Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI313	Semester ODD (specify Odd/Even)	Semester Fifth Session 2021 -2022 Month from Aug - Dec
Course Name	Computer Organization and Architecture		
Credits	4 (L=3, T=1)	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Dr. Hema N (Sec-62) / Dr. Rashmi Kushwah (Sec -128)
	Teacher(s) (Alphabetically)	Ms. Amarjeet Kaur, Dr. Bansidhar Joshi , Dr. Hema N, Dr. Kritika Rani Dr. Pawan Kumar Upadhaya , Dr. Rashmi Kushwah, Dr. Shailesh Kumar, Dr. Taj Alam and Dr. Vikash,

COURSE OUTCOMES		COGNITIVE LEVELS
C213.1	Summarize and compare the different computer systems based on RISC and CISC Architecture.	(Analyze Level)Level 4
C213.2	Categorize different types of computers based on Instruction set Architecture.	(Analyze Level)Level 4
C213.3	Apply the knowledge of performance metrics to find the performance of systems.	(Apply Level) Level 3
C213.4	Design RISC and CISC based Computer using Hardwired / Microprogrammed Controller.	(Evaluate Level) Level 5
C213.5	Create and analyze an assembly language program of RISC and CISC based systems.	(Evaluate Level) Level 5
C213.6	Apply the knowledge of pipeline, IO and cache to understand these systems. Further, analyze the performance of such systems.	(Analyze Level)Level 4

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Levels in architecture, Virtual machine, Evolution of multi-level machines.	02
2.	Performance of Computer	Performance Measures For Computer System	02
3.	CPU Organization	Data-path and control, Instruction execution, Microinstruction.	03
4.	Data Path and Control	Hardwired designing for JC62. Micro-programmed control designing for JC62.	02
5.	Generalized Study of Instruction Set Architecture	Stack/accumulator/register-register/register-memory type of architecture. Memory addressing techniques.	02
6.	Types of Instruction	Data movement, Arithmetic/logic, Control flow, Addressing modes. Instruction format.	02
7.	Instruction Set Architecture (ISA) of 8085	8085 Architecture, 8085 Instruction Set, 8085 Instruction Format, 8085 Addressing Modes, 8085 instruction execution and datapath. 8085 Assembly programming for simple applications.	05

8.	ISA of MIPS	MIPS Architecture, MIPS Instruction Set, MIPS Instruction Format, MIPS Addressing Modes, MIPS instruction execution and datapath. MIPS Assembly programming for simple applications.	05
9.	ISA of 8086	8086 Architecture, 8086 Instruction Set, 8086 Instruction Format, 8086 Addressing Modes, 8086 instruction execution and datapath. 8086 Assembly programming for simple applications.	05
10.	Memory Organization	Hierarchal memory structure, Cache memory and organization. Memory interfacing for 8085 and 8086.	05
11.	I/O Organization	Programmed/Interrupt driven I/O, Direct memory access	04
12.	Pipelining	Introduction To Pipelining System and Pipelining in RISC based Systems (MPIS)	03
13.	Multicore Architecture	Generalized study of Multicore Machines.	02
		Total number of Lectures	**42**

Project Based Learning: Each student in a group of 3-4 will choose a real-life computer hardware application area. To make a project, the students will analyze and define the performance improvement hardware and software systems in terms of functional requirements. Each group will design architectural diagram to understand the organizational structure of the application and implement in assemble or hardware level language. Each group will build prototype of such system and demonstrate among their peer group to get review/feedback on improvement of system..

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance =10, Class Test or/and Quizzes, etc = 04, Internal assessment = 04, Assignments in PBL mode = 07).
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.	M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt Ltd, 3rd Edition (updated) , 30 June 2017.
2.	William Stallings, Computer Organization and Architecture–Designing for Performance, Ninth Edition, Pearson Education, 2013.
3.	John L. Hennessy and David A Patterson, Computer Architecture A quantitative Approach, Morgan Kaufmann / Elsevier, Sixth Edition, 23rd November 2017
4.	Ramesh Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, Prentice Hall, Eight Edition, 2013.
5.	Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit Extensions : Architecture, Programming, and Interfacing. Pearson Education India, Eigth Edition, 2019.
6.	Nicholas Carter, Schaum's outline of Computer Architecture, Tata McGraw Hill, Second Edition, 2014.

Detailed Syllabus

Course Code	15B11CI373 NBA CODE:C273	Semester ODD (specify Odd/Even)	Semester Second Session 2021 -2022 Month from Aug to Dec
Course Name	Computer Organization and Architecture Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	Coordinator(s)	Amarjeet Kaur
	Teacher(s) (Alphabetically)	Amarjeet Kaur, Dr Hema N, Dr Pawan K. Upadhyay, Dr Taj Alam, Dr Vikash

COURSE OUTCOMES		COGNITIVE LEVELS
C273.1	Implement basic ALU of 2-bit and 4-bit computer using hardwired simulation tool	Apply (Level 3)
C273.2	Initialization and fetching of data from specific memory using various addressing mode of 8085 and 8086	Understand (Level 2)
C273.3	Develop 8086 assembly language programs using software interrupts and various assembler directives.	Apply (Level 3)
C273.4	Develop Microprocessor Interfacing program using PPI for various external devices	Apply (Level 3)
C273.5	Develop MIPS assembly language programs using software interrupts and various assembler directives.	Apply (Level 3)
C273.6	Create application and its software using 8085/8086 microprocessor or microcontrollers	Create (Level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	COA Hardwired simulation tool	Realize the truth table of various gates like as AND, OR, NOT, XOR, NAND and NOR., Conversion of universal gates, Design the half adder and full adder circuits, Ripple	C273.1

		adder logic circuit, 4 x1 multiplexor circuit and realize the various input output logic based on control, 4X1 multiplexor with NAND gates logic circuits	
2.	Combinational circuits	Design the subtractor circuits with defined bit logic, Adder-subtractor logic circuits, The odd frequency divider circuits, Carry lookup adder, Carry select and carry save, Adder circuits by modifying the ripple carry adder logic given in module-1.,Timing diagram of all four adder circuits and compare their performance, Decoder circuits with defined logic, 4-bit ALU circuits with defined operation logic.	**C273.1**
3.	8085 Simulator Introduction	Understanding Hardware Specification of the **8085 Simulator** in detail, Add two 8-bit numbers from load sample program from file menu, assemble and execute it step by step and view the contents of registers and memory., Basic Data transfer instructions, Arithmetic instructions, Logical instruction of 8085 using sample programs with note changes in flags.	**C273.2**
4.	8085 Programming (Simple)	8085 Assembly Programming: Basic Arithmetic (like addition, subtraction, multiplication, division etc), Array (sum , reverse, average copy etc) etc and explore more about Arithmetic , Logical and Flow control Instructions	**C273.2**
5.	8085 Programming (Complex)	8085 Assembly Programming: Logical and Data transfer (like Min, Max, Even/odd, Sorting etc), more complex program(like Factorial, Link list etc) , String etc and explore more about Arithmetic, Logical and Flow control Instructions, Interfacing with 8255	**C273.2, C273.4**
6.	8086(MASM/emu 86)	8086 Assembly Programming: Arithmetic (like addition, subtraction, multiplication, division etc), Logical and Data transfer (like Min, Max, Even/odd, Sorting etc), BIOS interrupt (I/O for read and write), String etc and explore more about Arithmetic, Logical, Flow control and Software Interrupt Instructions using MASM/emu86	**C273.3**
7.	MIPS(MARS) simulator	MIPS Assembly Programming: Arithmetic (like addition, subtraction, multiplication, division etc), Logical and Data transfer (like Min, Max, Even/odd, Sorting etc), Complex program (Factorial, Fibonacci etc), String etc and explore more about Arithmetic, Logical, Flow control Instructions using MARS Simulator.	**C273.5**
8.	Projects	Students are expected to create an hardware and software co-designed application based on 8085/ 8086/ MIPS/ Other controller (like Arduino) / Small Size computer (like Raspberry Pi)programming either in assembly or high level language.	**C273.6**
Project based learning: Project in COA lab is an integral part of the lab. Student form group size 3-4, and discuss the project idea with their lab faculty before finalizing. All projects are based on hardware			

and hardware components like microprocessor microcontrollers (like Arduino), microcomputer (like Raspberry pi), various sensors (like temperature sensor, humidity sensor etc), cams (like webcam), etc. are used. Programming language is used as per processor/controller. Students develop projects/prototypes to interact with physical environment, control physical object with software which is base of IoT and embedded system. Students learn various processor architecture as well as their programming languages. This helps students to understand how to develop IoT based products and embedded systems.

Evaluation Criteria

Components	Maximum Marks
Evaluation 1	10
Lab Test 1	20
Evaluation 2	10
Lab Test 2	20
Project / Assignments	25
Attendance	15
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.	William Stallings, Computer Organization and Architecture–Designing for Performance, 9th Edition, Pearson Education, 2013.
2.	Nicholas Carter, Schaum's outline of Computer Architecture, Tata McGraw Hill, 2017
3.	John L. Hennessy and David A Patterson, Computer Architecture A quantitative Approach, Morgan Kaufmann / Elsevier, Sixth Edition, 2017
4.	M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt Ltd, Fourth edition, 2002. ISBN: 81-203-0855-7.
5.	Microprocessor Architecture Programming and Applications with the 8085 [HB]-6/e. 25 September 2014. by Ramesh Gaonkar .
6.	The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro-Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit Extensions : Architecture, Programming, and Interfacing. Barry B. Brey, Pearson Education India, 2009.
7.	http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/comp_org_arc/web/
8.	http://cs.nyu.edu/~gottlieb/courses/2010s/2011-12-fall/arch/class-notes.html

9.	http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf
10.	http://www.cs.iastate.edu/~prabhu/Tutorial/title.html
11.	http://www.cag.csail.mit.edu/
12.	http://www.research.ibm.com/compsci/arch

Course Code	15B11CI412	Semester Odd (specify Odd/Even)	Semester V Session 2021-22 Month from July to Dec 2021
Course Name	Operating Systems and Systems Programming		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Sec 62: Dr. Ashish Mishra, Sec 128: Dr. Shilpa Budhkar
	Teacher(s) (Alphabetically)	Sec 62: Dr. Chetna, Dr. Keshav, Dr. Prakash, Dr. Prashant, Srishty
		Sec 128: Dr. Neeraj Jain, Rupesh Koshariya, Dr. Mukta Goyal

COURSE OUTCOMES		COGNITIVE LEVELS
C311.1	Describe and explain the fundamental components of operating systems and system programming.	Understand Level (C2)
C311.2	Apply and compare various policies of scheduling in processes and threads in OS.	Apply Level (C3)
C311.3	Describe and discuss various resource management techniques of operating systems and compare their performances.	Compare Level (C3)
C311.4	Understand the concept of IPC and describe various process synchronization techniques in OS.	Describe Level (C2)
C311.5	Discuss the working of IO management and apply various disk scheduling techniques.	Apply Level (C3)
C311.6	Analyze and report appropriate OS design choices when building real-world systems.	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction and Historical context of Operating Systems	What are Operating Systems? All components Description, The Evolution of OS: Batch Systems, multi programming systems, Time sharing systems, Parallel systems, Real Time systems, Distributed systems.	2
2.	Operating Structure and Architecture	Operating system structure: Micro kernel, Monolithic systems, Layered systems, Virtualization, Client-server model, Mobile Operating System. X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, Interrupts.	2
3.	Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues,	Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors.	10
4.	Deadlock	System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock	5

5.	Memory Management.	Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory	8
6.	File System management and Input output management	File concept, Access models, Directory structure, Protection, File-system Structure, Allocation methods, Free space management. Overview, I/O hardware, Application I/O interface.	2
7.	Secondary Storage Management	Disk structure, Disk scheduling, Disk management., Swap-space management	2
8.	Fault and Security Issues	Overview of system security, Security methods and devices, Protection, access, and authentication, Models of protection, Memory protection.	2
9.	Distributed O.S	Int. to distributed operating systems, synchronization and deadlock in distributed systems	1
10.	Case studies of OS	Windows, Linux ,IBM	2
11.	System Programming	Introduction, Components of a Programming System: Assemblers, Loaders, Macros, Compliers, Formal System.	2
12.	Interrupts and Exceptions	Synchronous and asynchronous interrupts, Calling a System Call from User Space, INT, Trap Handling, System call dispatch, arguments and return value, Device Interrupts.	2
13.	Kernel Synchronization, System Calls and System Signals	Disabling Interrupts, Lock Implementation, Linux Synchronization Primitives	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (5), Quiz/Assignment/PBL-Mini Project/Case Study (15))
Total	**100**

The students in the group of 3-4 submitted a case study of the Real-World Operating System like Windows, Linux, Macintosh etc. which was best suited for their mini project developed in their 5th semester. In the case study, they explained all the major components and services provided by the Operating system used for their mini project. This gave the students an exposure of the various components and services of real-world operating systems and helps them to map these services with the concepts taught in the subject and which further motivates them in the futuristic designing of a new Operating System.

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.	William Stallings, "OPERATING SYSTEMS INTERNALS AND DESIGN PRINCIPLES".
2.	Andrew S. Tanenbaum, "Operating Systems Design and Implementation", Third Edition, Prentice Hall Publications 2006
3.	A.S. Tanenbaum, "Modern Operating Systems", 2nd edition, Prentice Hall India.

4.	A.Silberschatz, P.Galvin, G. Gagne, "Operating systems concepts" Willey international company (sixth edition)
5.	Gary Nutt, "Operating Systems – A modern perspective", Pearson Education
6.	David Solomon and Mark Russinovich ," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
7.	D. M. Dhamdhere, " Systems Programming and Operating systems" TMH, 2nd revised edition.2006
8.	ACM/IEEE transactions on operating systems concepts.
9.	www.vmware.com
10.	www.luitinfotech.com/kc/what-is-cloud-computing.pdf
11.	https://cs162.eecs.berkeley.edu/static/sections/section8.pdf
12.	Charles Crowley "Operating System A Design Approach" TMH.

Detailed Syllabus
Lab-wise Breakup

Subject Code	15B17CI472	Semester Odd (specify Odd/Even)	Semester V Session 2021-2022 Month: July-Dec 2021	
Subject Name	Operating System and System Programming Lab		NBA Code: C275	
Credits	0-0-1	Contact Hours	2	

Faculty (Names)	Coordinator(s)	Dr. Chetna Dabas (Sec-62) & Dr. Mukta Goyal (Sec 128)
	Teacher(s) (Alphabetically)	Ashish Mishra, Chetna Dabas, Dharmveer Singh Rajpoot, Kashav Ajmera, Prashant Kaushik,

COURSE OUTCOMES		COGNITIVE LEVELS
C275.1	Understand Various Unix Commands.	Understand Level (Level 2)
C275.2	Develop programs to create different types of processes using pthread library under Linux environment.	Apply Level (Level 3)
C275.3	Develop programs to implement resource management task like CPU scheduling algorithms, deadlock handling.	Apply Level (Level 3)
C275.4	Develop programs to implement and test various synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites.	Apply Level (Level 3)
C275.5	Design and analyze various disk-scheduling algorithms, memory management schemes, file management systems.	Analyze Level (Level 4)

Module No.	Topic	No. of Labs	COs
1.	Unix Commands	1	C275.1
2.	Process creation/ Inter process communication (IPC)	1	C275.2
3.	Processes creation using pthread library under Linux environment.	2	C275.2
4.	Synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites.	2	C275.4
5.	Resource management task like CPU scheduling algorithms, deadlock handling.	1	C275.3
6.	Disk-scheduling algorithms, memory management schemes, file management systems.	1	C275.5

Evaluation Criteria

Components	Maximum Marks
Lab Test-1	20
Lab Test-2	20
Day-to-Day	60 (Mini Project-10, Lab Assessment-40, Attendance-10)
Total	100

Project Based Learning: Project based learning: Each student works on different case study in Lab Assignments. They utilize the concepts taught in lab and develop project in a group of 3-4.The course emphasized on the skill development for employability in software industry by engaging students on soft development methodologies of operating systems. Various activities are carried out to enhance the student's software development skills. Some of them are study of various scheduling methods, memory management techniques and file management techniques.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc.)	
Text book(s)	
1.	Charles Crowley "Operating System A Design Approach" TMH.
2.	Andrew S. Tanenbaum "Operating Systems Design and Implementation", Third Edition, Prentice Hall Publications 2006
3.	A.S. Tanenbaum, "Modern Operating Systems", 2nd edition, Prentice Hall India.
4.	A.Silberschatz, P.Galvin, G. Gagne, "Operating systems concepts" Willey international company (Ninth edition)
Reference Book(s)	
5.	Gary Nutt, "Operating Systems – A modern perspective", Pearson Education
6.	David Solomon and Mark Russinovich , "Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
7.	Milan Milenkovic, "Operating Systems: Concepts and Design", McGraw-Hill computer science series
8.	ACM/IEEE transactions on operating systems concepts.
9.	www.vmware.com

Course Code	15B17CI575	Semester ODD (specify Odd/Even)	Semester 5th Session 2021-2022 Month from Aug 21 to December 21
Course Name	Open Source Software Lab		
Credits	1	Contact Hours	2 hours

Faculty (Names)	Coordinator(s)	J62: Ms. Sarishty Gupta, Ms. Kirti Aggarwal J128: Dr. Chetna Gupta (J128)
	Teacher(s) (Alphabetically)	J62: Dr. Alka Singhal, Ms. Sonal J128: Dr. Charu, Dr. Himani

COURSE OUTCOMES		COGNITIVE LEVELS
C372.1	Demonstrate the working of Git repository hosting service through git commands to manage files, support version control and contribute to open source community by providing enhanced versions.	Understand level (Level 2)
C372.2	Develop python programs using lists, tuples, dictionaries, functions, Numpy, SciPy and Matplotlib.	Apply Level (Level 3)
C372.3	Develop python programs to scrap and process data using Beautiful Soup, pandas and MongoDB.	Apply Level (Level 3)
C372.4	Analyze baseline methods for pre-processing, clustering and classification algorithms using scikit-learn python libraries.	Analyze Level (Level 4)
C372.5	Build J2EE Programs using JDBC Connectivity with SQL Database and Apache/ Glassfish as web servers.	Create Level (Level 6)

Module No.	Title of the Module	List of Experiments	CO	#Labs
1.	Introduction to GitHub & Sustainable Development Goals (SDG's)	● Read and explore the Github and Sustainable Development Goals. ● Create a simple program and upload it on Github. ● Extract one open source project from Github. Perform the reverse engineering of the same.	CO1	1
2.	Introduction To Python	● Making use of lists, tuples, and dictionaries, indexing and slicing to access data	CO2	1
3.	Python	● Create user defined functions using built-in functions such as **filter (f, a)** from python libraries.	CO2	1
4.	Numpy, SciPy, Matplotlib (Python)	● Write python programs using various functions of Numpy, SciPy and Matplotlib library.	CO2	2
5.	Beautiful Soup (Python), Pandas, MongoDB	● Write a program using Beautiful Soup for scrapping data from web, store in csv files and process them. ● Write a program for processing data stored in MongoDB using Pandas.	CO3	2

6.	Java Script, Java Servlet and Java Server Pages.	● Write programs for building web-pages using java script. ● Buildweb-based applications using server-side programming – Java Server Pages (JSP) and Java Servlet.	CO5	1
7.	Scikit-Learn (Python)	● Write python programs for data analysis, feature engineering, clustering and classification.	CO4	1

Evaluation Criteria		
Components	**Maximum Marks**	
LabTest1	20	
LabTest2	20	
Evaluation	30	
Attendance	15	
Lab record submission	15	

Total	**100**	

Project Based Learning: The course emphasizes on skills required to develop open source projects. The use of Python, its libraries and frameworks allows students to create scripts to automate tasks. The skills acquired in open source software lab helps students in employability and improves possibility of career opportunities in the field of Data Science, Web Development, Application Development and Machine Learning.

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.	https://guides.github.com/
2.	https://sustainabledevelopment.un.org/
3.	David Beazley and Brian K. Jones. "*Python Cookbook: Recipes for Mastering Python 3*. " O'Reilly Media, Inc.", 2013.
4.	Basham, Bryan, Kathy Sierra, and Bert Bates. *"Head First Servlets and JSP™".* (2008).
5.	McKinney, Wes. *Python for data analysis: Data wrangling with Pandas, NumPy, and IPython*. " O'Reilly Media, Inc.", 2012.

Detailed Syllabus

Course Code	15B17CI576	**Semester** Odd **(specify Odd/Even)** **Special Sem 21**	**Semester 5th Session** 2021 -2022 **Months from** August 2021 **to** 18 December 2021
Course Name	Information Security Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Somya Jain (J-62), Himanshu Agarwal (J-128)
	Teacher(s) (Alphabetically)	J-62: Amarjeet Kaur, Dr. Jaspal Kaur, Dr. Sangeeta Mittal, Somya Jain J-128: Bansidhar Joshi, Himanshu Agarwal, Shariq Murtuza

Course Outcomes (CO)	**Description**	**Cognitive Level (Bloom's Taxonomy)**
C374.1	Demonstrate and illustrate the different cipher techniques and understand various anti-virus and anti worms	Level-2 (Understanding Level)
C374.2	Develop and make a code to implement various Symmetric key , Asymmetric key cryptographic techniques and steganography techniques	Level-3 (Applying Level)
C374.3	Apply a client server programming for symmetric ,asymmetric algorithms and key exchange algorithms, Application of information security to real world problems	Level-3 (Applying Level)
C374.4	Examine and analyze the packet information for different protocols using Wireshark.	Level-4 (Analyzing Level)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Cryptography	Introduction to Cryptography	C374.1
2.	Ciphers	Implementation of Cipher using Transposition techniques and Caesar Cipher	C374.2
3.	Ciphers	Implementation of Substitution Ciphers: Hill Cipher and Polyalphabetic Cipher	C374.2
4.	Symmetric key cryptography	Introduction to Symmetric key cryptography	C374.1
5.	Data Encryption Standard	Implementation of Data Encryption Standard (DES)	C374.2
6.	Public key cryptography	Introduction to Public key cryptography and Digital signature	C374.2

7.	Key Exchange Algorithm	Implementation of Diffie Hellman Key Exchange Algorithm	C374.3
8.	Client server programming	Client server programming using TCP	C374.3
9.	Client server programming	Implementation of DES and RSA using Client server programming	C374.3
10.	Steganography	Introduction to Steganography	C374.2
11.	Antivirus and Anti-Worms	Introduction to Antivirus and Anti-Worms, and Wireshark tool	C374.1
12.	Applications of Information Security	Applications of Information Security to real world problems	C374.3
13.	Wireshark	Understanding of Secure-socket layer, Application Layer (HTTP, FTP, DNS) using Wireshark tool	C374.4

Evaluation Criteria

Components	Maximum Marks
Lab Test -1	20
Lab Test -2	20
Quiz 1	15
Quiz 2	15
Project	15
Attendance	15
Total	**100**

Project based learning: The students are grouped into groups of size 5-6 and will be implementing a secure client server program with required encryption techniques. The student will analyze the requirements and select the required solutions. This will help in the employability of students in the information security 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.	Information Security, Principles and Practice, , 2nd Edition, Mark Stamp, Wiley, 2011
2.	Security in Computing 5th Edition , Charles P Fleeger et. al. - Prentice Hall, 2015
3.	The InfoSec Handbook: An Introduction to Information Security- Apress Open, Nayak, Umesha, and Umesh Hodeghatta Rao, 2014
4.	Information Security: The Complete Reference, 2nd Edition- Mark Rhodes Ousley, 2013
5.	Cracking Codes with Python: An Introduction to Building and Breaking Ciphers- Al Sweigart, 2018

Subject Code	16B1NHS432		Semester: ODD	Semester V Session 2021-2022 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 Ms. Shikha Kumari		

COURSE OUTCOMES		COGNITIVE LEVELS
C303-9.1	Demonstrate an understanding of the various perspectives of positive psychology and apply them in day to day life	Apply Level (C3)
C303-9.2	Examine various theories and models of happiness, well-being and mental health	Analyze Level (C4)
C303-9.3	Recommend possible solutions for enhancing happiness, well-being and mental health	Evaluating Level (C5)
C303-9.4	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;	6

		Intelligence; Education; and Religion.	
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)
Snyder, C.R., Lopez, S. J., & Pedrotti, J.T. (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. 2nd Ed., Sage Publications
Wesley J. Chun (2014). Positive Psychology, 1is Ed., Pearson
Dewe, P. & Cooper, C. (2012). Well-Being & Work: Towards a Balanced Agenda. Palgrave Macmillian:NY.
Vijay Parkash, Updesh Kumar, Archana. (2015). Positive Psychology: Applications in Work, Health and Well – Being. 1st Ed., Pearson

Detailed Syllabus
Lecture-wise Breakup

Subject Code	16B1NHS434	Semester :ODD	Semester V Session 2021-22 August - December
Subject Name	**Introduction to Contemporary Form of Literature**		
Credits	3	**Contact Hours**	3 (3-0-0)

Faculty (Names)	Coordinator(s)	Dr Monali Bhattacharya (Sector 62) Dr Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava & Dr Monali Bhattacharya

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.	CL-2 Understand
C303-6.2	Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society.	CL-3 Apply
C303-6.3	Analyze select representative texts of different cultures thematically and stylistically.	CL-4 Analyse
C303-6.4	Determine the reciprocal relationship between the individual and culture individually and/or through a research-based paper/poster presentation.	CL-5 Evaluate
C303-6.5	Create literary, non-literary write-up with proper applied grammar usage, individually and in a team.	CL-6 Create

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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**	• New Fiction: Graphic Novels, Cyberpunk	4

	Today: Features & Portions	• Non Fiction: Memoirs & Autobiographies, Biographies	
3.	**Modern Retellings/ Childeren'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 are supposed to write Personal Narrative: Memoir or a Blog (of 2 pages) keeping transition markers, stylistic and linguistic devices in mind, thereafter, submit it to preassigned peer, who reviews it and writes a biographical note of the writer, based on stylistic choices made by him/her in blog and memoir. Students also are required to submit an entire project having components of Research Paper (analyzing mythical text of one's choice), Comparative Analysis of his/her work with Penelopiad or Hayavadana in Digital Poster Format & Report on Online Collaboration

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'.7th Edition, Hienle&Hienle: Thomson Learning, USA, 1999.
For online version:
https://mthoyibi.files.wordpress.com/2011/05/a-glossary-of-literary-terms-7th-ed_m-h-abrams-1999.pdf

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

SYLLABUS AND EVALUATION SCHEME

Course Code	16B1NHS532	Semester: ODD (specify Odd/Even)	Semester: 5th Month from: Aug to Dec, 2021
Course Name	Planning and Economic Development		
Credits	03	Contact Hours	3-0-0

Faculty (Names)	**Coordinator**(s)	Dr. Akarsh Arora
	Teacher(s) (Alphabetically)	Dr. Akarsh Arora (akarsh.arora@mail.jiit.ac.in)

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.	6

		Financial Federalism under Constitution. Finance Commissions in India, Terms of References and its Recommendations	
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 (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 formula 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).

Course Code	17B1NHS531	Semester: Odd	Semester V Session 2021 -2022 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, organizations 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	5
2.	Dimensions of Culture	- Evolution of Culture - Principal theories of Culture: Kluckholn and Strodtbeck, Hofstede, Trompenaars and Schwartz - Cultural Diversity and cross-cultural literacy	6
3	Levels of Culture	- Levels of Culture - Measurement of Culture	5
4.	Cross cultural communication in physical and virtual teams	- The Communication Process - Language and Culture - Non-Verbal Communication - Barriers to Cross Cultural Understanding	6
5.	Negotiation and Decision Making	- Theories of Negotiation - Negotiation and Intercultural Communication - Decision making in cross cultural environment	6

		▪ Expatriate Management	
6.	Culture and Marketing	Culture and research Culture and Consumer behaviour ▪ Culture and Marketing	7
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.

Course Code	20B12CS331	Semester: **Odd**	Semester 5th Session 2021-2022
			Month from: July **to** Dec 2021

Course Name	**Fundamentals of Machine Learning**

Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Mukesh Saraswat (sec-128), Dr. Parul Agrawal (Sec-62)
	Teacher(s) (Alphabetically)	Dr. Mukesh Saraswat, Dr. Parul Agrawal

COURSE OUTCOMES		COGNITIVE LEVELS
C330-1.1	Understand the mathematical concepts of machine learning approaches.	Understand Level (C2)
C330-2.2	Apply the fundamentals of linear algebra and probability theory to the machine learning problems.	Apply Level (C3)
C330-1.3	Apply the concepts of regression analysis and vector calculus to the machine learning models.	Apply Level (C3)
C330-1.4	Analyze the role of dimensionality reduction and density estimation for machine learning problems	Analyze Level (C4)
C330-1.5	Evaluate and test the significance of machine learning results statistically.	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Machine learning	Why machine learning, learning problems, types of learning: supervised, unsupervised, semi-supervised learning, fundamentals of machine learning	02
2.	Linear Algebra	Linear equations, solving linear equations, matrices, Cholesky Decomposition, singular value decomposition, matrix approximation, vector space, Norms, inner product, length and distances, angles and orthogonality, orthogonal complement, inner product, orthogonal projections and rotations, linear independence, linear mapping, Affine spaces	09

3.	Probability Theory	Discrete and continuous probability, sum rule, product rule, Baye's Theorem, Gaussian Estimation, conjugacy and exponential family, inverse transform, Hidden Markov model	05
4.	Regression Analysis	Problem formulation, parameter estimation, linear regression vs non-linear regression models, univariate vs multivariate regression, regression using least squares, logistic regression in machine learning	05
5.	Vector Calculus	Gradients of vector valued function, gradient descent learning, lagrange's function in supervised learning, automatic differentiation, linearization and multivariate taylor series in machine learning	07
6.	Dimensionality Reduction and Density Estimation	Maximum variance, Low rank approximation, PCA, ICA, LDA, latent Variable, GMM, Maximum Likelihood estimation, expected maximization machine learning	08
7.	Statistical Validations	T test, paired T test, Z test, hypothesis testing, ANOVA, Pearson coefficient, significance testing	06
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Quiz/ Assignments in PBL mode (15))
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on fundamentals of machine learning algorithms. The students can opt any real-world application where these algorithms can be applied. The students have to implement the mini project using any open source programming language. Project development will enhance knowledge and employability of the students in 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.	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.
2.	Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. Mathematics for machine learning. Cambridge University Press, 2020.
	Reference Books:

1.	Mitchell, Tom M. "Machine learning." (1997).
2.	Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006.
3.	Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media, 2009.

Course Description

Subject Code	20B12CS332	Semester: Odd	Semester 5th Session 2021 -2022
			Month from: Sep to Dec 2021
Subject Name	Fundamentals of Computer Security		
Credits	3-1-0	**Contact Hours**	3

Faculty (Names)	Coordinator(s)	Dr.Charu Gandhi(128), Dr. Sangeeta Mittal(62)
	Teacher(s) (Alphabetically)	Dr.Charu Gandhi(128), Dr. Sangeeta Mittal (62)

COURSE OUTCOMES		COGNITIVE LEVELS
C330-2.1	Explain the fundamental concepts of computer security and malware types	Remember Level (C1)
C330-2.2	Identify types of cryptographic techniques and working of classical cryptosystems	Understand Level (C2)
C330-2.3	Describe authentication and access control paradigms	Understand Level (C2)
C330-2.4	Apply proactive solutions to security like Firewalls and IDS	Apply Level (C3)
C330-2.5	Describe legal and ethical issues with respect to information security	Understand Level (C2)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures for the module
1.	Security Basics	General overview, terminology and definitions, Security models and policy issues	6
2.	Introduction to Malware	Introduction to Malicious code, Spyware, Ransomware, Logic Bombs, Virus, Bacteria and Worms, Introduction to Anti-malware technology	6
3.	Threats to Network Communications and Basic Cryptography	Threats to Network Communications, Interception: Eavesdropping and Wiretapping, Modification, Fabrication: Data Corruption, Interruption: Loss of Service, Port Scanning, Introduction to cryptography and classical cryptosystem, Steganography vs Cryptography	8
4.	Authentication	Identification Versus Authentication, Authentication Based on Something You Know, Something You Are, Something You Have, Federated Identity Management, Multifactor Authentication, Secure Authentication, Password policies	5
4.	Access Control	Access Policies, Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control,	5

			Captchas	
5.	Intrusion Detection and Response	Goals for Intrusion Detection Systems, Types of IDSs – Anomaly Based and Signature Based ,Intrusion Prevention Systems, Intrusion Response	5
6.	Firewalls	What Is a Firewall?, Design of Firewalls, Types of Firewalls, Personal Firewalls, Comparison of Firewall Types, Example Firewall Configurations Network Address Translation (NAT), Data Loss Prevention	3
7.	Legal and Ethical Issues	Protecting Programs and Data - Copyrights, Patents, Trade Secrets, Information and the Law - Information as an Object, Legal Issues Relating to Information, Protection for Computer Artifacts, Ethical Issues in Computer Security	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (**Attendance-05, Class Test/ Quiz-05, Internal assessment-05, Project Based Learning - 10**)
Total	**100**

Project Based Learning: The students are grouped into groups of size 2-3 and will be implementing various cyber security tools. The student will analyze the requirements and select the required applications. This will help in the employability of students in the cyber security based industry and public sectors.

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.	Security in Computing (5th edition), Pfleeger, Pfleeger and Margulies, Pearson.
2.	Computer Security: Art and Science by Matt Bishop, Addison-Wesley Educational Publishers Inc
	Reference Books:
1.	Computer Security Fundamentals, (4th Edition), Chuck Easttum, Pearson Ed.
2.	Foundations of Computer Security, David Salomon, Springer
3.	Introduction to Modern Cryptography (2nd edition), Katz and Lindell, Chapman & Hall/CRC
4.	Elements of Computer Security, David Salomon, Springer
5.	Cryptography Theory and Practice (3rd edition), Stinson, Chapman & Hall/CRC

Course Code	20B12CS333	Semester ODD	Semester Session 2021 -2022
			Month from JUL-DEC

Course Name	**Introduction to Big Data & Data Analytics**

Credits	3	Contact Hours	3-1-0 (4 hrs per week)

Faculty (Names)	Coordinator(s)	**Dr. Bharat Gupta (62), Dr. Neeraj Jain (128)**
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		COGNITIVE LEVELS
C330-3.1	Explain the fundamental concepts of an exciting growing field of big data analytics	Understanding [Level 2]
C330-3.2	Demonstrate the tools required to manage and analyze big data like Hadoop, NoSql MapReduce	Apply [Level 3]
C330-3.3	Apply predictive models and advanced computing paradigms for big data analytics	Apply [Level 3]
C330-3.4	Analyze the big data using intelligent & visualization techniques and use various techniques for mining data stream	Analyze [Level 5]
C330-3.5	Design and create predictive and mathematical model to solve complex real-world problems in for decision support.	Create [Level 6]

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Big Data	Introduction to Big Data landscape, Big Data: Why and where, Characteristics of Big Data (V's of Big Data (volume, velocity, variety, veracity, valence, and value) and Dimensions of Scalability, Data Models for Big Data Products(NOSQL, NEWSQL,HADOOP),Data Science and Analytics.	7
2.	Data Visualization Techniques	Introduction to Python or R, Understanding and Visualizing Data, Data Visualization R/Python	5
3.	Data Modeling and Optimization	Modeling Uncertainty and Risk, Optimization and Modeling Simultaneous Decisions, Case Study	5
4.	Decision Making and Predictive Analytics-1	Data exploration, Evaluation methods, Regression Techniques, Classification Techniques, Case Study	9
5.	Decision Making and Predictive Analytics-2	Clustering Techniques, Anomaly Detection, Dimensionality Reduction, Neural networks for deep learning, Hands-on using Python/R, Case Study	9
6.	Big Data Technologies	Using Hadoop to store data(HDFS, HBASE), Process Data using Map Reduce, Testing and Debugging Map Reduce Applications	7

			Total number of Lectures	**42**

Evaluation Criteria

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

<mark>Project based learning: The students are grouped into groups of size 5-6 and will be implementing a decision making and predictive analytics techniques for big data. The student will analyze the big data and select appropriate technique for processing. This will help in the employability of students in the data science and big data sector.</mark>

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

Reference Books:

1.	Dey, N., Hassanien, A. E., Bhatt, C., Ashour, A., & Satapathy, S. C. (Eds.). (2018). Internet of things and big data analytics toward next-generation intelligence (pp. 3-549). Berlin: Springer.
2.	Marz, N., & Warren, J. (2015). Big Data: Principles and best practices of scalable real time data systems. Manning Publications Co.
3.	Grover, M., Malaska, T., Seidman, J., & Shapira, G. (2015). Hadoop Application Architectures: Designing Real-World Big Data Applications. " O'Reilly Media, Inc.".
4.	Covington, D. (2016). Analytics: Data Science, Data Analysis, and Predictive Analytics for Business. CreateSpace Independent Publishing Platform.

Text Books:

5.	EMC Education Services. (2015). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley.
6.	Nelli, F. (2018). Python data analytics: with pandas, numpy, and matplotlib. Apress.
7.	Sedkaoui, S. (2018). Data analytics and big data. John Wiley & Sons.
8.	Erl, T., Khattak, W., & Buhler, P. (2016). Big data fundamentals: concepts, drivers & techniques. Prentice Hall Press.
9.	Dasgupta, N. (2018). Practical big data analytics: Hands-on techniques to implement enterprise analytics and machine learning using Hadoop, Spark, NoSQL and R. Packt Publishing Ltd.
10.	Kumar, V. N., & Shindgikar, P. (2018). Modern Big Data processing with Hadoop: Expert techniques for architecting end-to-end Big Data solutions to get valuable insights. Packt Publishing Ltd.

Course Code	20B13HS311	Semester: Odd	Semester: V Session: 2021-22 Month: August-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. Niti Mittal • Dr. Praveen Sharma • Dr. Swati Sharma

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	8

		• The Legislature: Parliament and its components- Lok Sabha and Rajya Sabha (composition and functions) • The Judiciary: Supreme Court-composition, functions, appointment and jurisdiction	
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 5th and 6th schedule • Emergency provisions	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

Course Code	21B12HS312	Semester: Odd (specify Odd/Even)	Semester: 5th Session: 2021 -2022 Month from: August-December
Course Name	**Management Accounting**		
Credits	03	Contact Hours	3-0-0

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

	COURSE OUTCOMES	COGNITIVE LEVELS
C303-10.1	To understand and analyse the financial statements of a business organization	Analyse (C4)
C303-10.2	To apply cost concepts and cost-volume-profit analysis in decision making	Apply (C3)
C303-10.3	To understand the concepts of cost management and apply activity-based costing	Apply (C3)
C303-10.4	To analyse relevant information for decision making	Analyse (C4)
C303-10.5	To apply the concepts of accounting for planning and control	Apply (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Accounting	Concepts, Techniques and Conventions	4
2.	Understanding and analysing financial statements	Balance sheet, Income statement, statement of changes in stockholders' equity, statement of cash flows, Use of ratios for analysis	6
3.	Introduction to Management accounting	Management Accounting in service organizations, Management Process and accounting, Ethical conduct for accountants	4
4.	Introduction to cost behaviour	Identifying resources, Activities, Costs and Cost drivers; Variable and Fixed cost behaviour; Cost-Volume-Profit Analysis	4

5.	Measurement of Cost behaviour	Cost drivers, Management influence on cost behaviour, Cost functions	3
5.	Cost Management Systems and Activity-Based costing	Direct, Indirect cost; Cost allocation; Traditional and Activity Based costing systems	4
6.	Relevant information for decision making	Relevant information for Pricing decisions and operational decisions	7
6.	Budgetary Control	Introduction to budgets; Functional budgets, Master budget, Fixed and flexible budgets, Budgets as financial planning models	4
7.	Standard Costing and Variance analysis	Standard costing system, Variance analysis	3
8.	Management control systems and responsibility accounting	Management control system, Organizational goals, controllability and measurement of financial performance, measures of profitability, ROI or Economic profit	3
Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (assignments, class test, project)
Total	**100**

Project based learning- The students will be given a group project to identify a simple business, one with at-least two product, two services or one product & one service. They will estimate the fixed and variable costs related to the business and carry-out Cost-Volume-Profit analysis to determine the Break-even sales of the business. Also, they will determine the cost of products/services using Activity based Costing. Lastly the students will prepare projected master budget for next three years which include the sales budget, operating expenses budget, cash budget, purchase budget, projected balance sheet, profit and loss account and so on.

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.	Charles T. Horngren, Gary L. Sundem, Jeff O. Schatzberg, Dave Burgstahler, Introduction to Management Accounting, 16th Edition, Pearson Publication, 2014.

2.	Anthony A. Atkinson, Robert S. Kaplan, Ella Mae Matsumura, S. Mark Young, G. Arun Kumar, Management Accounting, 5th Edition, Pearson Publication, 2009.
3.	Arora, M.N. Cost and Management Accounting, Himalaya Publishing, 4th Edition, 2018.
4.	Hingorani, Ramanathan and Grewal, Management Accounting, S. Chand Publications, 2003.

Lecture-wise Breakup

Course Code	16B1NPH531	Semester : ODD	Semester V Session 2021 -2022
			Month from July to December
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,	8

		expectation values, and uncertainty principle and its implications, no cloning applications	
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**.**

Course Code	16B1NPH535	Semester: ODD	Semester: 5th Session: 2021-22 Month from July 2021 to December 2021
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 momenta and parities of nuclear ground state, Magnetic	05

		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.

Matrix Computations (16B1NMA533)

Detailed Syllabus

Course Code	16B1NMA533	Semester - Odd (specify Odd/Even)		Semester 5th Session 2021 -2022 Month from July 2021 - Dec 2021
Course Name	Matrix Computations			
Credits	4		Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Dr. Amita Bhagat and Dr. Neha Singhal
	Teacher(s) (Alphabetically)	Dr. Amita Bhagat, Dr. Neha Singhal, 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 (Assignments, Quizzes and Tutorial)
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.	**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, 3rd Edition, Prentice Hall of India, 2016.
4.	**David, W. Lewis**., Matrix Theory, World Scientific, 1991.

Basic Numerical Methods (17B1NMA531)

Course Description

Course Code	17B1NMA531	Semester - Odd	Semester V Session 2021-22 Month from Aug 2021- Dec 2021	
Course Name	Basic Numerical Methods			
Credits	3		Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Prof. Lokendra Kumar & Dr. P. K. Srivastava		
	Teacher(s) (Alphabetically)	Dr. D .C. S. Bisht , Prof. Lokendra Kumar, Dr. P. K. Srivastava & Prof. R. C. Mittal,		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C301-5.1	explain the concepts of approximation and errors in computation.	Understanding level (C2)
C301-5.2	construct numerical methods for algebraic and transcendental equations and their convergence.	Applying Level (C3)
C301-5.3	outline the methods of interpolation using finite differences and divided difference formulas.	Understanding level (C2)
C301-5.4	make use of numerical differentiation and integration.	Applying Level (C3)
C301-5.5	solve the system of linear equations using direct and iterative methods.	Applying Level (C3)
C301-5.6	solve ordinary differential equations using different numerical methods.	Applying Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Approximation and Errors in Computation	Errors, relative error, absolute error, error in series approximation.	02
2.	Algebraic and Transcendental Equations	Bisection Method, Regula- Falsi Method, Secant Method, Iterative method, Newton-Raphson Method, convergence.	07
3.	Interpolation	Finite Differences, Relation between difference operators, Newton's Forward and Backward Interpolation, Gauss Backward Interpolation, Bessel's and Sterling's central difference operators, Laplace-Everett's formula, Newton's divided difference formula, Lagrange's interpolation formula.	08
4.	Numerical Differentiation and Integration	Derivatives using Newton's Forward and Backward Interpolation, Bessel's and Sterling's central difference operators, Maxima and minima of a tabulated function. Trapezoidal, Simpson's, Boole's and Weddle's rules, Euler-Maclaurin formula.	11
5.	System of Linear Equations	Gauss Elimination method, LU decomposition method, Gauss-Seidel Method.	05
6.	Numerical	Picard's method, Euler's method, Modified Euler's	09

	Solution of Ordinary Differential Equations	<mark>method, Fourth order Runge-Kutta method, Milne's method for first order, second order and simultaneous differential equations, Finite-Difference Method</mark>	
Total number of Lectures			**42**

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

<mark>**Project Based Learning:** Students will be divided in a group of 4-5 to collect literature and submit a report on application of different numerical methodsto solve practical problemsbased on system of linear equations andordinary differential equations.</mark>

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.	**C. F. Gerald and P.O. Wheatley,** Applied Numerical Analysis, 7th Ed., Pearson Education, 2004.
2.	**M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International, New Delhi, 2014.
3.	**R. S. Gupta,** Elements of Numerical Analysis, 2nd Ed., Cambridge University Press, 2015.
4.	**S.D. Conte and C. deBoor,** Elementary Numerical Analysis, An Algorithmic Approach, 3rd Ed., McGraw-Hill, New York, 1980.