 2015

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Detailed Syllabus
Lecture-wise Breakup

Subject Code	16B1NHS434	**Semester: ODD**	**Semester: V Session: 2022-23** **Month: August - December**
Subject Name	**Introduction to Contemporary Form of Literature**		
Credits	**3**	**Contact Hours**	**3 (3-0-0)**

Faculty (Names)	**Coordinator(s)**	**Dr. Debjani Sarkar**
	Teacher(s) (Alphabetically)	**Dr. Debjani Sarkar**

Course Outcomes:

	Course Outcome	**COGNITIVE LEVELS**
C303-6.1	Interpret & relate with the genres, periods, and conventional as well as experimental forms of literature as current ethical, technological and cultural reflections of society.	Understand Level C2
C303-6.2	Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society.	Apply Level C3
C303-6.3	Analyze select representative texts of different cultures thematically and stylistically.	Analyse Level C4
C303-6.4	Determine the reciprocal relationship between the individual and culture individually and/or through a research-based paper.	Evaluate Level C5
C303-6.5	Create literary, non-literary write-up with proper applied grammar usage, individually and in a team.	Create Level C6

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Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Hours for the module**
1.	**Introducing Literary Theories**	• From Formalism to Reader Response Theory: Major Terms & Concepts • Narrative Art & Narratology • Language & Style: An Introduction	12
2.	**Introducing New Forms & Sub Genres Today: Features & Portions**	• New Fiction: Graphic Novels, Cyberpunk • Non-Fiction: Memoirs & Autobiographies,	4

		Biographies	
3.	**Modern Retellings/ Children's Literature**	*Cinderella* (Poem) - Roald Dahl	3
4.	**European Lit./Travel/ Memoir/ Spiritual Literature**	*Eat, Pray & Love (Travelogue& cinematic adaptation)*	4
5.	**Written Communication Through Non-Fiction**	*Personal Narratives (Diary, Blog, Memoirs, Travelogue)*	4
6.	**Commonwealth / Indian Literature**	*Hayavadana(Short Play)*- Girish Karnad	4
7.	**Afro-American Lit/ Post Colonial Literature**	*Sweetness (Short Story)* – Toni Morrison	3
8	**Sci-fi (Cyberpunk)**	*Neuromancer (Science Fiction) – William Gibson*	4
9	**Canadian Literature/ Speculative Fiction**	*The Penelopiad- Margaret Atwood*	4
Total number of Hours			**42**

Project Based Learning: Students will be required form groups of 4-5 and write a research article on a chosen text (novel, short story, drama, poetry, prose or film) and analyze it through one/or more of the following theoretical perspectives including Reader response theory, Structuralism and Post-structuralism, Narratology etc. The objective of this project would be to help students understand the textual, socio-political and cultural dimensions of literature and its imitation of life. It would also enhance the thinking and analytical skills of the students.

Evaluation Criteria

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

Recommended Reading material:

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.H. Abrams, 'A Glossary of Literary Terms'. Hienle&Hienle: Thomson Learning, USA, 2021.
2.	Mark William Roche, 'Why Literature matters in the 21st Century', 1st Edition, Yale University Press, 2004.
3	https://allpoetry.com/poem/8503199-Cinderella-by-Roald-Dahl Online video version: https://www.youtube.com/watch?v=dLmNG5EbHvc. An interview with Dahl: https://www.youtube.com/watch?v=pA7kUPStmPE
4	Elizabeth Gilbert, 'Eat, Pray & Love. 1st Edition, Penguin,US, 2006. For online version: http://mrs-sullivan.com/wp-content/uploads/Eat-Pray-Love-Book-on-pdf.pdf An interview with Elizabeth : https://www.youtube.com/watch?v=m9B9zFo4RFw
5	William Zinsser, 'On Writing Well: The Classic Guide to Writing Nonfiction', Harper Perennial; 30th Anniversary ed. Edition, 2016 For Online version: http://richardcolby.net/writ2000/wp-content/uploads/2017/09/On-Writing-Well-30th-Anniversa-Zinsser-William.pdf
6	Girish Karnad, 'Hayavadana', 1st Edition, Oxford University Press, Delhi, 1975 (30th Impression, 2012). For online version: https://pdfcoffee.com/hayavadana-girish-karnadpdf-pdf-free.html An interview with Karnad: https://www.youtube.com/watch?v=laL7oWWuLGI
7	https://www.newyorker.com/magazine/2015/02/09/sweetness-2 Audio version: https://www.youtube.com/watch?v=ltKXTZTBmPs. An interview with Morrison: https://www.youtube.com/watch?v=DQ0mMjII22I&list=RDDQ0mMjII22I&start_radio=1&rv=DQ0mMjII22I&t=107
8	William Gibson, 'Neuromancer', 1st Edition, The Berkley Publishing Group, New York, 1984. For online version http://index-of.es/Varios-2/Neuromancer.pdf
9	Margaret Atwood, 'The Penelopiad', 1st Edition, Canongate Series, Knopf, Canada, 2005. For online version: https://www.langhamtheatre.ca/wp- content/uploads/2010/09/The-Penelopiad.pdf An interview with Atwood: https://www.youtube.com/watch?v=D5Wj_JQ6NhY

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NHS532	**Semester: ODD**	**Semester: V Session 2022-23 Month from: Aug to Dec**
CourseName	**Planning and Economic Development**		
Credits	03	ContactHours	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Amba Agarwal & Dr. Amandeep Kaur
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal & Dr. Amandeep Kaur

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-4.1	Understand the issues and approaches to economic development.	Understand (Level 2)
C303-4.2	Evaluate National income accounting, human development index and sustainable development.	Evaluate (Level 5)
C303-4.3	Apply an analytical framework to understand the structural characteristics of development.	Apply (Level 3)
C303-4.4	Analyze the role of Macroeconomic stability & policies and Inflation in the development process.	Analyze (Level 4)
C303-4.5	Evaluate the importance of federal development and decentralization.	Evaluate (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Economic Development and its Determinants	Economic growth and development. Indicators of development. Approaches to economic development. Rostows Stages of Growth.	5
2.	National Income Accounting	National Income Accounting, Green GNP and Sustainable development	5
3.	Indicators of development	PQLI, Human Development Index (HDI) and gender development indices.	4
4.	Demographic Features, Poverty and Inequality	Demographic features of Indian population; Rural-urban migration; Growth of Primary, Secondary and Tertiary Sector.	5
5.	Inflation and Business Cycles	Inflation. Business cycle. Multiplier and Accelerator Interaction.	6
6.	Macro-Economic Stability & Policies	Monetary Policy. Fiscal Policy. Role of Central Bank & Commercial banks in the development of the country. Balance of payments; currency convertibility and Issues in export-import policy.	6

7.	Federal Development	The Federal Set-up - The Financial Issues in a Federal Set-up, Principles for Efficient Division of Financial Resources between Governments. Financial Federalism under Constitution. Finance Commissions in India, Terms of References and its Recommendations	6
8.	Planning and Development	Need for planning, Decentralisation, Rural and Urban local bodies.	5
		Total number of Lectures	**42**

Evaluation Criteria

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

Project-based Learning: Each student in a group of 4-5 will opt a topic and submit a report related to India's Development Indicators based on following parameters; National Income, State Income, Human Development Index (HDI), Gender Development Indices (GDI), Demographic Profile, Migration, Sectoral contributions of income and employment, Poverty, Income Inequality & literacy, Federal Structure, Budgetary estimates, Tax and Monetary Policy, Distribution of financial resources from central to state to local bodies. Understanding fundamental development indicators will upgrade student's knowledge on various Economic Development front and improve mechanism to formulate suitable policy design, which further strengthen their employability into public and private decision-making body.

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.	**Todaro, M.P**., **Stephen C. Smith,** Economic Development, Pearson Education, 2017
2.	**Thirwal, A.P**., Economics of Development, Palgrave, 2011
3.	**Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4.	**Ray, Debraj,** Development Economics, Oxford University Press, 2016
5.	**Meier, G.M.,** Leading Issues in Economic Development, Oxford University Press, New Delhi, 2008
6.	**Ahuja, H. L.,** Development Economics, S Chand publishing, 2016
7.	**Benavot, Aaron.** "Education, gender, and economic development: A cross-national study." Sociology of education (1989): 14-32.
8.	**Falk, Armin, and Johannes Hermle.** "Relationship of gender differences in preferences to economic development and gender equality." Science 362, no. 6412 (2018).

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NMA531**	**Semester** Odd **(specify Odd/Even)**	**Semester** V **Session** 2022 -2023 **Month from** August - December
Course Name	**DISCRETE MATHEMATICS**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Vipin Chandra Dubey	
	Teacher(s) (Alphabetically)	Dr. Vipin Chandra Dubey	

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

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

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

Evaluation Criteria

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

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to the diversified applications of graph theory. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material:

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NMA532	**Semester** Odd **(Specify Odd/Even)**	**Semester** V **Session** 2022-23 **Month from** August-December
Course Name	Finite Element Methods		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Prof. Lokendra Kumar
	Teacher(s) (Alphabetically)	Prof. Lokendra Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C301-2.1	explain different numerical methods for the solution of simultaneous linear equations.	Understanding Level (C2)
C301-2.2	solve ordinary differential equations using 4th order Runge-Kutta and finite difference methods.	Applying Level (C3)
C301-2.3	apply methods of weighted residuals for the solutions of boundary value problems.	Applying Level (C3)
C301-2.4	construct the weak formulation and derivation of shape functions for one and two dimensional problems.	Applying Level (C3)
C301-2.5	organise the elementwise assembly to solve the two point boundary value problems using finite element method.	Applying Level (C3)
C301-2.6	apply finite element method on partial differential equations with given boundary conditions.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Numerical Methods	Gauss-elimination, Gauss Seidel, Thomas algorithm, Gaussian quadrature formula for numerical integration, Runge-Kutta method for IVPs, Finite difference method for BVPs.	9
2.	Finite Element Method	Introduction to finite element method, comparison with finite difference method.	4
3.	Method of Weighted Residuals	Collocation, Subdomain, Method of least squares and Galerkin's method.	9
4.	Variational Formulation	Variational formulation of boundary value problems. Equivalence of Galerkin and Ritz method in some cases. Applications to solve simple problems of ODEs. One dimentional linear, quadratic and higher order elements. Derivation of element equations and their assembly, imposition of boundary conditions and solution of assembled equations.	12

5.	Partial Differential Equations	Two dimensional, triangular, rectangular, quadrilateral, serendipity and isoperimetric elements and their assembly. Discretization with curved boundaries. Solution of two dimensional partial differential equations under different Geometric conditions.	8
		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: Each student in a group of 4-5 students will apply the concepts of FEM to solve the ordinary and partial differential equations occurring in various disciplines.

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

1.	**J. N. Reddy**, An Introduction to the Finite Element Method, McGraw-Hill, New York, 1993.
2.	**L. J. Segerlind**, Applied Finite Element Analysis, 2nd Edition, John Wiley and Sons, 1984.
3.	**O. C. Zienkiewicz and R. L. Taylor**, The Finite Element Method, 3rd Edition, McGraw-Hill, 1989.
4.	**D. L. Logan**, A First Course in the Finite Element Method, 2nd Edition, PWS Publishing Company, Boston, 1993.
5.	**R. D. Cook, D. S. Malkus and M. E. Plesha**, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley and Sons, New York, 1989.
6.	**K. J. Bathe**, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, NJ, 1982.
7.	**Gupta, R.S.,** Elements of Numerical Analysis, 1st Ed., Macmillan 2009.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH531	**Semester: ODD**	**Semester V Session 2022-23** **Month from Aug 2022- Dec 2022**
Course Name	**Quantum Mechanics for Engineers**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Anuraj Panwar
	Teacher(s) (Alphabetically)	Anuraj Panwar

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Wave particle duality, quantum physics (Planck and Einstein's ideas of quantized light), postulates of quantum mechanics, time dependent and time independent Schrodinger equation, operators, probability theory, expectation values, and uncertainty principle and its implications, no cloning applications	8
2.	Measurement Theory with Applications	Matrix and linear algebra, Eigen values and eigenfunctions Hilbert space, Kets, Bras and Operators, Bras Kets and Matrix representations, Measurements, Stern Gerlach Experiment, Observables and Uncertainity Relations, No-cloning theorem, Pauli Spin Matrices.	10
3.	Potential problems	1-D, 2-D, and 3-D potential problems (including infinite and finite square well). Tunneling, harmonic oscillator, separation in spherical polar coordinates, hydrogen atom, etc.),	08

4.	Approximation methods	Time independent perturbation theory for nondegenerate and degenerate energy levels.	4
5.	Advanced Applications	Kronig Penny model, Basic ideas of quantum computing, Qubit, Gate model of quantum computing : H, CNOT, Pauli Gates, BB84 protocol, Advantages of quantum computing, Quantum wire, Quantum dot and realization of CNOT using Quantum dot.	10
		Total number of Lectures	**40**

Evaluation Criteria

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

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

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

Project Based Learning: Students may do projects on various applications of quantum mechanics like quantum computing and quantum information. This will help them apply theory learnt to more advanced problems in quantum mechanics. This should help students develop research-based learning which is very important in emerging technologies like quantum computing and information**.**

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NHS531	**Semester: Odd**	**Semester V Session** 2022 -2023 **Month from August - December**
Course Name	Technology and Culture		
Credits	3	**Contact Hours**	**(3-0-0)**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-5.1	Understand socio-cultural factors and their effect on individuals, organisations and the business environment	Applying (C 2)
C303-5.2	Appraise technological convergence and cultural divergence, relate the differences to the literature and suggest solutions	Evaluating(C 5)
C303-5.3	Interpret and communicate effectively in physical and virtual teams by evaluating appropriate concepts, logic and selecting the apt IT tools.	Evaluating (C5)
C303-5.4	Evaluation of the theoretical knowledge to adapt to cultural differences in global work environment.	Evaluating(C 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	▪ The Information Technology Revolution ▪ The concept of Network societies ▪ Technology and Culture-how cultural beliefs influence technology	**1.**
2.	**Dimensions of Culture**	▪ Evolution of Culture ▪ Principal theories of Culture: Kluckholn and Strodtbeck, Hofstede, Trompenaars and Schwartz ▪ Cultural Diversity and cross-cultural literacy	**2.**
3	**Levels of Culture**	▪ Levels of Culture ▪ Measurement of Culture	**3**
4.	Cross cultural communication in physical and virtual teams	▪ The Communication Process ▪ Language and Culture ▪ Non-Verbal Communication ▪ Barriers to Cross Cultural Understanding	**4.**
5.	Negotiation and Decision Making	▪ Theories of Negotiation ▪ Negotiation and Intercultural Communication ▪ Decision making in cross cultural environment ▪ Expatriate Management	**5.**

6.	Culture and Marketing	Culture and research Culture and Consumer behaviour ▪ Culture and Marketing	**6.**
7.	Cross Culture and Leadership	▪ Leadership and Culture ▪ Theories of Culture centric leadership and their Global Relevance ▪ Developing Competencies for Global citizens ▪ Women as International Leaders ▪ Cross Cultural Training ▪ Ethical Guidelines for Global Citizens	**7.**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project and Oral Viva)
Total	**100**

Project based learning: Students in group of 4-5 members are required to present a term paper exploring the influence of culture on diverse aspects of business, design and technology.

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.	Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2020). *International marketing*. McGraw-Hill Education.
2.	Coyle,D., The Culture Code: The Secrets of Highly Successful Groups, Bantam, 2018
3.	Fletcher, R., & Crawford, H. (2013). *International marketing: an Asia-Pacific perspective*. Pearson Higher Education AU.
4.	Gerard Bannon, J. (red.). Mattock, Cross-cultural Communication: The Essential Guide to International Business.2003
5.	Maidenhead.Riding the Waves of Culture: Understanding Cultural Diversity in Business (2012).3rd edition. McGraw Hill.
6.	Madhavan,S., Cross Cultural Management: Concepts and Cases(2nd Ed),Oxfor University Press 2016.
7.	Robertson, Ronald. Globalization: Social theory and global culture, London: Sage, 1992.

Detailed Syllabus
Lecture wise Breakup

Course Code	22B12PH311	**Semester:** Odd	**Semester V Session 2022-23** **Month from August to December**
Course Name	Engineering Materials and Technology		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Alok P. S. Chauhan
	Teacher(s) (Alphabetically)	Dr. Alok Pratap Singh Chauhan

COURSE OUTCOMES After completion of the course, students will be able to:		**COGNITIVE LEVELS**
CO1	Recall the importance of engineering materials existing in the environment around us.	Remember Level (Level 1)
CO2	Explain and compare the different properties of the materials along with their broad classifications.	Understand Level (Level 2)
CO3	Apply the knowledge to analyze and use the different processes of the materials manufacturing.	Apply Level (Level 3)
CO4	Apply the knowledge to develop/ choose materials for advanced engineering applications including robotic, drone and aerospace.	Analyze Level (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Materials	Broad categorization of materials, Structure, property and performance relationship in materials. Engineering Materials Development in India.	4
2.	Material Properties	Review of material properties. Fracture, fatigue, diffusion and creep. Failure of materials. Material Deformations. Durability, oxidation, corrosion and degradation. Basics of Phase Diagrams and Diffusion.	8
3.	Ceramics and Metals	Metals and Alloys. Strengthening and degradation, corrosion prevention. Material Strengthening. Sub-classification, processing and properties of traditional and advanced ceramics. Phase diagrams using CALPHAD approach for ceramics and metals.	8
4.	Polymers and Wood	Introduction and classification, polymeric structure, effects of glass transition temperature, polymer mechanical properties. Classification and facets of wood.	3
5	Material Composites	Composites: polymer matrix, metal matrix, ceramic matrix, carbon-carbon. Longitudinal and transverse modulus. Composite making methods.	6
6.	Processing and Selection of Material	Manufacturing Processes and Design, Instruments and Furnaces. Materials, Environment and Sustainability. Automation in Materials Processing, Laser ablation of materials in additive manufacturing.	7
7	Development	Exploring materials development using computer software tools. Python packages and machine learning algorithm. Material Analysis using PyMKS	4

Total number of Lectures	**40**

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

Recommended Reading material:	
1.	Callister, W. D., Material Science and Engineering: An Introduction, Wiley publication, 2014
2.	Ashby, Michael F. & Jones, David, Engineering materials, Elsevier publication, 2018
3.	Ashby, Michael F., Materials selection in mechanical design, Elsevier publication, 2019
4.	Jones, Robert M., Mechanics of composite materials, Taylor & Francis publication, 2015
5.	Chopra, Inderjit & Sirohi, Jayant, Smart structures theory, Cambridge press, 2013
6.	Raghavan, V., Materials Science and Engineering, Prentice Hall of India, 2004
7.	Bolton, W., Engineering Materials Technology, Elsevier, 2013, 1993

Project Based learning: Different groups of students with 3-4 students in each group may be formed and these groups may be given to complete a task like collecting and classifying the materials for different applications. Students may be given a task of preparing data on current and futuristic materials and processes. Students can explore and interact with different industry and come out with their understanding and interpretation. They can use different commercially available software tools to do designing and prediction. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**20B13HS311**	**Semester: Odd**	**Semester V Session 2022-23** **Month from August to December**
Course Name	**Indian Constitution and Traditional Knowledge**		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	• Dr. Chandrima Chaudhuri • Dr. Namreeta Kumari • Ms. Shikha Kumari

CO Code	**COURSE OUTCOMES**	**COGNITIVE LEVELS**
C305.1	Demonstrate an understanding about the early Indian traditional political thought and the constitutional design by knowing about the structure of government in place	Understand(C2)
C305.2	Demonstrate an understanding of the role of Indian President, Prime Minister, Governor, other members of the legislature in their mutual interaction and local governments as representatives of the common masses	Understand (C2)
C305.3	Analyze the working of Indian federalism with reference to centre-state relations	Analyze(C4)
C305.4	Analyze the impact of the contemporary challenges such as caste and gender to the working of Indian democracy	Analyze(C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	The Indian Constitution	• Historical Background to the Indian Constitution • Salient features of the Indian Constitution • Fundamental Rights (Part III of the Indian Constitution) • Fundamental Duties (Part IVA of the Indian Constitution) • Directive Principles of the State Policy (Part IV of the Indian Constitution) • Amendments to the constitution	8

2.	Organs of the Government	• The Executive: President, Prime Minister and Governor- appointment, powers and functions • The Legislature: Parliament and its components- Lok Sabha and Rajya Sabha (composition and functions) • The Judiciary: Supreme Court-composition, functions, appointment and jurisdiction	8
3.	Nature of Federalism in India	• Centre-State Legislative Relations • Centre-State Administrative Relations • Centre-State Financial Relations • Special Provisions of some state and the 5^{th} and 6^{th} schedule • Emergency provision	8
4.	Local Governance in India	• Urban local governance: Municipality- Structure & Functions • Rural Local governance: Panchayat- Organization and Powers • Civil Society: the participation of the people in local governance	8
5.	Traditional knowledge	• Kautilya- Theory of state • Mandala theory • Saptanga theory	6
6.	Challenges to Indian Democracy	• Caste as a critical factor in the Indian Constitution • Gender as critical to the process of Constutionalization	4
		Total number of Lectures	**42**

Evaluation Criteria

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

Project: Projects based on important Supreme Court judgments have to be submitted by the students as a part of the project-based learning method. This would help the students to know about the interpretation of the various rights done by Supreme
Court which would help them in their workplace as well as in general life.

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.A. George, *Important Judgements that transformed India*, New Delhi: McGraw Hill, 2020
2.	B. Chakraborty, *Indian Constitution: Text, Context and Interpretation,* New Delhi: Sage Publications, 2017
3.	B.K.Sharma, *Introduction to the Constitution of India,* New Delhi: Prentice Hall of India, 2002
4.	M.Laxmikanth, *Indian Polity*, 6th edition, Noida: McGraw Hill, 2019
5.	M.P.Singh and R. Saxena, R, *Indian Politics: Contemporary Issues and Concerns,* New Delhi: PHI Learning, 2008
6.	R. Kangle, *Arthashashtra of Kautilya*, New Delhi: Motilal Publishers, 1997
7.	Videos- Samvidhan series produced by Rajya Sabha Television .https://www.youtube.com/watch?v=0U9KDQnIsNk

Detailed Syllabus

Lecture-wise Breakup

Course Code	21B12CS322	**Semester:** Odd	**Semester:** V **Session:** 2022-23 **Month from** Aug 22 to Dec 22
Course Name	Web Technology		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Bhawna Saxena (62), Shariq Murtaza (128)
	Teacher(s)	Bhawna Saxena, Shariq Murtaza

COURSE OUTCOMES		**COGNITIVE LEVEL**
C316.1	Designing web pages using basic building blocks of web development.	Apply (Level 3)
C316.2	Understand Advanced Java Scripting and related web development concepts	Understand (Level 2)
C316.3	Apply functional aspects of database handling to create database using PHP	Apply (Level 3)
C316.4	Understand React JS, Node JS for event-driven programming concepts	Understand (Level 2)
C316.5	Using famous web development frameworks to build web applications	Understand (Level 2)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Essential topics in Web Development	HTML, CSS, JavaScript Basics, Primitives, Functions, Objects, Event-Driven Programming, Callbacks, JavaScript, DOM Manipulation	**7**
2.	Databases and PHP	Overview of MYSQL. PHP: Starting to script on server side, Arrays, function and forms, advance PHP. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Database Connectivity with PHP.	**12**
3.	Programming in React JS	Understanding SPA, React Overview, React vs Angular, React Deep-Dive, Composition over	**10**

		Inheritance, Declarative code with JSX, Unidirectional Data Flow, Components, Life Cycle, React Router, Handling States of the UI	
4.	Programming in Node JS	Introduction to Node JS, Event Loop, REPL, Modules, REST, Scaling, Use of API (Basics)	**6**
5.	Web Development Frameworks	Developing web applications using Django, Flask, Bootstrap etc.	**7**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Sem	35
TA	25 (Attendance (10), Assignment/ Quiz (5), Mini-Project (10))
Total	**100**

Project based learning: A group of 3-4 students will develop a web application using the web technologies covered as part of this course. Students will be required to develop a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of server-side scripting and database handling. This will give students hands on experience of working in the area of web technology. The knowledge gained will enhance their employability in the IT sector.

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

	Text Books
1.	Laura Lemay, Rafe Colburn, Jennifer Kymin, “Mastering HTML, CSS & JavaScript Web Publishing” , BPB Publications
2.	Chris Northwood, “The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer”, Apress, 2018.
3.	Jonathan Wexler, “Get Programming with Node.js”, Manning Publications, 2019
4.	Robin Nixon, “Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5”, O’Reilly, 2nd Edition
5.	Robin Wieruch, “The Road to React: Your journey to master plain yet pragmatic React.js”, 2022
	Reference Books
1.	Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd,Apress, 2019.
2.	Lynn Beighley & Michael Morrison, “Headfirst PHP & MySQL”, O’Reilly, 1st Edition
3.	Thomas A. Powell, “HTML & CSS: The Complete Reference”, TMH

Detailed Syllabus

Lab-wise Breakup

Course Code	21B16CS323	**Semester:** Odd	**Semester**: V **Session**: 2022-23 **Month from** Aug 22 to Dec 22
Course Name	Web Technology Lab		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Bhawna Saxena (62) and Shariq Murtuza(128)
	Teacher(s)	Dr. Bhawna Saxena, Shariq Murtuza

COURSE OUTCOMES		**COGNITIVE LEVEL**
C376.1	Apply the fundamental elements of Web development in design of web pages	Apply (Level 3)
C376.2	Understand the web development concepts built on Advanced Java Scripting	Understand (Level 2)
C376.3	Apply functional aspects of database handling to create database using PHP	Apply (Level 3)
C376.4	Understand event-driven programming using React JS, Node JS	Understand (Level 2)
C376.5	Use the popular web development frameworks to build web applications	Understand (Level 2)

Module No.	**Subtitle of the Module**	**Topics in the module**	**CO**
1.	Review of Essential topics in Web Development	Web page development using basics of HTML, CSS and JavaScript (Primitives, Functions, Objects, Event-Driven Programming, Callbacks)	C376.1, C376.2
2.	Databases and PHP	Writing server-side scripts using PHP, Database Connectivity with PHP, Queries for creating and selecting a database, creating a table, inserting data, altering tables, deleting database, deleting data and tables, selecting data from tables.	C376.3
3.	Programming in React JS	Setting up React JS environment, creating SPAs using React JS (Components, State, Props, Events, React Router)	C376.4
4.	Programming in Node JS	Creation of REST APIs and integration with client-side code written in React JS	C376.4
5.	Web Development Frameworks	Developing web applications using frameworks like Django, Flask and Bootstrap	C376.6

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day to Day	60 (Attendance (15), Evaluation/ Viva (25), Project (20))
Total	**100**

Project based learning: A group of 3-4 students will develop a web application using any of the web technologies (either single or in combination) covered as part of this course. Students will be required to develop a web application using React JS, PHP, Django and Flask. Building a web application using advanced JS scripting and/ or web frameworks will give students hands on experience of working in the area of web technology. The knowledge gained will enhance their employability in the IT sector.

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

	Text Books
1.	Laura Lemay, Rafe Colburn, Jennifer Kymin, "Mastering HTML, CSS & JavaScript Web Publishing" , BPB Publications
2.	Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress, 2018.
3.	Jonathan Wexler, "Get Programming with Node.js", Manning Publications, 2019
4.	Robin Nixon, "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5", O'Reilly, 2nd Edition
5.	Robin Wieruch, "The Road to React: Your journey to master plain yet pragmatic React.js", 2022
	Reference Books
1.	Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd,Apress, 2019.
2.	Lynn Beighley & Michael Morrison, "Headfirst PHP & MySQL", O'Reilly, 1st Edition
3.	Thomas A. Powell, "HTML & CSS: The Complete Reference", TMH

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NMA533	**Semester** - Odd **(specify Odd/Even)**	**Semester** V **Session** 2022 -2023 **Month from** August - December
Course Name	Matrix Computations		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Pato Kumari and Dr. Amita Bhagat
	Teacher(s) (Alphabetically)	Dr. Amita Bhagat and Dr. Pato Kumari

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-3.1	explain the basics of matrix algebra and inverse of a matrix by partitioning.	Understanding level (C2)
C301-3.2	solve the system of linear equations using direct and iterative methods.	Applying Level (C3)
C301-3.3	explain the vector spaces and their dimensions, inner product space, norm of a vector and matrix.	Understanding level (C2)
C301-3.4	apply the Gram-Schmidt process to construct orthonormal basis and Q-R decomposition of a matrix.	Applying Level (C3)
C301-3.5	construct Gershgorin's circles and solve eigenvalue problem using Jacobi, Givens, Housholder, power and inverse power methods.	Applying Level (C3)
C301-3.6	analyze systems of differential and difference equations arising in dynamical systems using matrix calculus.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Matrix Algebra	Review of matrices, partitioning, block diagonal matrix, elementary matrices, Inverse of a matrix by partitioning.	6
2.	Linear System of equations	Existence and uniqueness of solution for system of linear equations. LU decomposition, Crout's and Doolittle's method, Cholesky factorization. Gauss Siedel, Gauss Jacobi and partial pivoting.	6
3.	Vector and Inner Product Spaces	Vector spaces, Subspaces, dimension and basis, *p*-norms of vector, Inner product, Norm using inner product and norms of a matrix.	6
5.	Orthogonality	Orthogonal and orthonormal sets, Gram-Schmidt process, QR factorization.	4

4.	Eigen value Problems	Eigen values and Eigenvectors, spectral radius, Greshgorin's theorem, Jacobi method, Givens rotations method and Householder's method, Power and Inverse power methods, Q-R algorithm.	12
6.	Matrix Calculus	Powers and functions of matrices, application to solve discrete dynamical systems $x(t+1) = Ax(t)$, $x(0) = \alpha$ and a system of differential equations of the form $dx/dt = Ax$, $x(0) = \alpha$.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (PBL, Assignments, Quizzes and Tutorial)
Total	**100**

Project Based Learning: Each student in a group of 4-5 students will apply the concepts of matrix calculus to solve discrete dynamical systems and a system of differential equations arising in various disciplines

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.	**Bronson, R**., Matrix Methods an Introduction, Academic Press, 1991.
2.	**Golub, G. H., Loan, C. F. V.,**Matrix Computations, 4th Edition, Johns Hopkins University Press, 2013.
3.	**Datta, K. B.**, Matrix and Linear Algebra, 3rdEdition, Prentice Hall of India, 2016.
4.	**David, W. Lewis**., Matrix Theory, World Scientific, 1991.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH532	**Semester**: ODD	**Semester V Session 2022-23** **Month from August- December**
Course Name	Materials Science		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. R. K. Dwivedi and Dr. Vikas Malik
	Teacher(s) (Alphabetically)	Prof. R. K. Dwivedi and Dr. Vikas Malik

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-11.1	Recall variety of engineering materials for their applications in contemporary devices	Remembering (C1)
C301-11.2	Explain dielectric, optical, magnetic, superconducting, polymer and thermoelectric properties	Understanding (C2)
C301-11.3	Apply properties of dielectric, optical, magnetic, superconducting, polymer and thermoelectric materials to solve related problems	Applying (C3)
C301-11.5	Prove and estimate solution of numerical problems using physical and mathematical concepts involved with various materials	Evaluating (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Dielectric Materials	Polarization mechanism & Dielectric Constant, Behavior of polarization under impulse and frequency switching, Dielectric loss, Spontaneous polarization, Ferroelectrics, Piezoelectric effect; Applications of Dielectric Materials	10
2.	Optical Materials	Basic Concepts, Light interactions with solids, Optical properties of nonmetals: refraction, reflection, absorption, Beer-Lambert law, transmission, Photoconductivity. Drude Model, relation between refractive index and relative dielectric constant, Optical absorption in metals, insulators and semiconductors. Introduction to Photonic band gap (PBG) materials and its applications	**6**
3.	Magnetic Materials	Concept of magnetism, Classification – dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Their properties and Applications; Hysteresis; Magnetic Storage and Surfaces.	**10**
4.	Super conducting Materials	Meissner effect, Critical field, type-I and type-II superconductors; Field penetration and London equation; BCS Theory, High temperature Superconductors and their Applications	**5**
5.	Polymers and Ceramics	Various types of Polymers and their applications; Mechanical behavior of Polymers, synthesis of polymers; Structure, Types, Properties and Applications of Ceramics; Mechanical behavior and Processing of Ceramics.	**6**
6.	Thermoelectric Materials	Thermoelectric (TE) effects and coefficients (Seebeck, Peltier, Thompson); TE materials and devices, Heat conduction, Cooling, Figure of Merit; TE power generation (efficiency), refrigeration (COP), Examples and applications.	**3**

		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [Quiz/class test (7), attendance (7), PBL assignment (6) and teacher assessment (5)]
Total	**100**

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

1.	S.O. Pillai, Solid State Physics, New Age International Publishers.
2.	B. B. Laud, Laser and Non-linear Optics, John Wiley & Sons
3.	Van Vlack, Elements of Material Science and Engineering, Pearson Education.
4.	Srivastava and Srinivasan, Material Science and Engineering,
5	W.D. Callister Jr., Material Science and Engineering: An Introduction, John Wiley.

Project Based Learning: Students will make application oriented individual projects on selected material (dielectric, magnetic, superconducting,optical and Thermoelectric etc.) depending on its suitability for advanced application such as medical diagnostic, sensing (pertaining to current pandemic situation) and similar. Each project will envisage the material properties, the working principles, advantages and disadvantages of that specific material as well as the possible advancement from the literature. This will be a group project and students will work in a group of 3-4 students. This project will make them prepared for industry jobs in the material industry or for higher studies in similar fields.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH535	**Semester: ODD**	**Semester: V Session: 2022-23** **Month from August to December**
Course Name	NUCLEAR SCIENCE AND ENGINEERING		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi
	Teacher(s) (Alphabetically)	Dr. Manoj Tripathi

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nuclear Constituents and their properties, Nuclear Forces	Rutherford scattering and estimation of nuclear size, Constituents of the nucleus and their properties, Nuclear Spin, Moments and statistics, Magnetic dipole moment, Electric quadruple moment. Nuclear forces, Two body problem - Ground state of deuteron, Central and non-central forces, Exchange forces: Meson theory, Yukawa potential, Nucleon-nucleon scattering, Low energy n-p scattering, Effective range theory, Spin dependence, charge independence and charge symmetry of nuclear forces, Isospin formalism.	07
2.	Nuclear Models	Binding energies of nuclei, Liquid drop model: Semi-empirical mass formula, Mass parabolas, Prediction of Nuclear stability, Bohr-Wheeler theory of fission, Shell model, Spin-orbit coupling. Magic numbers, Angular	05

		momenta and parities of nuclear ground state, Magnetic moments and Schmidt lines, Collective model of a nucleus.	
3.	Nuclear decay and Nuclear reactions	Alpha decay, Beta decay, Pauli's Neutrino hypothesis-Helicity of neutrino, Theory of electron capture, Non-conservation of parity, Fermi's theory, Gamma decay: Internal conversion, Multipole transitions in nuclei, Nuclear isomerism, Artificial radioactivity, Nuclear reactions and conservation laws, Q-value equation, Centre of mass frame in nuclear Physics, Scattering and reaction cross sections, compound nucleus, Breit-Wigner one level formula	08
4.	Interaction of nuclear radiation with matter	Interaction of charge particles with matters: Bohr's ionization loss formula and estimation of charge, mass and energy. Interaction of electromagnetic radiation with matter, Linear absorption coefficient. Nuclear particle detectors and neutron counters.	07
5.	Accelerator and reactor Physics	Different types of reactors, tracer techniques, activation analysis. Radiation induced effects and their applications: Accelerators: Linear accelerators, Van de Graff generator, LINAC, Cyclotrons, Synchrotons, Colliders.	06
6.	Cosmic radiation and Elementary Particles	Cosmic radiation: Discovery of cosmic radiation, its sources and composition, Latitude effect, altitude effect and east-west asymmetry, secondary cosmic rays, cosmic ray shower, variation of cosmic intensity and Van Allen radiation belt. Elementary particles: Classification of particles, K-mesons, Hyperons, particles and antiparticles, fundamental interactions, conservation laws, CPT theorem, resonance particles and hypernucleus, Quark model.	07
		Total number of Lectures	**40**

Evaluation Criteria

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

Project Base Learning	Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in nuclear science, etc. The students may be asked to make presentations on topics like radioactive dating or nuclear models and their applications. Devices

	like linear accelerators, cyclotrons etc. may also be included. The students may also be asked to study the recent developments in nuclear science/ engineering and present them.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	K.S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
2.	I. Kaplan, 1989, Nuclear Physics, 2nd Edition, Narosa, New Delhi.
3.	B.L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi.
4.	R.R. Roy and B.P. Nigam, 1983, Nuclear Physics, New Age International, New Delhi.
5.	H.A. Enge, 1975, Introduction to Nuclear Physics, Addison Wesle, London.
6.	Y.R. Waghmare, 1981, Introductory Nuclear Physics, Oxford-IBH, New Delhi.
7.	R.D. Evans, 1955, Atomic Nucleus, McGraw-Hill, New York.