

Detailed Syllabus

Course Code	15B17CI576	Semester Odd (specify Odd/Even) Special Sem 21	Semester 5th Session 2020 -2021 Months from 2 June 2021 to 21 June 2021
Course Name	Information Security Lab		
Credits	1	Contact Hours	2

Faculty (Names)	Coordinator(s)	Amanpreet Kaur, Arpita Jadhav Bhat, Nitin Shukla
	Teacher(s) (Alphabetically)	

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, Mark Stamp, Wiley
2.	Security in Computing 5 th Edition , Charles P Fleeger et. al. - Prentice Hall
3.	The InfoSec Handbook: An Introduction to Information Security- Apress Open
4.	Information Security: The Complete Reference, Second Edition- Mark Rhodes Ousley
5.	Cracking Codes with Python: An Introduction to Building and Breaking Ciphers-Al Sweigart

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B1NHS434	Semester: Odd	Semester V Session 2020-2021 Month from Aug 2020 to Dec 2020
Course Name	Principles of Management		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Deepak Verma (deepak.verma@jiit.ac.in)
	Teacher(s) (Alphabetically)	Dr. Deepak Verma

COURSE OUTCOMES		COGNITIVE LEVELS
C303-1.1	Describe the functions, roles and skills of managers and illustrate how the manager's job is evolving.	Understanding Level (C2)
C303-1.2	Examine the relevance of the political, legal, ethical, economic and cultural environments in global business.	Analyzing Level (C4)
C303-1.3	Evaluate approaches to goal setting, planning and organizing in a variety of circumstances.	Evaluating Level (C5)
C303-1.4	Evaluate contemporary approaches for staffing and leading in an organization.	Evaluating Level (C5)
C303-1.5	Analyze contemporary issues in controlling for measuring organizational performance.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Managers and Management	Management an Overview: Introduction, Definition of Management, Role of Management, Functions of Managers, Levels of Management, Management Skills and Organizational Hierarchy, Social and Ethical Responsibilities of Management: Arguments for and against Social Responsibilities of Business, Social Stakeholders, Measuring Social Responsiveness and Managerial Ethics, Omnipotent and Symbolic View, Characteristics and importance of organizational culture, Relevance of political, legal, economic and Cultural environments to global business, Structures and techniques organizations use as they go international.	10
2.	Planning	Nature & Purpose, Steps involved in Planning, Objectives, Setting Objectives, Process of Managing by Objectives, Strategies, Policies & Planning Premises, Competitor Intelligence, Benchmarking, Forecasting, Decision-Making.	8
3.	Organizing	Nature and Purpose, Formal and Informal Organization, Organization Chart, Structure and Process, Departmentalization by difference strategies, Line and Staff authority- Benefits and Limitations-De-Centralization and Delegation of Authority Versus, Staffing, Managerial Effectiveness.	10
4.	Directing	Scope, Human Factors, Creativity and Innovation, Harmonizing Objectives, Leadership, Types of Leadership Motivation, Hierarchy of Needs, Motivation theories,	6

		Motivational Techniques, Job Enrichment, Communication, Process of Communication, Barriers and Breakdown, Effective Communication, Electronic media in Communication.	
5.	Controlling	System and process of Controlling, Requirements for effective control, The Budget as Control Technique, Information Technology in Controlling, Productivity, Problems and Management, Control of Overall Performance, Direct and Preventive Control, Reporting, The Global Environment, Globalization and Liberalization, International Management and Global theory of Management.	8
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project, Quiz, Attendance)	
Total		100	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Koontz H, Weihrich H. Essentials of management: an international, innovation, and leadership perspective. McGraw-Hill Education; 10 th Edition 2018.
2.	Tripathi PC. Principles of management. Tata McGraw-Hill Education; 6 th Edition 2017.
3.	Principles of Management Text and Cases, Pravin Durai, Pearson, 2015
4.	Robbins, S.P. & Decenzo, David A. Fundamentals of Management, 7 th ed., Pearson, 2010
5.	Robbins, S.P. & Coulter, Mary Management; 14 ed., Pearson, 2009

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI313	Semester ODD (specify Odd/Even)	Semester Fifth Session 2020 -2021 Month from Aug -Jan
Course Name	Computer Organization and Architecture		
Credits	4 (L=3, T=1)	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Dr. Hema N, Amarjeet Kaur (J62), Dr. Shailesh Kumar(J128)
	Teacher(s) (Alphabetically)	Amarjeet Kaur, Dr. Hema N and Dr. Pawan Kumar Upadhaya, Bansidhar Joshi, Kritika Rani, Dr. Rashmi Kushwaha, Dr, Shailesh Kumar

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	Hierarchical 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
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Attendance =07, Class Test or/and Quizzes, etc = 07, Internal assessment = 05, Assignments in PBL mode = 06).	
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, 3 rd 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, Eighth Edition, 2019.
6.	Nicholas Carter, Schaum’s outline of Computer Architecture, Tata McGraw Hill, Second Edition, 2014.

Detailed Syllabus

Course Code	15B11CI373	Semester Even (specify Odd/Even)	Semester Second Session 2020-2021 SPLSEM 2021
Course Name	Computer Organization and Architecture Lab		
Credits	1	Contact Hours	2

Faculty (Names)	Coordinator(s)	Dr. Taj Alam (62), Dr. Shailesh Kumar (128)
	Teacher(s) (Alphabetically)	Amarjeet Kaur, Hema N., Jyoti, Pawan K. Upadhyay, Purtee Kohli, Vikash

COURSE OUTCOMES		COGNITIVE LEVELS
C273.1	Implementation 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 of 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	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

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B11CI412	Semester Odd (specify Odd/Even)	Semester V Session 2020-21 Month from July to Dec 2020
Course Name	Operating Systems and Systems Programming		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Sec 62: Alka Singhal, Sec 128: Akanksha Mehndiratta
	Teacher(s) (Alphabetically)	Sec 62: Ashish Mehra, Kashav Ajmera Sec 128: Ambalika Sarkar, Dr. Neeraj Jain, Dr. Shilpa Budhkar

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	2

		loaders and their stages, BIOS and its routines, Interrupts.	
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, Compilers, Formal System.	2
13.	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
14.	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 (Quiz+ Assignment)
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.	CharlesCrowley “Operating System A Design Approach”TMH.
2.	Andrew S. Tanenbaum “Operating Systems Design and Implementation”, Third Edition,Prentice Hall Publications2006
3.	A.S. Tanenbaum, “Modern Operating Systems”, 2 nd 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, 2 nd 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.	CharlesCrowley “Operating System A Design Approach”TMH.

Detailed Syllabus

Lab-wise Breakup

Subject Code	15B17CI472	Semester Even (specify Odd/Even)	Semester VI Session SPLSEM2021 Month: June 2021
Subject Name	Operating system and system programming Lab		
Credits	0-0-1	Contact Hours	2

Faculty (Names)	Coordinator(s)	Prashant Kaushik & Kashav Ajmera(J62), Rupesh Koshariya(J128)
	Teacher(s) (Alphabetically)	Amanpreet Kaur, Ankit Vidyarthi, Anubhuti , Ashish Mishra, Kashav Ajmera, Kirti Aggarwal, Niyati Aggrawal, Prashant Kaushik, Rupesh Koshariya, Shardha Porwal, Sherry Garg, and Somya Jain, Shilpa Budhkar, Shruti Jaisawal

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

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

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

Project Based Learning: In project based learning students need to form group of 4 and they will be implementing the application of any or combination of concepts of operating system or any algorithm which is going to be used in real life. Application of concepts not only enhances their ability to comprehend the concept clearly but also improves their problem solving ability. As a consequence employability of student increases.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc.)	
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", 2 nd edition, Prentice Hall India.
4.	A.Silberschatz, P.Galvin, G. Gagne, "Operating systems concepts" Willey international company (Ninth 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.	Milan Milenkovic, "Operating Systems: Concepts and Design", McGraw-Hill computer science series
8.	ACM/IEEE transactions on operating systems concepts.
9.	www.vmware.com

Detailed Syllabus

Lab-wise Breakup

Course Code	15B17CI575	Semester ODD (SPL) (specify Odd/Even)	Semester 5th Session 2020-2021 Month from June 21 to June 21
Course Name	Open Source Software Lab		
Credits	1	Contact Hours	2 hours

Faculty (Names)	Coordinator(s)	Dr. Ankita Verma (J62), Mr. Himanshu Mittal (J128)
	Teacher(s) (Alphabetically)	J62: Dr. Ankita Verma, Dr. Adwitiya Sinha ,Dr. Archana Purwar, Dr. Indu Chawla, Dr. Megha Rathi, Dr. Parul Agarwal, Dr. Sandeep Kumar Singh, Dr. Suma Dawn J128: Dr. Avinash Pandey, Dr. Charu Gandhi, Dr. Chetna Gupta, Dr. Devpriya Soni, Dr. Mukesh Saraswat, Dr. Shikha Mehta, Dr. Himanshu Mittal

COURSE OUTCOMES		COGNITIVE LEVELS
C375.1	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)
C375.2	Apply a mix of Client, Server and Database technologies to solve Open Source Software issues/ to enhance projects.	Apply Level (Level 3)
C375.3	Develop Server-side programs using python with Database Servers-SQL, MongoDB	Apply Level (Level 3)
C375.4	Analyze baseline methods for pre-processing, clustering and classification algorithms using scikit-learn python libraries	Analyze Level (Level 4)
C375.5	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	<ul style="list-style-type: none"> • 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. 	CO1	1

	(SDG's)	Perform the reverse engineering of the same.																		
2.	Introduction To Python	<ul style="list-style-type: none"> Making use of lists, tuples, and dictionaries, indexing and slicing to access data 	CO2	1																
3.	Python	<ul style="list-style-type: none"> Create user defined functions using built-in functions such as filter (f, a) from python libraries. 	CO3	1																
4.	Numpy, SciPy, Matplotlib (Python)	<ul style="list-style-type: none"> Write python programs using various functions of Numpy, SciPy and Matplotlib library. 	CO4	2																
5.	Beautiful Soup (Python), Pandas, MongoDB	<ul style="list-style-type: none"> 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. 	CO5	2																
6.	Java Script, Java Servlet and Java Server Pages.	<ul style="list-style-type: none"> Write programs for building web-pages using java script. Buildweb-based applications using server-side programming – Java Server Pages (JSP) and Java Servlet. 	CO5	2																
7.	Scikit-Learn (Python)	<ul style="list-style-type: none"> Write python programs for data analysis, feature engineering, clustering and classification. 	CO4	2																
Evaluation Criteria																				
<table border="0"> <thead> <tr> <th style="text-align: left;">Components</th> <th style="text-align: right;">Maximum Marks</th> </tr> </thead> <tbody> <tr> <td>LabTest1</td> <td style="text-align: right;">20</td> </tr> <tr> <td>LabTest2</td> <td style="text-align: right;">20</td> </tr> <tr> <td>Evaluation</td> <td style="text-align: right;">30</td> </tr> <tr> <td>Attendance</td> <td style="text-align: right;">15</td> </tr> <tr> <td>Lab record maintenance and submission</td> <td style="text-align: right;">15</td> </tr> <tr> <td colspan="2">-----</td> </tr> <tr> <td>Total</td> <td style="text-align: right;">100</td> </tr> </tbody> </table>					Components	Maximum Marks	LabTest1	20	LabTest2	20	Evaluation	30	Attendance	15	Lab record maintenance and submission	15	-----		Total	100
Components	Maximum Marks																			
LabTest1	20																			
LabTest2	20																			
Evaluation	30																			
Attendance	15																			
Lab record maintenance and submission	15																			

Total	100																			

Project based learning: Students will learn different open-source technologies which will help them in developing the solutions for real-life problems. The lab session implementation using python, Java, and different open-source tools will expose students to the usability of such technologies. This will enhance their understanding and also help them during their employability.

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.	Python Cookbook by David Beazley and Brian K. Jones

4.	Head First Servlets & Java Server Pages by Bryan Basham, Kathy Sierra, and Bert Bates
5.	Python for Data Analysis, by Wes McKinney

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B19CI591	Semester Odd (specify Odd)	Semester V Session 2020 -2021 Month from July to December
Course Name	Minor Project-1		
Credits	2	Contact Hours	4

Faculty (Names)	Coordinator(s)	ANKIT VIDHYATHI, MUKESH SARASWAT
	Teacher(s) (Alphabetically)	ALL FACULTY

COURSE OUTCOMES		COGNITIVE LEVELS
C350.1	Analyze chosen literature addressing real world research problem to identify the requirements	Analyzing Level (4)
C350.2	Build technical report detailing the software specification, design, test plan, and implementation details.	Creating Level (6)
C350.3	Build a practicable solution for the research problem	Creating Level (6)
C350.4	Evaluate results to test the effectiveness of the proposed solution	Evaluating Level (5)
C350.5	Develop effective communication skills for presentation of project related activities	Apply Level (3)

Evaluation Criteria	
Components	Maximum Marks
Viva-1	20
Viva-2	20
D2D	60
Total	100

Detailed Syllabus
Lecture-wise Breakup

Course Code	16BINHS433	Semester: Odd	Semester Session 2020-2021 Month from August to Dec 2020
Course Name	Financial Management		
Credits	3	Contact Hours	3 (3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Mukta Mani (Sec-62) Dr. Sakshi Varshney (Sec-128)
	Teacher(s) (Alphabetically)	Dr. Mukta Mani (Sec-62) Dr. Sakshi Varshney (Sec-128) Dr. Shirin Alavi (Sec-62)

COURSE OUTCOMES		COGNITIVE LEVELS
C303-3.1	Analyze the time value of money in taking investment decisions.	Analyze (Level 4)
C303-3.2	Contrast the various forms of business organizations and evaluate their financial performance.	Evaluate (Level 5)
C303-3.3	Evaluate investment projects using capital budgeting techniques	Evaluate (Level 5)
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 long term sources of finance.	Evaluate (Level 5)
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, Finance functions and Role of Finance manager	4
2.	Time value of Money	Compounding, Discounting, Annuity, Perpetuity, Loan Amortization	6
3.	Analysis of Financial Statements	Understanding of Balance Sheet and Income Statements, Ratio Analysis, Interpretation, Importance and limitations	7
4.	Capital Budgeting: Principle Techniques	Nature of Capital Budgeting, Evaluation Techniques: Discounting (NPV, IRR etc.) and Non-discounting Techniques (payback, ARR etc)	5
5.	Long Term Sources of Finance	Definition, types, advantages and disadvantages	3
6.	Concept and measurement of cost of capital	Definition, measurement of specific costs, computation of Overall Cost of Capital,	4
7.	Cash Flows for Capital	Identification and determination of relevant cash flows	5

	Budgeting		
8.	Leverages and Capital structure decision and Working Capital Management	Break Even Analysis, Operating, Financial and combined leverage, Capital structure EBIT- EPS analysis, Concept of working capital management, Practical Considerations in Working capital management	5
9.	Project presentations		3
		Total	42

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Term	35
TA	25 (Project, Class Participation)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Khan, M.Y. and Jain, P.K., <i>Financial Management: Text, Problems and Cases</i> , 5th ed, Tata McGraw Hill, 2007.
2.	Chandra, P., <i>Financial Management Theory and Practice</i> , 6th ed., Tata McGraw Hill, 2004.
3.	Pandey, I.M., <i>Financial management</i> , 9th ed, Vikas Publishing House Pvt Ltd, 2006
4.	Van Horne, J.C. and Wachowicz, J.M., <i>Fundamentals of Financial Management</i> , 11th ed, Pearson Education, 2001
5.	Kishore, R.M., <i>Financial Management</i> , 6th ed, Taxmann, 2007.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	16B1NHS434	Semester : ODD	Semester V Session 2020-21 July - December
Subject Name	Introduction to Contemporary Forms of Literature		
Credits	3	Contact Hours	3 (3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Monali Bhattacharya (Sector 62)
	Teacher(s) (Alphabetically)	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 social, cultural, moral and linguistic changes in contemporary world through close study of 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 with an aim to analyze social, cultural and moral fibre of	CL-5

	youth in multidisciplinary environment, giving holistic solutions for sustainable development of society.	Evaluate
C303-6.5	Create literary, non-literary write-up with proper applied grammar usage, having moral and cultural significance for today's world individually and in a team.	CL-6 Create

Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
1.	Introducing Literary Theories	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • New Fiction: Graphic Novels, Cyberpunk • Non Fiction: Memoirs & Autobiographies, Biographies & Personal Narrative 	6
3.	Spiritual Literature	<u>Siddhartha</u> - Hermen Hesse (novella)	4
4.	Travel Literature	<u>Eat, Pray & Love (Travelogue & cinematic adaptation)</u>	4
5.	Written Communication Through Non-Fiction	<i>Diary, Blog, Travelogue</i>	4

6.	Commonwealth / Post Colonial Literature	<u>Hayavadana(Short Play)</u> - Girish Karnad	4
7.	European Literature	<u>Brave New World – Aldous Huxley (Science Fiction)</u>	4
8	Canadian Literature	<u>The Penelopiad- Margaret Atwood</u>	4
Total number of Hours			42

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.	Margaret Atwood, 'The Penelopiad', 1 st Edition, Canongate Series, Knopf, Canada, 2005.
2.	M.H. Abrams, 'A Glossary of Literary Terms'.7 th Edition, Hienle & Hienle: Thomson Learning, USA, 1999.
3	Mark William Roche, 'Why Literature matters in the 21 st Century', 1 st Edition, Yale University Press, 2004.
4	Girish Karnad, 'Hayavadana', 1 st Edition, Oxford University Press, Delhi, 1975 (30 th

	Impression, 2012).
5	Aldous Huxley, 'Brave New World', 1 st Edition, Harper Collins, 2004.
6	<u>Hermen Hesse, 'Siddhartha', 1st Edition. New Directions, US, 1951.</u> <u>For online version: https://www.gutenberg.org</u>
7	<u>Elizabeth Gilbert, 'Eat, Pray & Love. 1st Edition, Penguin,US, 2006.</u>

Detailed Syllabus

Lecture-wise Breakup

Subject Code	16B1NHS435	Semester : ODD	Semester: V Session: 2020-21 Month: August to December
Subject Name	SOCIOLOGY OF MEDIA		
Credits	3 (2-1-0)	Contact Hours	42

Faculty (Names)	Coordinator(s)	Prof. Alka Sharma
	Teacher(s) (Alphabetically)	Prof. Alka Sharma

COURSE OUTCOMES		COGNITIVE LEVELS
C304-1.1	Demonstrate a basic understanding of different concepts used in the systematic study of Sociology of Media	Understanding(C 2)
C304-1.2	Examine various sociological theoretical orientation towards media and society.	Analyzing(C 4)
C304-1.3	Analyze the key issues related to the processes of Production of Media, Popular Culture and consumer culture.	Analyzing(C 4)
C304-1.4	Critically evaluate the major methods of Cultural Consumption ,Social Class & the process of construction of subjectivities and audience reception in new Media	Evaluating(C 5)
C304-1.5	Create positive and critical attitude towards the use of new media and understanding of threats of Digital Age	Creating(C 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to the Course	1
2.	Concepts and Theoretical Orientation of	<ul style="list-style-type: none">• Different concepts related to Sociology of media• Functionalist Approach to the Sociology of Media• Critical Approach to the Sociology of Media• Symbolic Interactionist Approach to the Sociology	8

	Sociology of Media	<p>of Media</p> <ul style="list-style-type: none"> Different theories of Media 	
3.	Concept of Popular Culture and its critical analysis	<ul style="list-style-type: none"> What is popular culture? Difference between 'pop' culture and 'high' culture What distinguishes popular culture from other kinds of culture (art, folk culture)? Is there a distinction at all anymore? Visualizing Society through 'pop' culture/ media Risks and rituals that come with Popular Culture 	8
4.	New media	<ul style="list-style-type: none"> Difference between tradition media and new media New media as technology New Information Technology (brief history in case of India) 	5
5.	Media & State	<ul style="list-style-type: none"> Mediatization of Society Free-speech Media 	5
6.	Consumption of Media and Media reception	<ul style="list-style-type: none"> Social Actors as Audience/ Audience as market– Theory Media effects: Media and representations (gender, ethnic)- the under-representation and misrepresentation of subordinate groups. Media and the construction of reality: media logic and cultivation analysis theory Information Society vs Informed Society Cultural Consumption and Social Class 	9
7.	Media in Global Age	<ul style="list-style-type: none"> Rise of Network Society- Manuel Castells Global Media: impact of market & state Global Perspectives: The world on our doorstep Marketing and aesthetics in everyday life 	6
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Presentation and attendance)

Total	100
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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.	Ritzer, George, and Steven Miles. " <i>The changing nature of consumption and the intensification of McDonaldization in the digital age.</i> " <i>Journal of Consumer Culture</i> 19, no. 1, pp 3-20, 2019.
2.	Turow, Joseph. <i>Media today: An introduction to mass communication.</i> Taylor & Francis, 2011.
3.	Curran, James. <i>Media and society.</i> Bloomsbury Publishing, 2010.
4	JA Fisher 'High Art v/s Low Art, in Berys Nigel Gaut& Dominic Lopes (eds.), <i>The Routledge Companion to Aesthetics.</i> Routledge 2001

DETAILED SYLLABUS
Lecture-wise Breakup

CourseCode	16B1NHS532	Semester:ODD (specifyOdd/Even)	Semester: 5th Monthfrom: Aug to Dec2020
CourseName	Planning and Economic Development		
Credits	03	ContactHours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Akarsh Arora
	Teacher(s) (Alphabetically)	1. Dr. Akarsh Arora(akarsh.arora@mail.jiit.ac.in) 2. Dr. Amandeep Kaur(amandeep.kaur@mail.jiit.ac.in)

COURSE OUTCOMES		COGNITIVE LEVELS
C303-4.1	Understand the issues and approaches to economic development.	C2
C303-4.2	Evaluate National income accounting, human development index and sustainable development.	C5
C303-4.3	Apply an analytical framework to understand the structural characteristics of development.	C3
C303-4.4	Analyze the role of Macroeconomic stability & policies and Inflation in the development process.	C4
C303-4.5	Evaluate the importance of federal development and decentralization.	C5

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	

Recommended Reading material:	
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

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NHS531	Semester ODD	Semester V Session 2020 -2021
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 the main theories in cultural management,	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	<ul style="list-style-type: none"> ▪ Genealogy of the concept ▪ The Information Technology Revolution ▪ The concept of Network societies 	7
2.	Dimensions of Culture	<ul style="list-style-type: none"> ▪ Evolution of Culture ▪ Principal theories of Culture: Kluckhohn and Strodtbeck, Hofstede, Trompenaars and Schwartz ▪ Cultural Diversity and cross cultural literacy 	12
3.	Cross cultural communication in physical and virtual	<ul style="list-style-type: none"> ▪ The Communication Process ▪ Language and Culture 	7

	teams	<ul style="list-style-type: none"> ▪ Non Verbal Communication ▪ Barriers to Cross Cultural Understanding 	
4.	Negotiation and Decision Making	<ul style="list-style-type: none"> ▪ Theories of Negotiation ▪ Negotiation and Intercultural Communication ▪ Decision making in cross cultural environment 	8
5.	Cross Culture and Leadership	<ul style="list-style-type: none"> ▪ 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 	8
Total number of Lectures			42

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Projectand Oral Viva)
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.	Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2020). <i>International marketing</i> . McGraw-Hill Education.
2.	Coyle,D., <i>The Culture Code: The Secrets of Highly Successful Groups</i> , Bantam, 2018
3.	Fletcher, R., & Crawford, H. (2013). <i>International marketing: an Asia-Pacific perspective</i> . Pearson Higher Education AU.
4.	Gerard Bannon, J. (red.). Mattock, <i>Cross-cultural Communication: The Essential Guide to International Business</i> .2003
5.	Maidenhead. <i>Riding the Waves of Culture: Understanding Cultural Diversity in Business</i> (2012).3rd edition. McGraw Hill.

6.	Madhavan,S., Cross Cultural Management: Concepts and Cases(2 nd Ed),Oxfor University Press 2016.
7.	Robertson, Ronald. Globalization: Social theory and global culture, London: Sage, 1992.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	19B12HS311	Semester: ODD	Semester V Session 2020-21 Month from Aug 2020 to Dec 2020
Subject Name	ENTREPRENEURIAL DEVELOPMENT		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr Badri Bajaj
	Teacher(s) (Alphabetically)	Dr Badri Bajaj

COURSE OUTCOMES		COGNITIVE LEVELS
C303-8.1	Understand basic aspects of establishing a business in a competitive environment	Understand Level (C2)
C303-8.2	Apply the basic understanding to examine the existing business ventures	Apply Level (C3)
C303-8.3	Examine various business considerations such as marketing, financial and teaming etc.	Analyze Level (C4)
C303-8.4	Assessing strategies for planning a business venture	Evaluate Level (C5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Entrepreneurial perspective	Foundation, Nature and development of entrepreneurship, importance of entrepreneurs, Entrepreneurial Mind, Individual entrepreneur Types of entrepreneurs	6
2.	Beginning Considerations	Creativity and developing business ideas; Legal	10

		issues; Creating and starting the venture; Building a competitive advantage	
3.	Developing Marketing Plans	Developing a powerful Marketing Plan, E-commerce, Integrated Marketing Communications	8
4.	Developing Financial Plans	Sources of Funds, Managing Cash Flow, Creating a successful Financial Plan Developing a business plan	10
5.	Leading Considerations	Developing Team, Leading the growing company, Resources for growth	8
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Assignment, Quiz , Oral Questions)	
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.	Robert D Hisrich, Michael P Peters & Dean A Shepherd, "Entrepreneurship" 10 th Edition, McGraw Hill Education, 2018
2.	Norman M. Scarborough and Jeffery R. cornwell, "Essentials of entrepreneurship and small business management" 8th Edition, Pearson, 2016
3.	Rajiv Roy, "Entrepreneurship", 2 nd Edition, Oxford University Press, 2011
4.	Sangeeta Sharma, "Entrepreneurship Development", 1 st Edition, Prentice-Hall India, 2016

Course Description

Subject Code	20B12CS332	Semester: Odd	Semester 5th Session 2020 -2021 Month from: July to Dec 2020
Subject Name	Fundamentals of Computer Security		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr.Charu Gandhi(128), Dr. Pawan Singh Mehra(62)
	Teacher(s) (Alphabetically)	Dr.Charu Gandhi(128), Dr. Pawan Singh Mehra(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	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

	Cryptography		
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, Captchas	5
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-07, Class Test/ Quiz-07, Internal assessment-05, Assignment-06)
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)	
	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

Detailed Syllabus

Lecture-wise Breakup

Course Code	20B12CS33 1	Semester: Odd	Semester 5th Session 2020-2021 Month from: July to Dec 2020
Course Name	Fundamentals of Machine Learning		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Shikha Mehta(sec-128), Dr. Bharat Gupta(Sec-62)
	Teacher(s) (Alphabetically)	Dr. Shikha Mehta, Dr. Bharat Gupta, Dr. Dhanlaxmi

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	Analyze Level (C4)

	estimation for machine learning problems	
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-07, Class Test/ Quizze-07, Internal assessment-05,Assignment-06)	
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)	
	Text Books:
	Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. <i>Mathematics for machine learning</i> . Cambridge University Press, 2020.
	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. <i>Deep learning</i> . MIT press, 2016.
	Reference Books:
1.	Mitchell, Tom M. "Machine learning." (1997).

2.	Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006.
	Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. <i>The elements of statistical learning: data mining, inference, and prediction</i> . Springer Science & Business Media, 2009.

Detailed Syllabus

Lecture-wise Breakup

Course Code	20B12CS333	Semester ODD	Semester Session 2020 -2021 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. Megha Rathi (62), Dr. Payal Khurana Batra (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
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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
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Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance-07, Class Test/ Quizze-07, Internal assessment-05, Assignments-06)

Total	100
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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.

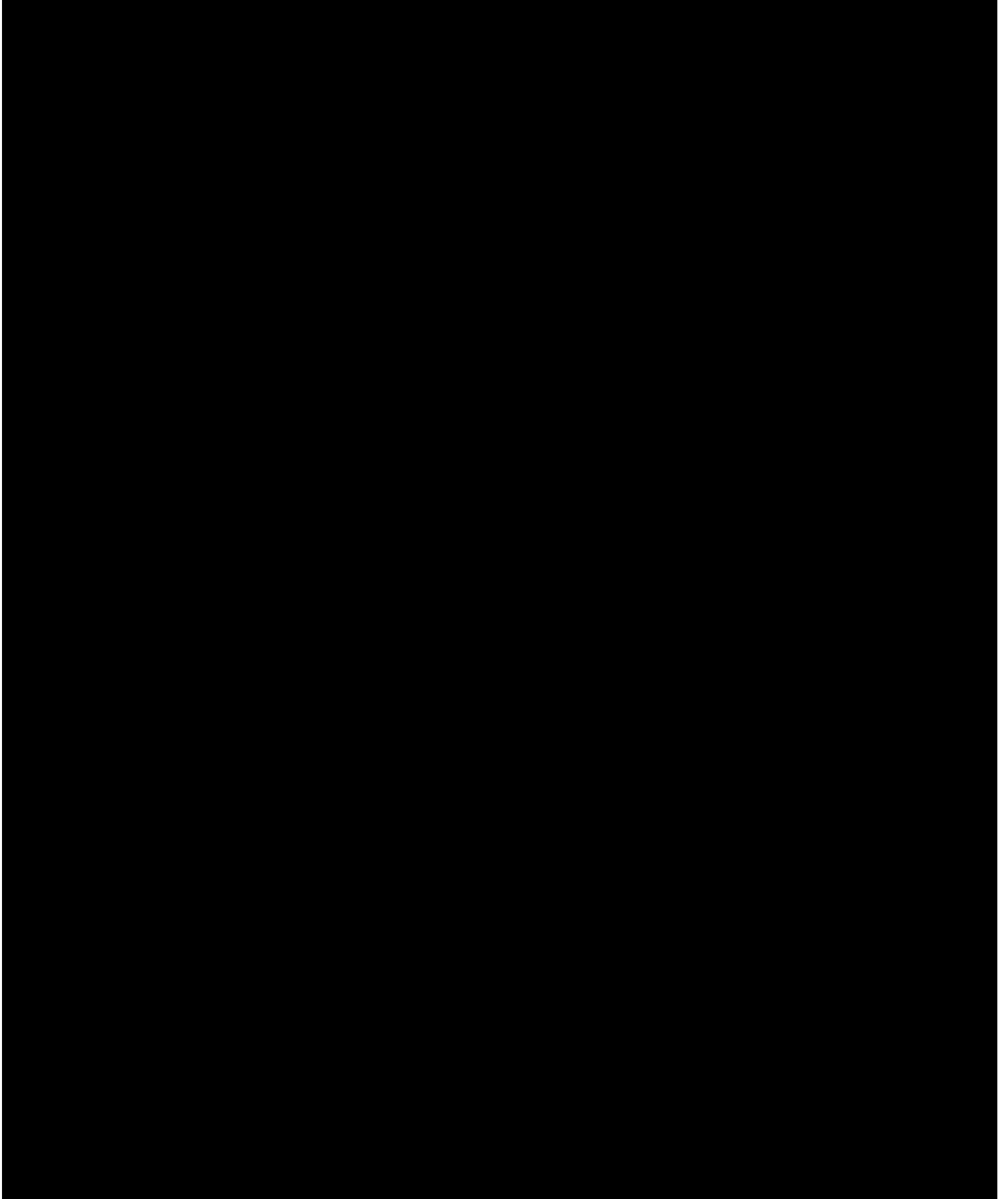
Text Books:

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.

Dr.AmarjeetPrajapati

Apply Level (C3)





Detailed Syllabus

Lecture-wise Breakup

Course Code	20B12CS335	Semester: Odd	Semester: 5 th Session: 2020 -2021 Month from: July to Dec 2020
Course Name	Image Processing and Computer Vision		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Aparajita Nanda
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		COGNITIVE LEVELS
At the completion of the course, Students will be able to		
CO 1	Understand the basic concepts of image processing and computer vision	Understand Level (C2)
CO 2	Apply different methods for intensity transformation, binary image processing and Fourier transformation	Apply Level (C3)
CO 3	Apply different spatial and spectral domain filters for image enhancements	Apply Level (C3)
CO 4	Apply thresholding, edge-based and region-based techniques for image segmentation	Apply Level (C3)
CO 5	Apply image processing techniques for various computer vision tasks	Apply Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Fundamentals of Digital Image Processing and Computer Vision	Introduction to Computer Vision and Image Processing, Image geometry, Fundamental steps in Digital Image Processing, Applications with examples of Imaging Modalities, Elements of Visual Perception, Image Sensing and Acquisition, Sampling and Quantization, Basic Relationships Between Pixels	5
2.	Basic Mathematical Tools for Intensity Transformations	Elementwise versus Matrix Operations, Linear versus Nonlinear Operations, Arithmetic Operations, Set and Logical Operations, Spatial Operations, Vector and Matrix Operations, Image Transforms, Probability and Random Variables, Image Negatives, Log Transformations, Power-Law (Gamma) Transformations, Piecewise Linear Transformation Functions, Histogram Processing	5
3.	Binary Image Processing	Formation of Binary Image, Thresholding, Geometric properties, Projections, Run length encoding, Binary algorithms, Morphological operators	4
4.	Spatial Filtering	Mechanics of Linear Spatial Filtering, Spatial Correlation and Convolution, Separable Filter Kernels, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters, Highpass, Bandreject, and Bandpass Filters from Lowpass Filters, Combining Spatial Enhancement Methods	5
5.	Sampling and Fourier Transformation	Complex Numbers, Fourier Series, Impulses and their Sifting Properties, The Fourier Transform of Functions of One Continuous Variable, Convolution, The Fourier Transform of Sampled Functions, The Sampling Theorem, Aliasing, Function Reconstruction (Recovery) from Sampled Data, Discrete Fourier Transform of One Variable and two variables, Properties of the 2-D DFT and IDFT, The Fast Fourier Transform	4

6.	Frequency Domain Filtering	Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering	3
7.	Image Segmentation	Point, Line, and Edge Detection, Image Gradient and Its Properties, The Canny Edge Detector, Local Processing and Global Processing Using Hough Transform, Basic Global Thresholding, Optimum Global Thresholding Using Otsu's Method, Segmentation by Region Growing and by Region Splitting and Merging.	6
8.	Computer Vision Applications	Case Studies like OCR, Scene understanding, Gesture recognition etc. using basic image processing techniques.	10
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA Assignments-06)		25 (Attendance-07, Class Test/ Quizze-07, Internal assessment-05,	
Total		100	

Text Books:	
1.	Digital Image Processing 4th Edition by Rafael C Gonzalez, PEARSON INDIA, May 2018.
2.	Computer Vision and Image Processing: Fundamentals and Applications by Manas Kamal Bhuyan, CRC Press; 1 edition, Oct 2019.

Reference Books:	
1.	Computer Vision: Algorithms and Applications by Richard Szeliski, Springer, 2010.
2.	Machine Vision by Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, McGraw-Hill, Inc., ISBN 0-07-032018-7, 1995

Detailed Syllabus

Lecture-wise Breakup

Subject Code	20B12CS336	Semester: (specify Odd/Even)	Semester ODD Session 2020-21 Month from Aug 2020 to Dec 2020
Course Name	Automata Theory and its Applications		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Shikha Jain/ Dr. Ambalika
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		COGNITIVE LEVEL
CO1	Solve the problems related to regular expression, regular grammar, DFA & NFA.	Apply Level (C3)
CO2	Identify the phases of compilers for a programming language and construct the parsing table for a given syntax	Apply Level (C3)
CO3	Appraise automata over infinite words	Apply Level (C3)
CO4	Experiment with Context Free Grammar and Context Sensitive Grammar	Apply Level (C3)
CO5	Apply concepts of automata in various real world problems.	Apply Level (C3)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Finite automata and its application	Introduction to Automata, its types and regular expressions, Equivalence of NFA, DFA and ϵ -NFA, Conversion of automata and regular expression, Applications of Finite Automata to lexical analysis.	14
2.	PDA and its application	Push down automata, Context Free grammars, Applications of PDA as top down and bottom up parser	12
3.	Turing Machine and its applications	Turing Machine: Context Sensitive features like type checking, Turing Machine as language acceptors and its design.	6
4.	Automata over infinite words	Introduction to Buchi automata and its properties, Buchi Theorem, Decidability	5
5.	Applications of automata	Games played on finite graph: finite games, infinite games, update games, solve games.	5

Evaluation Criteria

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

Total	100
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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.	Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D. (2013) "Introduction to Automata Theory, Languages, and Computation" (3rd ed.). Pearson.
2.	Raghavan, Compiler Design, TMH Pub,2013
Edition Reference Book(s):	
3.	Alfred Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: principles, techniques, and tools," 2nd Edition, Pearson Education
4.	John C. Martin, "Introduction to Language and the Theory of Computation", TMH 2004
5.	. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", 3rdEdition, PHI 2007
6.	S.P.Eugene, "Theory of automata, formal language and computation", New Age International Publishers , New Delhi 2003
7.	Sipser, M., Introduction to the Theory of Computation, Second Edition, Thomson Course Technology, 2007
8.	ACM Transactions on Computation Theory 9. ACM Journal on Theory of Computation.
9.	D. Kozen, Automata and computability, Springer, 1997.
10.	B. Khoussainov, A. Nerode, Automata theory and its applications, Springer, 2001.

Detailed Syllabus

Lecture-wise Breakup

Course Code	20B13HS311	Semester: Odd	Semester: V Session: 2020-21 Month: JULY-DECEMBER
Course Name	Indian Constitution and Traditional Knowledge		
Credits	3	Contact Hours	3(3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	<ul style="list-style-type: none">• Dr. Chandrima Chaudhuri• Dr. Praveen Sharma• Dr. Santosh Dev• Ms. Shikha Kumari• Dr. Swati Sharma

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C305.1	Demonstrate an understanding about the early Indian traditional political thought and the current Indian political scenario 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 and local governments as representatives of the common masses	Understand (C2)
C305.3	Analyze the working of Indian federalism with reference to	Analyze(C4)

	centre-state relations	
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	<ul style="list-style-type: none"> • 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) 	8
2.	Organs of the Government	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Centre-State Legislative Relations • Centre-State Administrative Relations • Centre-State Financial Relations • Special Provisions of some state and the 5th and 6th schedule 	8
4.	Local Governance in India	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Kautilya- Theory of state • Mandala theory • Saptanga theory 	6
6.	Challenges to Indian Democracy	<ul style="list-style-type: none"> • Caste as a critical factor in the Indian Constitution • Gender as critical to the process of Constitutionalization 	4
Total number of Lectures			42
Evaluation Criteria			

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, <i>Important Judgements that transformed India</i> , New Delhi: McGraw Hill, 2020
2.	B. Chakraborty, <i>Indian Constitution: Text, Context and Interpretation</i> , New Delhi: Sage Publications, 2017
3.	B.K.Sharma, <i>Introduction to the Constitution of India</i> , New Delhi: Prentice Hall of India, 2002

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

4.	M.Laxmikanth, <i>Indian Polity</i> , 6 th edition, Noida: McGraw Hill, 2019
5.	M.P.Singh and R. Saxena, R, <i>Indian Politics: Contemporary Issues and Concerns</i> , New Delhi: PHI Learning, 2008
6.	R. Kangle, <i>Arthashastra of Kautilya</i> , New Delhi: Motilal Publishers, 1997

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH531	Semester : ODD	Semester: 5th Session: 2020 -2021 Month from July to December
Course Name	Quantum Mechanics for Engineers		
Credits	3	Contact Hours	3+1

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
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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 Uncertainty Relations, No-cloning theorem, Pauli Spin Matrices.	10
3.	Potential problems	1-D, 2-D, and 3-D potential problems (including infinite and finite square well). Tunneling, harmonic oscillator, separation in spherical polar coordinates, hydrogen atom, etc.),	08
4.	Approximation methods	Time independent perturbation theory for nondegenerate and degenerate energy levels.	4
5.	Advanced Applications	Kronig Penny model, Basic ideas of quantum computing, Qubit, Gate model of quantum computing : H, CNOT, Pauli Gates, BB84 protocol, Advantages of quantum computing, Quantum wire, Quantum dot and realization of CNOT using Quantum dot.	10
Total number of Lectures			40
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	

TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	The new quantum universe by Toney Hey and Patrick Walters, Cambridge University Press.
2.	Quantum mechanics a new introduction by Kenichi Konishi and G Paffuti, OUP., 2009
3.	Quantum physics by Eyvind H Wichman (Berley Physics course Vol 4) Tata McGraw Hill 2008
4.	Elements of quantum computation and quantum communication by A Pathak, CRC Press 2013.
5.	Introduction to Quantum Mechanics by David J. Griffiths, Second Edition, Pearson, 2015.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH532	Semester: ODD	Semester: 5 th Session: 2020 -2021 Month from July to December
Course Name	Materials Science		
Credits	3	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Manoj Kumar and Sandeep Chhoker
	Teacher(s) (Alphabetically)	Manoj Kumar and Sandeep Chhoker

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
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			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.	Magnetic Materials	Concept of magnetism, Classification – dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Their properties and Applications; Hysteresis; Magnetic Storage and Surfaces.	10
3.	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
4.	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
5.	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
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 [2 Quiz (10), Attend. (10) and Class performance (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.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH533	Semester: ODD	Semester: 5th Session: 2020 -2021 Month from July to December
Course Name	Laser Technology and Applications		
Credits	3	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Navneet Kumar Sharma and Anshu Varshney
	Teacher(s) (Alphabetically)	Navneet Kumar Sharma and Anshu Varshney

COURSE OUTCOMES		COGNITIVE LEVELS
C301-12.1	Define the coherent properties, high brightness of laser, population inversion and optical feedback to laser technology	Remember Level (C1)
C301-12.2	Extend the knowledge of lasers in some applications like LIDAR, laser tracking, bar code scanner, lasers in medicine and lasers in industry	Understand Level (C2)
C301-12.3	Apply the optical ray transfer matrix to determine the stability of a laser resonator	Apply Level (C3)
C301-12.4	Distinguish the operational principles of CW, Q-switched, mode locked lasers; laser rate equations for three & four level lasers; different types of laser systems	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for
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			the module
1.	Fundamentals of Lasers	Laser idea and properties; Monochromaticity, directionality, brightness, Temporal and spatial Coherence. Interaction of radiation with matter; Absorption, spontaneous and stimulated emission of radiation, Rates equations, Einstein's A and B coefficients. Laser rate equations: Four level and three level systems. Conditions for producing laser action, population inversion, saturation intensity, threshold condition and gain optimization. Experimental techniques to characterize laser beam.	12
2.	Types of Lasers	Pumping processes; optical and electrical pumping. Optical Resonators; The quality factor, transverse and longitudinal mode selection; Q switching and Mode locking in lasers. Confocal, planar and spherical resonator systems. Types of Lasers; Solid state Lasers; Ruby Laser, Nd:YAG laser. Gas lasers; He-Ne laser, Argon laser, CO ₂ , N ₂ and Excimer Laser. Dye (liquid) Laser, Chemical laser (HF), Semiconductor Lasers; Heterostructure Lasers, Quantum well Lasers. Free electron laser, X-ray laser and Ultrafast Laser.	16
3.	Applications of Lasers	Image processing; Spatial frequency filtering and Holography, Laser induced fusion; Fusion reactor, creation of Plasma. Lightwave communications. Use in optical reader (CD player) and writer. Nonlinear optics; harmonic generation, self focusing. Lasers in industry; Material processing, Cutting, welding and whole drilling. Precision length measurement, velocity measurement, Laser Tracking, Metrology and LIDAR. Lasers in medicines and surgery. Lasers in defense, Lasers in space sciences, Lasers in sensors.	12
Total number of Lectures			40
Evaluation Criteria			

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

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Thyagarajan and Ghatak, <i>Lasers Theory and Applications</i> , Macmilan India.
2.	W. T. Silfvast, <i>Laser Fundmentals</i> , Cambridge Univ-Press.
3.	O. Svelto, <i>Principles of Lasers</i> , Springer.
4.	Saleh and Teich, <i>Fundamentals of Photonics</i> , John Wiley & Sons.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH535	Semester: ODD	Semester: 5th Session: 2020 -2021 Month from July 20 to December 20
Course Name	NUCLEAR SCIENCE AND ENGINEERING		
Credits	3	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Manoj Tripathi
	Teacher(s) (Alphabetically)	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 quadrupole moment. Nuclear forces, Two body problem - Ground state of deuteron, Central and non-central forces, Exchange forces: Meson theory, Yukawa potential, Nucleon-nucleon scattering, Low energy n-p scattering, Effective range theory, Spin dependence, charge independence and charge symmetry of nuclear forces, Isospin formalism.	07

2.	Nuclear Models	Binding energies of nuclei, Liquid drop model: Semi-empirical mass formula, Mass parabolas, Prediction of Nuclear stability, Bohr-Wheeler theory of fission, Shell model, Spin-orbit coupling. Magic numbers, Angular momenta and parities of nuclear ground state, Magnetic moments and Schmidt lines, Collective model of a nucleus.	05
3.	Nuclear decay and Nuclear reactions	Alpha decay, Beta decay, Pauli's Neutrino hypothesis-Helicity of neutrino, Theory of electron capture, Non-conservation of parity, Fermi's theory, Gamma decay: Internal conversion, Multipole transitions in nuclei, Nuclear isomerism, Artificial radioactivity, Nuclear reactions and conservation laws, Q-value equation, Centre of mass frame in nuclear Physics, Scattering and reaction cross sections, compound nucleus, Breit-Wigner one level formula	08
4.	Interaction of nuclear radiation with matter	Interaction of charge particles with matters: Bohr's ionization loss formula and estimation of charge, mass and energy. Interaction of electromagnetic radiation with matter, Linear absorption coefficient. Nuclear particle detectors and neutron counters.	07
5.	Accelerator and reactor Physics	Different types of reactors, tracer techniques, activation analysis. Radiation induced effects and their applications: Accelerators: Linear accelerators, Van de Graff generator, LINAC, Cyclotrons, Synchrotrons, Colliders.	06
6.	Cosmic radiation and Elementary Particles	Cosmic radiation: Discovery of cosmic radiation, its sources and composition, Latitude effect, altitude effect and east-west asymmetry, secondary cosmic rays, cosmic ray shower, variation of cosmic intensity and Van Allen radiation belt. Elementary particles: Classification of particles, K-mesons, Hyperons, particles and antiparticles, fundamental interactions, conservation laws, CPT theorem, resonance particles and hypernucleus, Quark model.	07
Total number of Lectures			40

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (7 M) and PBL & Cass performance (8 M)]
Total	100

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

Matrix Computations (16B1NMA533)

Course Description

Course Code	16B1NMA533	Semester - Odd	Semester V Session 2020 -2021 Month from Aug 2020 - Dec 2020
Course Name	Matrix Computations		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Amita Bhagat and Dr. Neha Singhal	
	Teacher(s) (Alphabetically)	Dr. Amita Bhagat, Dr. DCS Bisht, Dr. Neha Singhal, Dr. Pato Kumari	
COURSE OUTCOMES After the successful completion of this course, the student will be able to			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. Partial pivoting , LU decomposition, Crout's and Doolittle's methods, Cholesky factorization. Gauss Siedel, Gauss Jacobi iterative methods.	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
4.	Orthogonality	Orthogonal and orthonormal sets, Gram-Schmidt process, QR factorization.	4
5.	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, 4 th 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.		

Basic Numerical Methods (17B1NMA531)

Course Description

Course Code	17B1NMA531	Semester - Odd	Semester V Session 2020-21 Month from Aug 2020- Dec 2020
Course Name	Basic Numerical Methods		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Lokendra Kumar and Dr. Pankaj Kumar Srivastava	
	Teacher(s) (Alphabetically)	Dr. Lokendra Kumar, Dr. Trapti Neer, Dr. Pankaj Kumar Srivastava, Dr. DCS Bisht	
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 Solution of Ordinary Differential Equations	Picard's method, Euler's method, Modified Euler's method, Fourth order Runge-Kutta method, Milne's method for first order, second order and simultaneous differential equations, Finite-Difference Method	09
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	
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, 7 th Ed., Pearson Education, 2004.		
2.	M. K. Jain, S. R. K. Iyengar and R. K. Jain , Numerical Methods for Scientific and Engineering Computation, 6 th Ed., New Age International, New Delhi, 2014.		
3.	R. S. Gupta , Elements of Numerical Analysis, 2 nd Ed., Cambridge University Press, 2015.		
4.	S.D. Conte and C. deBoor , Elementary Numerical Analysis, An Algorithmic Approach, 3 rd Ed., McGraw-Hill, New York, 1980.		

Statistical Information Theory with Applications (17B1NMA533)

Course Description

Course Code	17B1NMA533	Semester Odd	Semester V Session 2020-21 Month from Aug 2020- Dec 2020
Course Name	Statistical Information Theory with Applications		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Amit Srivastava	
	Teacher(s) (Alphabetically)	Dr. Amit Srivastava	
COURSE OUTCOMES			COGNITIVE LEVELS
C301-8.1	explain the notions of information, entropy, relative entropy and mutual information.		Understanding Level(C2)
C301-8.2	explain fuzzy sets and compare the various measures of discrepancy.		Analyzing Level (C4)
C301-8.3	develop and compare Shannon-Fano and Huffman source codes using measures of uncertainty.		Analyzing Level (C4)
C301-8.4	analyse the notion of distance measure in pattern recognition generated in Intuitionistic fuzzy environment.		Analyzing Level (C4)
C301-8.5	apply information theoretic concepts in encryption and decryption.		Applying Level (C3)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Information Theoretic Measures	Review of Probability theory, Average information, Shannon and Renyi Entropy, Mutual information. Introduction to concepts of directed divergence, inaccuracy and information improvement	10
2.	Fuzzy Sets and Measures of Fuzzy Uncertainty.	Fuzzy Sets. Fuzzy Uncertainty and Fuzzy Information Measure, Similarity Measures, Fuzzy Measures of Directed Divergence, Total Ambiguity and Information Improvement, R-Norm Fuzzy	10

		Information Measure and its Generalizations.	
3.	Source Coding	Data compression, Kraft-McMillan Equality and Compact Codes, Encoding of the source output, Shannon-Fano coding, Huffman coding, Lempel-Ziv (LZ) coding, Shannon-Fano-Elias Coding and Introduction to Arithmetic Coding. rate distortion theory, Lossy Source coding.	10
4.	Applications of information theory in Cryptography	Basic concepts of cryptography and secure data, Mathematical Overview and Shannon theory of Cryptography, perfect secrecy and the one time pad, Spurious Keys & Unicity Distance, Classical and Product Cryptosystems. semantic security and Stream ciphers, Characteristics for perfect security, Limitations of perfectly secure encryption, Block and Stream ciphers, Cipher Modes, Substitution Ciphers, Mono-alphabetic Substitution and Poly-alphabetic Substitution, Polygram, Transposition Ciphers, Rail Fence, Scytale, Book cipher, Vernam cipher, VigenereTabulae, Playfair, Hill Cipher, Cryptanalysis of Classical Cryptosystems,	12
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	
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.	Bose, R. ,Information Theory Coding and Cryptography, 3 rd Ed, Tata McGraw-Hill, 2016.		
2.	Jain, K. C., and Srivastava, A. , Information Theory & Coding, 3 rd Ed, Genius Publications, 2009		
3.	Stallings, W. , Cryptography and Network Security Principles and Practices, Prentice Hall, 2003		
4.	Cover, T.M. and Thomas, J. A. , Elements of Information Theory, 2nd Edition, Wiley, 2006.		
5.	Haykin, S. , Communication Systems, John Willey & Sons, Inc, Newyork, 4th Ed, 2006		

6.	Behrouz, A. F. , Introduction to Cryptography and Network Security, McGraw-Hill International Edition, 2008
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Logical Reasoning and Inequalities (18B12MA312)

Course Description

Course Code	18B12MA312	Semester Odd	Semester V Session 2020-21 Month from Aug 2020- Dec 2020
Course Name	Logical Reasoning and Inequalities		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Lakhveer Kaur	
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur	
COURSE OUTCOMES			COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:			
C301-9.1	interpret the mathematical foundation of various inequalities.		Understanding level(C2)
C301-9.2	examine inequalities in the field of information theory and cryptography.		Analyzing level(C4)
C301-9.3	apply the concepts of permutation and combination of multi sets in combinatorics.		Applying level(C3)
C301-9.4	apply special numbers in combinatorial and number theoretic problems.		Applying level(C3)
C301-9.5	explain the basic concepts of logical reasoning and solve related problems.		Understanding level(C2)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Inequalities	Basic Inequalities, Inequalities between means with special reference to AGM inequality, Jensen inequality for concave and convex functions, Hermite hadamard inequality, Karamata's inequality, Popoviciu's inequality, Weighted AGM inequality and Young's inequality with applications in information theory. Bounds on Shannon entropy function and their generalizations. Perfect secrecy in cryptography.	12
2.	Basics of Counting	Pigeon Hole Principle, Binomial Theorem, Properties of binomial coefficients, combinatorial identities, Permutation of Multisets, Multinomial Theorem, Combinations of Multisets, Sterling's Formula, Generalization of Binomial coefficients, Inclusion exclusion principle.	12
3.	Special numbers	Catalan numbers, Partition numbers, difference	10

		sequences, Sterling Numbers, Perfect numbers.	
4.	Logical Reasoning	Clocks, calendars, binary logic, seating arrangement, blood relations, logical sequence, assumption, premise, conclusion, linear and matrix arrangement, Syllogism, Binary Logic, Logical sequence & Matching, Mathematical Puzzles with applications.	8
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	
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.	Cerone, P. and Dragomir, S. S. , Mathematical Inequalities, CRC Press, Boca Raton, FL, 2011		
2.	Praveen, R. V. , Quantitative Aptitude and Reasoning, Second Edition, Prentice Hall India, 2013.		
3.	Rosen & Kenneth H , Discrete Mathematics and its Applications, Tata Mc-Graw Hill, New Delhi, 2007.		
4.	Kolman, B., Busby, R. C. and Ross, S. , Discrete Mathematical Structures, 6 th Edition, Prentice Hall, 2018.		
5.	Simmons, G. J. , The Great Book of Puzzles & Teasers, 1999.		

Discrete Mathematics (16B1NMA531)

Course Description

Course Code	16B1NMA531	Semester Odd	Semester V Session 2020-21 Month from Aug 2020- Dec 2020
Course Name	Discrete Mathematics		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Anuj Bhardwaj	
	Teacher(s) (Alphabetically)	Dr. Anuj Bhardwaj	
COURSE OUTCOMES: After the successful completion of this course, the student will be able to			COGNITIVE LEVELS
C301-1.1	explain partial order relations, Hasse diagram, lattices and recursive functions.		Understanding Level (C2)
C301-1.2	solve the difference equations using generating function and Z-transform.		Applying Level (C3)
C301-1.3	explain the propositional and predicate calculus to check the validity of arguments.		Understanding Level (C2)
C301-1.4	demonstrate graphs, digraphs, trees and use it to solve the different problems of graph theory.		Applying Level (C3)
C301-1.5	illustrate various algebraic structures and their properties.		Understanding Level (C2)
C301-1.6	explain the theory of formal languages and solve the related problems of automata.		Applying Level (C3)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Relations and Lattices	Relations and their composition. Pictorial representation, matrix and graphical representations. Equivalence relations and partitions. Partial ordered relations and Hasse diagram. Lattices.	5
2.	Functions	Functions and Recursively defined functions, generating functions, solution of recurrence relations by generating function. Z transforms, solution of difference equations by Z transform.	8
3.	Propositional Calculus	Propositions- simple and compound. Basic logical operators. Implication. Truth tables. Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers.	4
4.	Graphs	Graphs and related definitions, subgraphs, isomorphism, paths and connectivity. Eulerian graph and Konigsberg problem. Hamiltonian graph.	7

		Labelled and weighted graphs. Tree Graphs- Minimum spanning Tree (Prim's algorithm). Graph colorings. Four color problem.	
5.	Directed Graphs	Trees, Digraphs and related definitions. Rooted trees. Algebraic expressions and Polish notation. Sequential representation. Adjacency matrix. Path matrix. Shortest path. Linked representation of directed graphs. Binary trees.	5
6.	Algebraic Structures	Groups- definitions and examples, order of elements, subgroup, condition for subgroups. Quotient groups, Lagrange theorem and applications, Rings, integral domains and Fields- definition and examples.	7
7.	Languages and Grammars	Strings (words) and languages, grammars, types of grammars, Finite state machines, finite state automata, regular languages and regular expressions.	6
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz, Assignments, Tutorials, PBL)	
Total		100	
Recommended Reading material:			
1.	Lipschutz, S. and Lipson, M. , Discrete Mathematics, 2 nd Edition, Tata McGraw-Hill, 1997.		
2.	Rosen, K. H. , Discrete Mathematics and its Application, 7 th Edition, Tata McGraw-Hill, 2011.		
3.	Liu, C. L. , Elements of Discrete Mathematics, 2 nd Edition, Tata McGraw-Hill, 1998.		
4.	Kolman, B., Busby, R. C. and Ross, S. , Discrete Mathematical Structures, 6 th Edition, Prentice Hall, 2018.		
5.	Deo, N. , Graph Theory, Prentice Hall, 2004.		
6.	Grimaldi, R.P. , Discrete and Combinatorial Mathematics, 5 th Edition, Pearson Education, 2011.		