## Detailed Syllabus
## Lecture-wise Breakup

| Course Code | 15B11CI313 | Semester Odd (specify Odd/Even) | Semester V Session 2022-23 Month from Aug. to Dec. 2022 |
|---|---|---|---|
| **Course Name** | Computer Organization and Architecture | | |
| **Credits** | 4 (L=3, T=1) | **Contact Hours** | (3,1,0) |

| Faculty (Names) | Coordinator(s) | Dr. Hema N, Dr. Taj Alam (J62), Dr. Naveen Kumar(J128) |
|---|---|---|
| | Teacher(s) (Alphabetically) | Amarjeet Kaur, Dr. Hema N and Dr. Pawan Kumar Upadhaya, Bansidhar Joshi, Kritika Rani, Dr. Naveen Kumar, 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 | Hierarchal memory structure, Cache memory and organization. Memory interfacing for 8085 and 8086. | 05 |
| 11. | I/O Organization | Programmed/Interrupt driven I/O, Direct memory access | 04 |
| 12. | Pipelining | Introduction To Pipelining System and Pipelining in RISC based Systems (MPIS) | 03 |
| 13. | Multicore Architecture | Generalized study of Multicore Machines. | 02 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| Components | Maximum Marks |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Attendance =10, Assignment /Quiz= 05, Mini-Project = 10) |
| **Total** | **100** |

Project based learning:  In this subject students will learn Organization and Architecture of different computer system. After completing the subject, students will be able to measure the performance of different computer system. They can create low bit assembler application. Along with this they will be able to interface memory with different architectures like 8085, 8086 and MIPS.

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

| 1. | M. Morris Mano, Computer System Architecture, Prentice Hall of India  Pvt Ltd, 3rd Edition (updated) , 30 June 2017. |
|---|---|
| 2. | William Stallings, Computer Organization and Architecture–Designing for Performance, Ninth Edition, Pearson Education, 2013. |
| 3. | John L. Hennessy and David A Patterson, Computer Architecture A quantitative Approach, Morgan Kaufmann / Elsevier, Sixth Edition, 23rd November 2017 |
| 4. | Ramesh Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, Prentice Hall, Eight Edition, 2013. |

| 5. | Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit Extensions : Architecture, Programming, and Interfacing. Pearson Education India, Eigth Edition, 2019. |
|---|---|
| 6. | Nicholas Carter, Schaum's outline of Computer Architecture, Tata McGraw Hill, Second Edition, 2014. |

## Detailed Syllabus

*Lab-wise Breakup*

| Course Code | 15B11CI373 NBA CODE:C273 | Semester Odd (specify Odd/Even) | Semester V  Session  2022-23 Month from Aug. to Dec. 2022 |
|---|---|---|---|
| Course Name | Computer Organization and Architecture Lab | | |
| Credits | 1 | Contact Hours | 2 |

| Faculty (Names) | Coordinator(s) | Ms Amarjeet Kaur (62) |
|---|---|---|
| | Teacher(s) (Alphabetically) | Ms Amarjeet Kaur, Dr Hema N,Dr Janardan Verma, Dr Kapil Madan, DrPawan K. Upadhyay, Dr Taj Alam, |

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

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

| | | gates,Design the half adder and full adder circuits, Ripple adder logic circuit, 4 x1 multiplexor circuit and realize the variousinput 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 logicgiven in module-1.,Timing diagram of all four adder circuits and comparetheir 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** indetail, Add two 8-bit numbers from load sample programfrom file menu, assemble and execute it step by step andview 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 )programmingeither 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 2-3, | | | |

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

**Evaluation Criteria**

| Components | Maximum Marks |
|---|---|
| Evaluation 1 | 10 |
| Lab Test 1 | 20 |
| Evaluation 2 | 10 |
| Lab Test 2 | 20 |
| Project / Assignments | 25 |
| Attendance | 15 |
| Total | 100 |

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

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

| Course Code | 15B11CI412 | Semester Odd (specify Odd/Even) | Semester V  Session  2022-23 |
|---|---|---|---|
| | | | Month from Aug. to Dec. 2022 |

| Course Name | Operating Systems and Systems Programming |
|---|---|

| Credits | 4 | Contact Hours | 3-1-0 |
|---|---|---|---|

| Faculty (Names) | Coordinator(s) | Sec 62: Dr. Ashish Mishra<br>Sec 128: Dr. Anubhuti Roda Mohindra |
|---|---|---|
| | Teacher(s) (Alphabetically) | Sec 62: Dr. Apeksha Agrawal, Mr. KashavAjmera ,Dr.Vikas,<br>Sec 128: Prof. Charu, Dr. Gaurav Nigam, Dr. Neeraj Jain |

| 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.<br><br>X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, Interrupts. | 2 |
| 3. | Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues, | Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors. | 10 |
| 4. | Deadlock | System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock | 5 |
| 5. | Memory Management. | Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual | 8 |

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

**Evaluation Criteria**

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

PBL: Each student in a group of 3-4 will have to develop a small Project based on different engineering concepts. The students will be applying the fundamentals of computer operating systems concepts including Process Management, Memory and Input Output Management, Processor Scheduling, Synchronization, File System. It will familiarize the students with the design and implementation aspect of an Operating system

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|---|
| **1.** | William Stallings, "OPERATING SYSTEMS INTERNALS AND DESIGN PRINCIPLES". |
| **2.** | Andrew S. Tanenbaum, "Operating Systems Design and Implementation", Third Edition,Prentice Hall Publications2006 |
| **3.** | A.S. Tanenbaum, "Modern Operating Systems", 2nd edition, Prentice Hall India. |
| **4.** | A.Silberschatz, P.Galvin, G. Gagne, "Operating systems concepts" Willey international company (sixth |

| | |
|-----|-----------------------------------------------------------------------------------------------------------------------|
| | edition) |
| 5. | Gary Nutt, "Operating Systems – A modern perspective", Pearson Education |
| 6. | David Solomon and Mark Russinovich ," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press |
| 7. | D. M. Dhamdhere, " Systems Programming and Operating systems" TMH, 2<sup>nd</sup> 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 Odd (specify Odd/Even) | Semester V  Session  2022-23  Month from Aug. to Dec. 2022 |
|---|---|---|---|
| Subject Name | Operating System and System Programming Lab | | NBA Code: C275 |
| Credits | 0-0-1 | Contact Hours | 2 |

| Faculty (Names) | Coordinator(s) | Dr. Vikash (Sec-62) & Dr. Neeraj Jain (Sec 128) |
|---|---|---|
| | Teacher(s) (Alphabetically) | Ahish Mishra, Kashav Ajmera, Chetna Dabas, Prashant Kaushik |

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

| Module No. | Topic | No. of Labs | Cos |
|---|---|---|---|
| 1. | Unix Commands | 1 | CO1 |
| 2. | Process creation/ Inter process communication (IPC) | 1 | CO2 |
| 3. | Processes creation using pthread library under Linux environment. | 2 | CO2 |
| 4. | Synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites. | 2 | CO3 |
| 5. | Resource management task like CPU scheduling algorithms, deadlock handling. | 1 | CO4 |
| 6. | Disk-scheduling algorithms, memory management schemes, file management systems. | 1 | CO5 |

**Evaluation Criteria**

| Components | Maximum Marks |
|---|---|
| Lab Test-120 | |
| Lab Test-2 | 20 |
| Day-to-Day | 60(Mini Project-10, Lab Assessment-40, Attendance-10) |

| Total | 100 |
|---|---|

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

**Text book(s)**

| 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 (Ninth edition) |

**Reference Book(s)**

| 5. | Gary Nutt, "Operating Systems – A modern perspective", Pearson Education |
|---|---|
| 6. | David Solomon and Mark Russinovich , "Inside Microsoft Windows 2000", Third Edition, Micorosoft Press |
| 7. | Milan Milenkovic, "Operating Systems: Concepts and Design", McGraw-Hill computer science series |
| 8. | ACM/IEEE transactions on operating systems concepts. |
| 9. | www.vmware.com |

# Detailed Syllabus
# Lab-wise Breakup

| Course Code | 15B17CI575 | Semester Odd (specify Odd/Even) | Semester V  Session  2022-23 Month from Aug. to Dec. 2022 |
|---|---|---|---|
| Course Name | Open Source Software Lab | | |
| Credits | 1 | Contact Hours | 2 hours |

| Faculty (Names) | Coordinator(s) | J62: Dr. Sonal |
|---|---|---|
| | | J128: Prof. Chetna Gupta |
| | Teacher(s) (Alphabetically) | J62: Dr. Alka Singhal, Dr. Janardan Verma, Ms. Deepti, Ms. Purtee Kohli |
| | | J128: Dr Anubhuti, Dr Sailesh Kumar, Ms. Anuradha |

| 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 | Implement python programs using lists, tuples, dictionaries, functions, Numpy, SciPy and Matplotlib. | Apply Level (Level 3) |
| C375.3 | Develop python programs to scrap and process data using Beautiful Soup, pandas and 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 (SDG's) | ● Read and explore the Github and Sustainable Development Goals. <br> ● Create a simple program and upload it on Github. <br> ● Extract one open source project from Github. Perform the reverse engineering of the same. | CO1 | 1 |
| 2. | Introduction To Python | ● Making use of lists, tuples, and dictionaries, indexing and slicing to access data | CO2 | 1 |
| 3. | Python | ● Create user defined functions using built-in functions such as **filter (f, a)** from python libraries. | CO2 | 2 |
| 4. | Numpy, SciPy, Matplotlib (Python) | ● Write python programs using various functions of Numpy, SciPy and Matplotlib library. | CO2 | 2 |
| 5. | Beautiful Soup (Python), Pandas, MongoDB | ● Write a program using Beautiful Soup for scrapping data from web, store in csv files and process them. <br> ● Write a program for processing data stored in MongoDB using Pandas. | CO3 | 2 |

| 6. | Java Script, Java Servlet and Java Server Pages. | ● Write programs for building web-pages using java script.<br>● Buildweb-based applications using server-side programming – Java Server Pages (JSP) and Java Servlet. | CO5 | 1 |
|---|---|---|---|---|
| 7. | Scikit-Learn (Python) | ● Write python programs for data analysis, feature engineering, clustering and classification. | CO4 | 2 |

**Evaluation Criteria**

| Components | Maximum Marks |
|---|---|
| LabTest1 | 20 |
| LabTest2 | 20 |
| Evaluation /Quiz | 30 |
| Attendance | 15 |
| Lab record submission | 5 |
| PBL | 10 |
| -------------------------------------------------------------------------------- | |
| **Total** | **100** |

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

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

| 1. | https://guides.github.com/ |
|---|---|
| 2. | https://sustainabledevelopment.un.org/ |
| 3. | 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

| Course Code | 15B17CI576 | Semester Odd (specify Odd/Even) | Semester V  Session 2022-23 |
| --- | --- | --- | --- |
| | | | Month from Aug. to Dec. 2022 |
| Course Name | Information Security Lab | | |
| Credits | 1 | Contact Hours | 2 |

| Faculty (Names) | Coordinator(s) | J62:Mradula Sharma, Dr. Sakshi Gupta, J128: Dr. Mukta Goyal |
| --- | --- | --- |
| | Teacher(s) (Alphabetically) | J-62: Dr. ArpitaJadav Bhatt,Mradula Sharma, Dr. NitishAndola, Dr. Sakshi Gupta, Dr. SharddhaPorwal |

| 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 |
| Eval 1 | 15 |
| Eval2 | 15 |
| Project | 15 |
| Attendance | 15 |
| **Total** | **100** |

Project based learning: The students are grouped into groups of size 5-6 and will be implementing a secure client server program with required encryption techniques. The student will analyze the requirements and select the required solutions. This will help in the employability of students in the information security sector.

| | |
|---|---|
| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| 1. | Information Security, Principles and Practice, , 2nd Edition, Mark Stamp, Wiley, 2011 |
| 2. | Security in Computing 5thEdition , Charles P Fleeger et. al. - Prentice Hall, 2015 |
| 3. | The InfoSec Handbook: An Introduction to Information Security- Apress Open, Nayak, Umesha, and UmeshHodeghatta Rao, 2014 |
| 4. | Information Security: The Complete Reference, 2ndEdition- Mark Rhodes Ousley, 2013 |
| 5. | Cracking Codes with Python: An Introduction to Building and Breaking Ciphers-Al Sweigart, 2018 |

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

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

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Introduction to Positive Psychology | Overview, Perspectives, Classification and Measures: Human Strengths and Positive Outcomes. | 6 |
| 2. | Prosocial Behavior | Empathy and Egotism; Altruism, Gratitude, and Forgiveness. | 6 |
| 3. | Positive Emotions and Wellbeing | Emotional and Cognitive States; Focus on Application: Finding the positive in the Negative; Positive Emotions & Well-Being; Positive Emotions & Flourishing; Flow Experiences | 6 |
| 4. | Happiness | Happiness and its Traditions; Determinants- Subjective Well-Being Hedonic Basis of Happiness; Life Satisfaction; Self –Realization: The Eudaimonic Basis of Happiness Happiness and Emotional Experiences; Other Facts of Life- Work & Unemployment; Intelligence; Education; and Religion. | 6 |
| 5. | Mental Health | Mental Health and Behavior; Prevent the Bad and Enhance the Good. | 6 |

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

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

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

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|---|
| 1. | Snyder, C.R., Lopez, S. J., & Pedrotti, J.T. *Positive Psychology: The Scientific and Practical Explorations of Human Strengths*, 4th Ed., Sage Publications, 2018. |
| 2 | Steve, B., & Marie, C. *Positive psychology*, 1st Ed., Pearson Education India, 2014. |
| 3. | Boniwell, I., & Tunariu, A. D., *Positive Psychology: Theory, Research and Applications*, 2nd Ed., McGraw-Hill Education, 2019. |
| 4. | Zelenski, J., *Positive Psychology: The Science of Well-being*, 1st Ed., Sage Publications, 2019. |
| 5. | Snyder, C. R., Lopez, S. J., Edwards, L. M., & Marques, S. C. (Eds.), *The Oxford handbook of positive psychology*. 1st Ed., Oxford university press, 2020. |

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

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

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

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

| | | | | |
|---|---|---|---|---|
| | | | **Total number of Lectures** | **42** |

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

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

| | **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |
|---|---|
| **1.** | Chandra, P., *Financial Management Theory and Practice*, 7th ed., Tata McGraw Hill, 2007. |
| **2.** | Horne, J.C.V. and Wachowicz, J.M. Fundamentals of Financial Management, 13th ed., Pearson Publication, 2009. Accessed online: https://wps.pearsoned.co.uk/ema_uk_he_wachowicz_fundfinm an_13/106/27149/6950308.cw/-/6950310/index.html |
| **3.** | Khan, M.Y. and Jain, P.K. Financial Management: Text, Problems and Cases, 8th ed., McGraw Hill Education, 2019. |
| **4.** | Kishore, R.M., *Financial Management*, 6th ed, Taxmann, 2007. |
| **5.** | Mukherjee,M and Hanif.M., Financial accounting, 8th ed., Tata McGraw Hill,2008. |
| **6.** | Pandey, I.M., Financial management, 11th ed, Vikas Publishing House Pvt Ltd, 2015 |

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

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

| **Course Outcomes:** | | |
|---|---|---|
| | **Course Outcome** | **COGNITIVE LEVELS** |
| C303-6.1 | Interpret & relate with the genres, periods, and conventional as well as experimental forms of literature as current ethical, technological and cultural reflections of society. | CL-2 Understand |
| C303-6.2 | Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society. | CL-3 Apply |
| C303-6.3 | Analyze select representative texts of different cultures thematically and stylistically. | CL-4 Analyse |
| C303-6.4 | Determine the reciprocal relationship between the individual and culture individually and/or through a research-based paper. | CL-5 Evaluate |
| C303-6.5 | Create literary, non-literary write-up with proper applied grammar usage, individually and in a team. | CL-6 Create |

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

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

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

| **Evaluation Criteria** |
|---|

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

**Recommended Reading material:**

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

| 1. | M.H. Abrams, 'A Glossary of Literary Terms'. Hienle&Hienle: Thomson Learning, USA, 2021. |
|---|---|
| 2. | Mark William Roche, 'Why Literature matters in the 21st Century', 1st Edition, Yale University Press, 2004. |

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

# Finite Element Methods (16B1NMA532)

Some basic numerical methods. Introduction to FEM. Weighted residual methods. Variational formulation of BVPs. Equivalence of Galerkin and Ritz method in some cases. Applications to solve simple problems of ODEs. 1D linear, quadratic and higher order elements. Derivation of element equations and their assembly, imposition of boundary conditions and solution of assembled equations. 2D elements and their assembly. Discretization with curved boundaries. Solution of two dimensional PDEs under different Geometric conditions.

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

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Basic Numerical Methods | Gauss-elimination, Gauss Seidel, Thomas algorithm, Gaussian quadrature formula for numerical integration, Runge-Kutta method for IVPs, Finite difference method for BVPs. | 9 |
| 2. | Finite Element Method | Introduction to finite element method, comparison with finite difference method. | 4 |
| 3. | Method of Weighted Residuals | Collocation, Subdomain, Method of least squares and Galerkin's method. | 9 |

| 4. | Variational Formulation | Variational formulation of boundary value problems. Equivalence of Galerkin and Ritz method in some cases. Applications to solve simple problems of ODEs. One dimentional linear, quadratic and higher order elements. Derivation of element equations and their assembly, imposition of boundary conditions and solution of assembled equations. | 12 |
|---|---|---|---|
| 5. | Partial Differential Equations | Two dimensional, triangular, rectangular, quadrilateral, serendipity and isoperimetric elements and their assembly. Discretization with curved boundaries. Solution of two dimensional partial differential equations under different Geometric conditions. | 8 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

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

**Project Based Learning:** Each student in a group of 4-5 students will apply the concepts of FEM to solve the ordinary and partial differential equations occurring in various disciplines.

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

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

## CO-PO and CO-PSO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C301-2.1 | 3 | 3 | 2 | | | | | | | | | 2 | | |
| C301-2.2 | 3 | 2 | 2 | | | | | | | | | 2 | | |
| C301-2.3 | 3 | 3 | 2 | | | | | | | | | 1 | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **C301-2.4** | 3 | 3 | 2 | | | | | | | | | 2 | | |
| **C301-2.5** | 3 | 2 | 3 | | | | | | | | | 2 | | |
| **C301-2.6** | 3 | 3 | 3 | | | | | | | | | 2 | | |
| **Avg** | 3 | 3 | 2 | | | | | | | | | 2 | | |

## Detailed Syllabus
### Lecture-wise Breakup

| Course Code | 16B1NPH531 | Semester: ODD | Semester V Session 2022 -2023 |
|---|---|---|---|
| | | | **Month from** July to December |
| **Course Name** | **Quantum Mechanics for Engineers** | | |
| **Credits** | 3 | **Contact Hours** | 3 |

| Faculty (Names) | Coordinator(s) | Anuraj Panwar |
|---|---|---|
| | Teacher(s) (Alphabetically) | Anuraj Panwar |

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Introduction | Wave particle duality, quantum physics (Planck and Einstein's ideas of quantized light), postulates of quantum mechanics, time dependent and time independent Schrodinger equation, operators, probability theory, 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 [Attendance (07 M), Class Test, Quizzes, *etc* (07 M), Assignments in PBL mode (06 M), and Internal assessment (05 M)] |
| **Total** | **100** |

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

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

| Course Code | 16B1NPH532 | Semester: ODD | | Semester: 5th Session: 2022 -2023 Month from July 22 to December 22 | |
|---|---|---|---|---|---|
| Course Name | Materials Science | | | | |
| Credits | 3 | | Contact Hours | 3 | |

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

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

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

| | Materials | Cooling, Figure of Merit; TE power generation (efficiency), refrigeration (COP), Examples and applications. | |
|---|---|---|---|
| | | **Total number of Lectures** | **40** |

**Evaluation Criteria**

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

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|---|
| **1.** | S.O. Pillai, Solid State Physics, New Age International Publishers. |
| **2.** | B. B. Laud, Laser and Non-linear Optics, John Wiley & Sons |
| **3.** | Van Vlack, Elements of Material Science and Engineering, Pearson Education. |
| **4.** | Srivastava and Srinivasan, Material Science and Engineering, |
| **5** | W.D. Callister Jr., Material Science and Engineering: An Introduction, John Wiley. |

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

| Course Code | 16B1NPH535 | Semester: ODD | Semester: 5ᵗʰ Session: 2022-23 Month from July 2022 to December 2022 |
|---|---|---|---|
| **Course Name** | NUCLEAR SCIENCE AND ENGINEERING | | |
| **Credits** | 3 | **Contact Hours** | 3 |

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

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

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

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

**Evaluation Criteria**

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

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

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

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

| Course Code | 17B1NHS531 | Semester: Odd | Semester V Session 2022 -2023 |
|---|---|---|---|
| | | | **Month from August - December** |

| Course Name | Technology and Culture | | |
|---|---|---|---|
| **Credits** | 3 | **Contact Hours** | **(3-0-0)** |

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

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

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

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

**Evaluation Criteria**

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

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

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|---|
| 1. | Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2020). *International marketing*. McGraw-Hill Education. |
| 2. | Coyle,D., The Culture Code: The Secrets of Highly Successful Groups, Bantam, 2018 |
| 3. | Fletcher, R., & Crawford, H. (2013). *International marketing: an Asia-Pacific perspective*. Pearson Higher Education AU. |
| 4. | Gerard Bannon, J. (red.). Mattock, Cross-cultural Communication: The Essential Guide to International Business.2003 |
| 5. | Maidenhead.Riding the Waves of Culture: Understanding Cultural Diversity in Business (2012).3rd edition. McGraw Hill. |
| 6. | Madhavan,S., Cross Cultural Management: Concepts and Cases(2nd Ed),Oxfor University Press 2016. |
| 7. | Robertson, Ronald. Globalization: Social theory and global culture, London: Sage, 1992. |

| Course Code | 20B12CS331 | **Semester Odd** **(specify Odd/Even)** | **Semester V  Session** 2022-23 **Month from** Aug. to Dec. 2022 |
|---|---|---|---|
| **Course Name** | **Fundamentals of Machine Learning** | | |
| **Credits** | 3-0-0 | **Contact Hours** | 3 |

| Faculty (Names) | Coordinator(s) | Varsha garg(sec-128), Dr. Dhanelakshmi(Sec-62) |
|---|---|---|
| | Teacher(s) (Alphabetically) | Ambalikasarkar, Dr. Dhanelakshmi, Varsha garg |

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

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

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

**Evaluation Criteria**

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

**Project based learning:** Each student in a group of 3-4 will have to develop a mini project based on fundamentals of machine learning algorithms. The students can opt any real-world application where these algorithms can be applied. The students must implement the mini project using any open source programming language. Project development will enhance knowledge and employability of the students in IT sector.

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) ||
|---|---|
| | **Text Books:** |
| **1.** | Goodfellow, Ian, YoshuaBengio, and Aaron Courville. Deep learning. MIT press, 2016. |
| **2.** | Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. Mathematics for machine learning. Cambridge University Press, 2020. |
| | **Reference Books:** |

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

# Course Description

| Subject Code | 20B12CS332 | Semester Odd (specify Odd/Even) | Semester V  Session  2022-23 Month from Aug. to Dec. 2022 |
|---|---|---|---|
| Subject Name | Fundamentals of Computer Security | | |
| Credits | 3 | Contact Hours | 3-1-0 |

| Faculty (Names) | Coordinator(s) | Dr. Shariq Murtaza(128),Dr. Surendra Kumar(128), Dr. Amanpreet Kaur(62), Dr. P. Raghu Vamsi(62) |
|---|---|---|
| | Teacher(s) (Alphabetically) | Dr. Amanpreet Kaur (62), Dr. P. Raghu Vamsi(62) , Dr. Shariq Murtaza(128),Dr. Surendra Kumar(128) |

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

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

| 5. | Access Control | Access Policies, Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control, Captchas | 5 |
|---|---|---|---|
| 6. | Intrusion Detection and Response | Goals for Intrusion Detection Systems, Types of IDSs – Anomaly Based and Signature Based ,Intrusion Prevention Systems, Intrusion Response | 5 |
| 7. | 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 |
| 8. | 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- 10, Class Test/ Quiz-5, Mini Project (for PBL) -10**) |
| **Total** | **100** |

**Project Based Learning:** Each student in a group of 2-4 will choose one of the computer security aspects such as malware defence, cryptographic applications, reverse engineering code, authentication implementation, intrusion detection system development, firewalls configuration etc. for development and analysis. Applying theseconceptswill enable the students in enhancing their understanding and skills towards computer system hardening.

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

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

| **Course Code** | **20B12CS333** | **Semester Odd**<br>**(specify Odd/Even)** | **Semester V  Session** 2022-23<br>**Month from** Aug. to Dec. 2022 | |
|---|---|---|---|---|
| **Course Name** | **Introduction to Big Data & Data Analytics** | | | |
| **Credits** | 3 | **Contact Hours** | 3 | |

| **Faculty (Names)** | **Coordinator(s)** | **Dr. Bharat Gupta (62), Dr. Arti Jain (128)** |
|---|---|---|
| | **Teacher(s)**<br>**(Alphabetically)** | **Dr. Arti Jain,**<br>**Dr. Bharat Gupta**<br>**Dr. Payal Khurna Batra** |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| C330-3.1 | To understand the fundamental concepts of growing field of big data analytics | Understanding [Level 2] |
| C330-3.2 | To demonstrate the tools required to manage and analyze big data like Hadoop, NoSql MapReduce | Apply [Level 3] |
| C330-3.3 | To apply predictive models and advanced computing paradigms for big data analytics | Apply [Level 3] |
| C330-3.4 | To analyze the big data using intelligent & visualization techniques | Analyze [Level 5] |
| C330-3.5 | To design and create predictive and mathematical model to solve complex real-world problems for decision making. | Apply [Level 3] |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Introduction to Big Data | Introduction to Big Data landscape, Big Data: Why and where, Characteristics of Big Data (V's of Big Data (volume, velocity, variety, veracity, valence, and value) and Dimensions of Scalability,  Data Models for  Big  Data Products (NOSQL, NEWSQL, HADOOP), Data Science and Analytics. | 7 |
| 2. | Data Visualization Techniques | Introduction to Python or R, Understanding and Visualizing Data, Data Visualization R/Python | 5 |
| 3. | Data Modeling and Optimization | Modeling Uncertainty and Risk, Optimization and Modeling Simultaneous Decisions, Case Study | 5 |
| 4. | Decision Making and Predictive Analytics-1 | Data exploration, Evaluation methods, Regression Techniques (Linear , Logistics, Multivariate), Classification Techniques (Decision Tree, ID3, Naïve Bayes), Case Study | 9 |
| 5. | Decision Making and Predictive Analytics-2 | Clustering Techniques, Anomaly Detection, Dimensionality Reduction, Neural networks for deep learning, Hands-on using Python/R, Case Study | 9 |
| 6. | Big Data Technologies | Using Hadoop to store data(HDFS, HBASE), Process Data using Map Reduce, Testing and Debugging Map Reduce Applications | 7 |
| | | **Total number of Lectures** | **42** |

| Evaluation Criteria | |
|---|---|
| **Components** | **Maximum Marks** |
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Internal assessment-05, Class Test/Quiz/Assignment-10, Mini-project in PBL mode-10) |
| **Total** | **100** |

Project based learning: The number of students in mini-project will be between 2-3. The project members will design, develop and implement the big data application by using Python language.

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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:**

| | |
|---|---|
| 1. | EMC Education Services. (2015). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley. |
| 2. | Nelli, F. (2018). Python data analytics: with pandas, numpy, and matplotlib, Apress publication |
| 3. | Sedkaoui, S. (2018). Data analytics and big data. John Wiley & Sons. |
| 4. | Erl, T., Khattak, W., & Buhler, P. (2016). Big data fundamentals: concepts, drivers & techniques. Prentice Hall Press. |
| 5. | 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. |
| 6. | Kumar, V. N., & Shindgikar, P. (2018). Modern Big Data processing with Hadoop: Expert techniques for architecting end-to-end Big Data solutions to get valuable insights, Packt Publishing Ltd. |

| Course Code | 20B12CS334 | **Semester Odd** **(specify Odd/Even)** | **Semester V   Session**  2022-23 |
|---|---|---|---|
| | | | **Month from** Aug. to Dec. 2022 |
| **Course Name** | **Object Oriented Analysis and Design Using JAVA** | | |
| **Credits** | 3-0-0 | **Contact Hours** | 3 |

| **Faculty (Names)** | **Coordinator(s)** | Prof Sandeep Kumar Singh |
|---|---|---|
| | **Teacher(s) (Alphabetically)** | Prof Sandeep Kumar Singh |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|---|---|---|
| **C330-4.1** | Illustrate Object-Oriented Design and convert it to its code using JAVA Programming language. | Understand Level (C2) |
| **C330-4.2** | Dissect the requirements to identify the potential use cases, classes and objects in the system. | Analyze Level (C4) |
| **C330-4.3** | Build UML diagrams such as class diagram, object diagram for structural modelling and state chart diagram, sequence diagrams for behavioural modelling. | Apply Level (C3) |
| **C330-4.4** | Create solutions to solve real world problems. using object-oriented analysis and design principles. | Apply Level (C3) |
| **C330-4.5** | Estimate the complexity of object-oriented designs using several metrics. | Evaluate Level (C5) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Introduction to Principles of Object Oriented Analysis and Design | Programming Paradigms, Introduction to Object Oriented Paradigm, Principles of Object Orientation, Software Complexity: Benefits and Understanding the challenges OOAD can address, Overview of Software Development Life Cycle (SDLC**)** & Rational Unified Process (RUP), Object-Oriented Requirements Elicitation & Analysis and Systems Behavior, Quality Attributes, Software Architect and Design Roles in Industry, Conceptual and Technical Designs, Competing Qualities and Trade-offs, Record, Organize, and Refine Components | 12 |
| 2. | Object Oriented Analysis | Identifying Classes and Objects, Responsibilities, Relationships in problem domain, Object Model, Methods of Class Identification, Listing nouns and Verbs, Synonyms, Attributes and Methods | 3 |

| 3. | Object Oriented analysis with UML | UML structure: Overview of static and dynamic UML diagrams, Modeling System Behavior with use case diagram and notations, From Use Cases to Functional Requirements, Elements of object and class diagram with notations: object, class, link, association, multiplicity, link attributes, association end names, association classes, qualified association, association ends, N-ray association, aggregation and composition, generalization, abstract class, Sequence & Collaboration diagram with notations, Object Collaborations, Interaction Diagrams, State Diagram - Event ,Change Event, Signal Event, Call Event, Time Event , States, Transition & Conditions, Transition, Guard Condition, Action, State Diagrams, One shot State Diagram, Creating State Diagram, State Diagram Behaviour, Activity, Do-activity, Entry Activity, Exit Activity, Nested State Diagram, Nested States, Signal Generalization, Concurrency, Activity and Swim lane diagram, Elements of Component and deployment Diagram Object Constraint Language(OCL) | 8 |
| 4. | Converting Design to Code in JAVA | Objects and Classes in JAVA, Implementing various relationships in JAVA- Association, Inheritance, generalization, Abstraction in Java, Method Overriding and Overloading, Object Roles, Class Types, Implementing Polymorphism, Extensibility and UML, Generalization with Interfaces and Packages in Java | 10 |
| 5. | Design Principles | SOLID principles, Cohesion, Coupling, techniques for good Object-Oriented design, separation of concerns, information hiding, and conceptual integrity | 5 |
| 6. | OO Design Metrics | Understanding and Analyzing Software Design Metrics for Object Oriented Software. | 4 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| Components | Maximum Marks |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 [Attendance (10) + Assignment/Quiz/Mini-project (15)] |
| **Total** | **100** |

**Project based learning:** Each student in a group of 3-4 have to work on a mini-project, in which they will identify a real-life problem and develop the solution by applying their knowledge of object-oriented approach. The project implementation should be in JAVA preferably along with well documentation on different aspects of the software. This enhances the understanding of students towards different concepts of object-oriented approach and also helps 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) |
| --- |

**Text Books:**

| 1. | Object Oriented Modeling And Design With UML 2nd Edition by MICHAEL BLAHA and JAMES RUMBAUGH, PEARSON INDIA 2013 |
| --- | --- |
| 2. | UML 2 AND THE UNIFIED PROCESS: Practical Object-oriented Analysis and Design 2nd Editon by Jim Arlow, Pearson 2015 |
| 3. | The Object-Oriented Thought Process: ObjectOr Thought Process by Matt Weisfeld 2013 |
| 4. | Java: The Complete Reference, Eleventh Edition by Herbert Schildt , 2019 |
| 5. | Core Java Volume I--Fundamentals (Core Series) 11th Edition, by Cay S. Horstmann, 2018 |

**Reference Books:**

| 1. | Head First Object-Oriented Analysis and Design A Brain Friendly Guide to OOA&D By Brett McLaughlin, Gary Pollice, David West 2011 |
| --- | --- |
| 2. | An Introduction to Programming and Object-Oriented Design with Java by Frederick A. Hosch Jaime Nino 2009 |
| 3. | OBJECT-ORIENTED ANALYSIS AND DESIGN With applications Third EDITION Grady Booch Rational Santa Clara, California 2009 |
| 4. | Object Oriented Analysis and Design Andrew Haigh 2001 |
| 5. | UML and C++ A practical approach to OO Development, 1997 |

| Course Code | 20B13HS311 | Semester: Odd | Semester: V Session: 2022-23 Month: August 2022-January 2023 |
|---|---|---|---|
| Course Name | Indian Constitution and Traditional Knowledge | | |
| Credits | 3 | Contact Hours | 3-0-0 |

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

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

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

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

**Evaluation Criteria**

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

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

| | Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |
|---|---|
| 1. | A.A. George, *Important Judgements that transformed India*, New Delhi: McGraw Hill, 2020 |
| 2. | B. Chakraborty, *Indian Constitution: Text, Context and Interpretation,* New Delhi: Sage Publications, 2017 |
| 3. | B.K.Sharma, *Introduction to the Constitution of India*, New Delhi: Prentice Hall of India, 2002 |
| 4. | M.Laxmikanth, *Indian Polity*, 6th edition, Noida: McGraw Hill, 2019 |
| 5. | M.P.Singh and R. Saxena, R, *Indian Politics: Contemporary Issues and Concerns*, New Delhi: PHI Learning, 2008 |
| 6. | R. Kangle, *Arthashashtra of Kautilya*, New Delhi: Motilal Publishers, 1997 |
| 7. | Videos- Samvidhan series produced by Rajya Sabha Television .https://www.youtube.com/watch?v=0U9KDQnIsNk |

| Course Code | 21B12HS312 | Semester: Odd (specify Odd/Even) | Semester: 5th Session: 2022 -2023 Month from: August-December |
|---|---|---|---|
| Course Name | **Management Accounting** | | |
| Credits | 03 | Contact Hours | 3-0-0 |

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

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|---|---|---|
| C303-10.1 | Understand basic accounting concepts and analyze financial statements of a business organization | Analyze (C4) |
| C303-10.2 | Understand various aspects of the management accounting system including ethical conduct for accountants | Understand (C2) |
| C303-10.3 | Understand cost behaviour and apply cost-volume-profit analysis in decision making | Apply (C3) |
| C303-10.4 | Analyze various costing systems for cost allocation and pricing decisions | Analyze (C4) |
| C303-10.5 | Evaluate the master budget and carry out variance analysis for planning and management control decisions | Evaluate (C5) |

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Basic Accounting concepts and financial statements | Accounting Concepts, principles, accounting equation, analysis of Balance sheet, Income statement, statement of changes in stockholders' equity, statement of cash flows. Common size statement, trend analysis and ratio analysis | 7 |
| 2. | Management accounting system | Meaning of Management Accounting, Influences on accounting systems, Ethical conduct for accountants | 7 |

| 3. | Cost Concepts and cost behaviour | Identifying resources, Activities, Costs and Cost drivers; Variable and Fixed cost behaviour; Cost-Volume-Profit Analysis | 7 |
|---|---|---|---|
| 4. | Cost Management Systems | Direct, Indirect cost; Cost allocation; Traditional and Activity Based costing systems, special orders, pricing decision, cost-plus pricing, target costing, make or buy decision | 7 |
| 5. | Budgetary Control | Introduction to budgets; Functional budgets, Master budgets, Fixed and flexible budgets, Budgets as financial planning models, Variance analysis | 8 |
| 6. | Management control system | Organizational goal and performance measures, designing a management control system | 6 |
| **Total number of Lectures** | | | **42** |

**Evaluation Criteria**

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

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

| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
|---|---|
| 1. | Charles T. Horngren, Gary L. Sundem, Jeff O. Schatzberg, Dave Burgstahler, Introduction to Management Accounting, 16th Edition, Pearson Publication, 2014. |
| 2. | Anthony A. Atkinson, Robert S. Kaplan, Ella Mae Matsumura, S. Mark Young, G. Arun Kumar, Management Accounting, 5th Edition, Pearson Publication, 2009. |
| 3. | Arora, M.N. Cost and Management Accounting, Himalaya Publishing, 4th Edition, 2018. |
| 4. | Hingorani, Ramanathan and Grewal, Management Accounting, S. Chand Publications, 2003. |
| 5. | Ghosh, T. P., Financial Accounting for Managers, 4th Edition, Taxmann Publications, 2009. |

| 6. | Maheshwari, S.N., Maheshwari, S.K., Financial Accounting, 10th ed, Vikas Publishing House. |
|---|---|
| 7. | Pandey, I.M., Financial management, 11th ed, Vikas Publishing House Pvt Ltd, 2015 |
| 8. | Chandra, P., Financial Management Theory and Practice, 7th ed., Tata McGraw Hill, 2007. |
| 9. | Chawla, M, Chawla, C and Gupta, A. "India: Anti-corruption Compliance in India" Mondaq, January, 2021. Accessed on: 30th October 2021. Link: https://www.mondaq.com/india/white-collar-crime-anti-corruption-fraud/1022326/anti-corruption-compliance-in-india |
| 10. | Tangdall, S. "The CEO of Starbucks and the Practice of Ethical Leadership", Santa Clara University, 29th August 2018. Accessed on: 30th October 2021. Link:  https://www.scu.edu/leadership-ethics/resources/the-ceo-of-starbucks-and-the-practice-of-ethical-leadership/ |

## Detailed Syllabus

| Course Code | 22B12PH311 | Semester: Odd | Semester: 5th Session: 2022-2023 From: July to December |
|---|---|---|---|
| Course Name | Engineering Materials and Technology | | |
| Credits | 3 | Contact Hours | 3 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Introduction to Materials | Broad categorization of materials, Structure, property and performance relationship in materials. Engineering Materials Development in India. | 4 |
| 2. | Material Properties | Review of material properties. Fracture, fatigue, diffusion and creep. Failure of materials. Material Deformations. Durability, oxidation, corrosion and degradation. Basics of Phase Diagrams and Diffusion. | 8 |
| 3. | Ceramics and Metals | Metals and Alloys. Strengthening and degradation, corrosion prevention. Material Strengthening. Sub-classification, processing and properties of traditional and advanced ceramics. Phase diagrams using CALPHAD approach for ceramics and metals. | 8 |
| 4. | Polymers and Wood | Introduction and classification, polymeric structure, effects of glass transition temperature, polymer mechanical properties. Classification and facets of wood. | 3 |
| 5 | Material Composites | Composites: polymer matrix, metal matrix, ceramic matrix, carbon-carbon. Longitudinal and transverse modulus. Composite making methods. | 6 |
| 6. | Processing and Selection of Material | Manufacturing Processes and Design, Instruments and Furnaces. Materials, Environment and Sustainability. Automation in Materials Processing, Laser ablation of materials in additive manufacturing. | 7 |
| 7 | Development | Exploring materials development using computer software tools. Python packages and machine learning algorithm. Material Analysis using PyMKS | 4 |
| | | Total number of Lectures | 40 |

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

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

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

# Matrix Computations (16B1NMA533)

## Detailed Syllabus

| Course Code | 16B1NMA533 | Semester - Odd (specify Odd/Even) | Semester 5th Session 2022 -2023 Month from July 2022 - Dec 2022 |
|---|---|---|---|
| Course Name | Matrix Computations | | |
| Credits | 3 | Contact Hours | 3 |

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

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

| Module No. | Title of the Module | Topics in the Module | No. of Lectures for the module |
|---|---|---|---|
| 1. | Matrix Algebra | Review of matrices, partitioning, block diagonal matrix, elementary matrices, Inverse of a matrix by partitioning. | 6 |
| 2. | Linear System of equations | Existence and uniqueness of solution for system of linear equations. 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 |

| 5. | Orthogonality | Orthogonal and orthonormal sets, Gram-Schmidt process, QR factorization. | 4 |
|----|---------------|-----|---|
| 4. | Eigen value Problems | Eigen values and Eigenvectors, spectral radius, Greshgorin's theorem, Jacobi method, Givens rotations method and Householder's method, Power and Inverse power methods, Q-R algorithm. | 12 |
| 6. | Matrix Calculus | Powers and functions of matrices, application to solve discrete dynamical systems $x(t+1) = Ax(t)$, $x(0) = \alpha$ and a system of differential equations of the form $dx/dt = Ax$, $x(0) = \alpha$. | 8 |
| | | **Total number of Lectures** | **42** |
| | | | |

**Evaluation Criteria**

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

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

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

| 1. | **Bronson, R**., Matrix Methods an Introduction, Academic Press, 1991. |
|----|------|
| 2. | **Golub, G. H., Loan, C. F. V.,**Matrix Computations, 4th Edition, Johns Hopkins University Press, 2013. |
| 3. | **Datta, K. B.**, Matrix and Linear Algebra, 3rdEdition, Prentice Hall of India, 2016. |
| 4. | **David, W. Lewis**., Matrix Theory, World Scientific, 1991. |

# Basic Numerical Methods (17B1NMA531)

Approximation and errors in computation, Bisection Method, Regula- Falsi Method, Secant Method, Iterative method, Newton-Raphson Method, finite differences, Newton's Forward and Backward interpolation, Bessel's and Sterling's central difference operators, Laplace-Everett's formula, Newton's divided difference formula, Lagrange's interpolation formula,derivatives using difference operators, Numerical integration formulas, Gauss elimination method, LU decomposition method, , Gauss-Seidel method, Picard's method, Euler's methods, Runge-Kutta method, Milne's method, Finite-Difference method.

## Course Description

| Course Code | 17B1NMA531 | Semester  - Odd | Semester V Session 2022-23 Month from Aug 2022- Dec 2022 |
|---|---|---|---|
| Course Name | Basic Numerical Methods | | |
| Credits | 3 | Contact Hours | 3-0-0 |
| Faculty (Names) | Coordinator(s) | Dr. Pankaj K. Srivastava & Dr. Dinesh C. S. Bisht | |
| | Teacher(s) (Alphabetically) | Dr. Dinesh C. S. Bisht & Dr. Pankaj K. Srivastava | |

| 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 | 08 |

| | | 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. | |
|---|---|---|---|
| 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** |

**Project Based Learning:** Students will be divided in a group of 4-5 to collect literature and submit a report on application of different numerical methods to solve practical problems based on systems of linear equations and ordinary differential equations.

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

| 1. | **C. F. Gerald and P.O. Wheatley,** Applied Numerical Analysis, 7th Ed., Pearson Education, 2004. |
|---|---|
| 2. | **M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International, New Delhi, 2014. |
| 3. | **R. S. Gupta,** Elements of Numerical Analysis, 2nd Ed., Cambridge University Press, 2015. |
| 4. | **S.D. Conte and C. deBoor,** Elementary Numerical Analysis, An Algorithmic Approach, 3rd Ed., McGraw-Hill, New York, 1980. |

## CO-PO and CO-PSO Mapping:

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C301-5.1 | 3 | 2 | 1 | 1 | | | | | | | | 2 | | | |
| C301-5.2 | 3 | 2 | 2 | 1 | | | | | | | | 2 | | | |
| C301-5.3 | 3 | 2 | 2 | 1 | | | | | | | | 2 | | | |
| C301-5.4 | 3 | 2 | 1 | 1 | | | | | | | | 2 | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **C301-5.5** | 3 | 2 | 2 | 1 | | | | | | | 2 | | | |
| **C301-5.6** | 3 | 3 | 2 | 1 | | | | | | | 2 | | | |
| **Avg** | 3 | 2 | 2 | 1 | | | | | | | 2 | | | |

## Theory of Numbers (16B1NMA731)

Divisibility, The greatest common divisor, coprime integers, The least common multiple, Linear Diophantine Equations, The Fundamental Theorem of Arithmetic, Prime Number Theorem, Goldbach and Twin Primes conjectures, Residue classes, Euclid's algorithm, Chinese Remainder, Wilson's and Fermat's Theorem, pseudoprimes. Greatest integer function, The Euler phi function, RSA Cyptosystem, arithmetic function, The Mobius function, Carmichael conjecture, The number-of-divisors and sum-of-divisors functions, Perfect numbers, characterization of even perfect numbers. Quadratic residues and non-residues, The Legendre symbol, Euler's Criterion, The law of quadratic reciprocity. Primitive roots.

## Course Description

| Subject Code | 16B1NMA731 | Semester Odd | B.Tech. V Semester Session Month from July 2022 to Dec. 2022 | |
|---|---|---|---|---|
| **Subject Name** | Theory of Numbers | | | |
| **Credits** | 3 | **Contact Hours** | 3-0-0 | |
| **Faculty (Names)** | **Coordinator(s)** | Dr. Himanshu Agarwal | | |
| | **Teacher(s) (Alphabetically)** | Dr. Himanshu Agarwal | | |

| COURSE OUTCOMES | | COGNITIVE LEVELS |
|---|---|---|
| After pursuing the above mentioned course, the students will be able to: | | |
| C301-4.1 | explain Euclid algorithm, linear Diophantine equations and prime numbers. | Understanding Level (C2) |
| C301-4.2 | solve system of linear congruences using properties of congruences. | Applying Level (C3) |
| C301-4.3 | explain numbers of special form and number theoretic functions. | Understanding Level (C2) |
| C301-4.4 | apply the concepts of order, primitive roots and indices to solve conguences. | Applying Level (C3) |
| C301-4.5 | apply Legendre symbol and quadratic reciprocity theorem to solve quadratic congruences. | Applying Level (C3) |
| C301-4.6 | apply and analyse the concepts of number theory in hashing, cryptography, calendar and ISBN check digits problems. | Analyzing Level (C4) |

| Module No. | Subtitle of the Module | Topics in the module | No. of Lectures for the module |
|---|---|---|---|
| 1. | **Divisibility and Primes** | Division algorithm, Greatest common divisor, Euclid's algorithm, gcd as a linear combination of coprime integers, Linear Diophantine equations, primes, The fundamental theorem of arithmetic, The Sieve of Eratosthenes, Canonical prime factorization, Least common multiple, Prime number theorem(statement only), Goldbach and twin primes conjectures. | 5 |
| 2 | **Theory of** | Definitions and basic properties, Residue classes, | 4 |

| | Congruences | complete residue systems, reduced residue systems, Linear congruences in one variable, Simultaneous linear congruences, Chinese remainder theorem and its applications, Linear congruences in more than one variable, Fermat's theorem, Pseudoprimes and carmichael numbers, Wilson's Theorem | |
|---|---|---|---|
| 3. | **Number Theoretic Functions and Numbers of Special Form** | Greatest integer function, The number-of-divisors function, The sum-of-divisors function, Multiplicative function, The Mobius function, Mobius inversion formula, The Euler's totient function, Euler's theorem, Perfect numbers, characterization of even perfect numbers, Mersenne primes, Fermat primes | 8 |
| 4. | **Primitive Roots and Indices** | The order of an integer, Primitive roots, Theory of indicies, Solution of non-linear congruences. | 9 |
| 5. | **Quadratic Residues** | Quadratic residues and non-residues, Euler's Criterion, The Legendre symbol, Gauss Lemma, Quadratic reciprocity, Solution of quadratic congruences. | 8 |
| 6. | **Applications** | Hashing functions, Cyptosystem, Calendar problem, ISBN check digits | 8 |
| | | **Total Number of Lectures** | **42** |

**Evaluation Criteria**

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

Project based learning: Each student in a group of 4-5 will analyse applications of Chinese remainder theorem in congruency problems. Also the students will explore the applications of secure communication techniques, Cyptosystem, Calendar problem, ISBN check digits.

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

| 1. | **James Strayer**, Elementary Number Theory, Waveland Press, 1994/2002, ISBN 1-57766-224-5. |
|---|---|
| 2. | **Kenneth Rosen**, Elementary Number Theory and its Applications, 5th Edition, McGraw Hill, ISBN 0-201-87073-8. |
| 3. | **I. Niven, H. Zuckerman, H. Montgomery**, An Introduction to the Theory of Numbers, 5th Edition, Wiley, ISBN 0471625469. |
| 4. | **David M. Burton**, Elementary Number Theory, 7th Edition, McGraw Hill Education (India) Private Limited. |