Program Structure for Second Year Computer Engineering
Semester-IV-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
CEC401	Applications of Mathematics in Engineering-II	3– 0 – 1	04	3 – 0 – 1	04	BS
CEC402	Analysis of Algorithm	3– 0 – 0	03	3 – 0 – 0	03	PC
CEC403	Database Management System	3 – 0 – 0	03	3 – 0 – 0	03	PC
CEC404	Operating Systems	3 – 0 – 0	03	3 – 0 – 0	03	PC
CEC405	Microprocessor	3 – 0 – 0	03	3 – 0 – 0	03	PC
CEL402	Analysis of Algorithm Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
CEL403	Database Management System Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
CEL404	Operating Systems Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
CEPR42	Project Based Learning- Mini Project Lab-II	0 – 2 – 0	02*	0 – 1 – 0	01	PBL
CEXS45	Skill Based Learning: Python Programming (SAT -V)	0 – 2 – 0	02$	0 – 1 – 0	01	SAT
CEXS46	Skill Based Learning (SAT-VI) (Foreign and Indian Regional Languages-II)	0 – 2 – 0	02$	0 – 1 – 0	01	SAT
INT41	Internship-III	2 to 3 Weeks		--	--	INT
Total		**15-12-01**	**28**	**15 - 06 – 1**	**22**	

*Load of learner, not the faculty $SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need.

Mini Project I and II: Students can form groups with minimum two and maximum four. **Faculty Load:** 1 hour per week per four groups

Semester-IV Examination Scheme

Course Code	Course Name	Marks										
		CA				ESE	ESE duration(Hrs)	TW	O	P	P&O	Total
		T-1	T-2	Average (T-1 & T-2)	IA							
CEC401	Applications of Mathematics in Engineering-II	30	30	30	10	60	2.30	25	--	--	--	125
CEC402	Analysis of Algorithms	30	30	30	10	60	2.30	--	--	--	--	100
CEC403	Database Management System	30	30	30	10	60	2.30	--	--	--	--	100
CEC404	Operating System	30	30	30	10	60	2.30	--	--	--	--	100
CEC405	Microprocessor	30	30	30	10	60	2.30	--	--	--	--	100
CEL402	Analysis of Algorithm Lab	--	--	--		--	--	25	--	--	25	50
CEL403	Database Management System Lab	--	--	--	--	--	--	25	--	--	25	50
CEL404	Operating System Lab	--	--	--	--	--	--	25	--	--	25	50
CEPR42	Project Based Learning- Mini Project Lab-II	--	--	--	--	--	--	25	--	--	25	50
CEXS45	Skill Based Learning: Python Programming (SAT -V)	--	--	--	--	--	--	25	--	--	--	25
CEXS46	Skill Based Learning (SAT-VI) (Foreign and Indian Regional Languages-II)	--	--	--	--	--	--	25	--	--	--	25
INT41	Internship-III	--	--	--	--	--	--	--	--	--	--	--
Total		**150**	**150**	**150**	**50**	**300**		**175**	**--**	**--**	**100**	**775**

Course Code	Course Name	Credits Assigned			
		TH	P	TUT	Total
CSC401	Applications of Mathematics in Engineering-II	03	-	1	04

Prerequisites:	1. Engineering Mathematics-I 2. Engineering Mathematics-II 3. Applications of Mathematics in Engineering-I
Course Objectives (COBs):	1. Matrix algebra to understand engineering problems. 2. Line and Contour integrals and expansion of a complex valued function in a power series. 3. To understand the concepts of vector spaces used in the field of machine learning and engineering problems. 4. The concepts of probability distributions and sampling theory for small samples. 5. Linear and Non-linear programming problems of optimization.
Course Outcomes (COs):	**Upon completion of the course, the learners will be able to:** 1. Apply the concepts of eigenvalues and eigenvectors in engineering problems. 2. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals. 3. Apply the concept of vector spaces and orthogonalization process in Engineering Problems. 4. Use the concept of probability distribution and sampling theory to engineering problems. 5. Apply the concept of Linear Programming Problems to optimization. 6. Solve Non-Linear Programming Problems for optimization of engineering problems.

Module No. & Name	Sub-Topics	CO Mapped	Hrs / Sub Topics	Total Hrs/ module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Induction.	**-**	**02**	**02**
1. Linear Algebra (Theory of Matrices)	Characteristic Equation, Eigenvalues and Eigenvectors, and properties (Without proof)	**CO1**	**02**	**06**
	Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials		**02**	
	Similarity of matrices, diagonalizable and non-diagonalizable matrices. Self-learning Topics: Derogatory and non-derogatory matrices, functions of Square Matrix, Linear Transformations, Quadratic forms. Singular Value Decomposition		**02**	
2. Complex Integration	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (Without proof).	**CO2**	**02**	**07**
	Taylor's and Laurent's series (without proof)		**03**	

	Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof) Self-learning Topics: Application of Residue Theorem to evaluate real integrations.		**02**	
3. Linear Algebra: Vector Spaces	Vectors in n-dimensional vector space, norm, dot product, The Cauchy-Schwarz inequality (with proof), Unit vector.	**CO3**	**02**	**06**
	Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors.		**02**	
	Vector spaces over real field, subspaces. Self-Learning Topics: - Linear combinations, linear Dependence and Independence, QR decomposition.		**02**	
4. Probability Distribution and Sampling Theory	Probability Distribution: Poisson and Normal distribution	**CO4**	**03**	**07**
	Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		**02**	
	Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: test of goodness of fit and independence of attributes, Contingency table. Self-learning Topics: Test significance for large samples, Estimate parameters of a population, Yate's Correction. Binomial distribution, F- distribution.		**02**	
5. Linear Programming Problems	Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.	**CO5**	**02**	**06**
	Artificial variables, Big-M method (Method of penalty)		**02**	
	Duality, Dual of LPP and Dual Simplex Method. Self-learning Topics: Sensitivity Analysis, Two-Phase Simplex Method, Revised Simplex Method. Error minimizing LPP.		**02**	
6. Nonlinear Programming Problems	NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers	**CO6**	**02**	**07**
	NLPP with two equality constraints		**02**	
	NLPP with inequality constraint: Kuhn-Tucker conditions. Self-learning Topics: Problems with two inequality constraints, Unconstrained optimization: One-dimensional search method (Golden Search method, Newton's method). Gradient Search method		**03**	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**01**	**01**
Total Hours				**42**

<table>
<tr><td colspan="2"></td></tr>
<tr><td>Text Books:</td><td>1. E. Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited.
2. R. Jain and S. Iyengar, Advanced Engineering Mathematics, Narosa publication.
3. Brown and Churchill, Complex Variables and Applications, McGraw-Hill Education.</td></tr>
<tr><td>Reference Books:</td><td>1. T. Veerarajan, Probability, Statistics and Random Processes, McGraw-Hill Education.
2. H. Taha, Operations Research: An Introduction, Pearson.
3. S. Rao, Engineering Optimization: Theory and Practice, Wiley-Blackwell.
4. Hira and Gupta, Operations Research, S. Chand Publication</td></tr>
<tr><td>Useful Links:</td><td>1. https://nptel.ac.in/courses/111/108/111108066/
2. https://nptel.ac.in/courses/111/103/111103070/
3. https://nptel.ac.in/courses/111/104/111104071/
4. https://nptel.ac.in/courses/111/105/111105041/
5. https://www.coursera.org/learn/complex-analysis</td></tr>
<tr><td>Term work:</td><td>1. Term work should consist of 6 batch wise tutorials.
2. Journal must include at least 2 assignments on content of theory of the course.
The distribution of term work marks will be as follows
<table><tr><td>1</td><td>Tutorials</td><td>15</td></tr><tr><td>2</td><td>Assignment</td><td>10</td></tr></table></td></tr>
<tr><td>Assessment :</td><td>Continuous Assessment for 40 marks:
1. Test 1 – 30 marks
2. Test 2 – 30 marks
3. Internal assessment – 10 marks
Internal assessment will be based on assignments/quizzes/case study/activity conducted by thefaculty</td></tr>
<tr><td colspan="2">End Semester Theory Examination will be of 60 marks for 02 hrs 30 min duration</td></tr>
</table>

Course Code	Course Name	Credits (TH+P+TUT)
CEC402	Analysis of Algorithms	3 - 0 - 0

Prerequisite:	1. Data structure concepts 2. Discrete structures
Course Objectives:	1. To provide mathematical approaches for Analysis of Algorithms 2. To understand and solve problems using various algorithmic approaches 3. To analyze algorithms using various methods
Course Outcomes:	**At the end of the course, the students should be able to** 1. Analyze the running time and space complexity of algorithms 2. Describe, apply and analyze the complexity of divide and conquer strategy. 3. Describe, apply and analyze the complexity of greedy strategy. 4. Describe, apply and analyze the complexity of dynamic programming strategy. 5. Explain and apply backtracking, branch and bound. 6. Explain and apply string matching techniques.

Module No. & Name	Sub-Topics	CO mapped	Hrs / Sub Topics	Total Hrs /Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**	**02**	**02**
1.Introduction	Performance analysis, space and time complexity, Growth of function, Big- Oh, Omega Theta notation. Mathematical background for algorithm analysis.	**CO1**	**02**	**08**
	Complexity class: Definition of P, NP, NP-Hard, NP-Complete		**01**	
	Analysis of selection sort, insertion sort		**02**	
	Recurrences: The substitution method, Recursion tree method, Master method		**03**	
2. Divide and Conquer Approach	General method, Merge sort, Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search.	**CO2**	**05**	**05**
3. Greedy Method Approach	General Method, Single source shortest path: Dijkstra Algorithm Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees: Kruskal and Prim's algorithms	**CO3**	**06**	**06**
	General Method, Multistage graphs, Single source shortest path: Bellman Ford Algorithm All pair shortest path: Floyd Warshall Algorithm	**CO4**	**05**	**10**

4. Dynamic Programming Approach	Assembly-line scheduling Problem, 0/1 knapsack Problem, Travelling Salesperson problem, Longest common subsequence		**05**	
5. Backtracking and Branch and bound	General Method, Backtracking: N-queen problem, Sum of subsets, Graph coloring	**CO5**	**03**	**06**
	Branch and Bound: Travelling Salesperson Problem, 15 Puzzle problem		**03**	
6. String Matching Algorithms	The Naïve string-matching algorithm, The Rabin Karp algorithm, The Knuth-Morris-Pratt algorithm	**CO6**	**04**	**04**
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization.	-	**01**	**01**
Total Hours				**42**

Books:

Text Books	1. T. H. Cormen, C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005. 2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.
Reference Books	1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition. **2.** S. K. Basu, "Design Methods and Analysis of Algorithm", PHI**.**

Useful Links:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://swayam.gov.in/nd1_noc19_cs47/preview
3. https://www.coursera.org/specializations/algorithms
4. https://www.mooc-list.com/tags/algorithms

Assessment:

Continuous Assessment for 40 marks:

4. Test 1 – 30 marks
5. Test 2 – 30 marks
6. Internal assessment – 10 marks

Internal assessment will be based on assignments/quizzes/case study/activity conducted by the faculty

End Semester Theory Examination will be of 60 marks for 02 hrs 30 min duration

Course Code	Course Title	Credits (TH+P+TUT)
CEC403	**Database Management System**	**3 - 0 - 0**
Prerequisite:	Data Structures	
Course Objectives:	1. Develop entity relationship data model and its mapping to relational model 2. Learn relational algebra and Formulate SQL queries 3. Apply normalization techniques to normalize the database 4. Understand the concept of transaction, concurrency control and recovery techniques.	
Course Outcomes:	**After completion of the course students will be able to..** 1. Recognize the need of database management system 2. Design ER and EER diagram for real life applications 3. Construct relational models and write relational algebra queries. 4. Formulate SQL queries 5. Apply the concept of normalization to relational database design. 6. Describe the concept of transaction, concurrency and recovery.	

Module No. & Name	Sub-Topics	CO mapped	Hrs / Sub Topics	Hrs/ module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	**-**	**02**	**02**
1. Introduction Database Concepts	Introduction, Characteristics and applications of databases, File system v/s Database system,	**CO1**	**01**	**03**
	Data abstraction and data Independence, DBMS system architecture, Database Administrator		**02**	
2. Entity–Relationship Data Model	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys	**CO2**	**03**	**06**
	Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation		**03**	
3. Relational Model and relational Algebra	Introduction to the Relational Model, relational schema and concept of keys.	**CO3**	**02**	**08**
	Mapping the ER and EER Model to the Relational Model		**03**	
	Relational Algebra-operators, Relational Algebra Queries		**03**	
4. Structured Query Language (SQL)	Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check constraints	**CO4**	**02**	**06**
	Data Manipulation commands, Data Control commands		**01**	

	Set and string operations, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, Triggers, PL/SQL		**03**	
5. Relational-Database Design	Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies	**CO5**	**03**	**06**
	First Normal Form, 2NF, 3NF, BCNF, 4NF (Conversion of Normalization forms)		**03**	
6. Transactions Management and Concurrency and Recovery	Transaction concept, Transaction states, ACID properties, Transaction Control Commands	**CO6**	**02**	**10**
	Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based		**04**	
	Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling		**04**	
ii. Course Conclusion:	Recap of Modules, Outcomes, Applications and Summarization.	**-**	**01**	**01**
Total Hrs				**42**

Textbooks:

1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH

References:

1. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management‖, Thomson Learning, 5thEdition.
2. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press.
3. G. K. Gupta, Database Management Systems, McGraw Hill, 2012

Useful Links

1.https://nptel.ac.in/courses/106/105/106105175/

2.https://swayam.gov.in/nd1_noc19_cs46/preview

3.https://www.classcentral.com/course/swayam-database-management-system-9914

4.https://www.mooc-list.com/tags/dbms

Assessment:

Continuous Assessment for 40 marks:

1. Test 1– 30 marks
2. Test 2 – 30 marks
3. Internal assessment--10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60 marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEC404	Operating Systems	3+0+0

Prerequisite:	1. Data structures 2. Computer architecture
Course Objectives:	1. To introduce basic concepts and functions of operating systems. 2. To understand the concept of process, thread and resource management. 3. To understand the concepts of process synchronization and deadlock. 4. To understand various Memory, I/O and File management techniques.
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Describe the objectives, functions and structure of OS 2. Analyze the concept of process management and evaluate performance of process scheduling algorithms. 3. Apply the concepts of synchronization and deadlocks 4. Evaluate performance of Memory allocation and replacement policies 5. Explain the concepts of file management. 6. Apply concepts of I/O management and analyze techniques of disk scheduling.

Module No & Name	Sub-Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisite	Prerequisites concepts and course introduction	--	**02**	**02**
1. Operating system Overview	Introduction, Objectives, Functions and Evolution of Operating System	**CO1**	**01**	**04**
	Operating system structures: Layered, Monolithic and Microkernel		**01**	
	Linux Kernel, Shell and Shell Programming, System Calls		**02**	
2. Process and Process Scheduling	Concept of a Process, Process States, Process Description, Process Control Block.	**CO2**	**02**	**09**
	Uniprocessor Scheduling-Types: Preemptive and Non-preemptive , scheduling algorithms (FCFS, SJF, SRTN, Priority, RR)		**04**	
	Threads: Definition and Types, Concept of Multithreading		**03**	
3. Process Synchronization and Deadlocks	Concurrency: Principles of Concurrency, Inter-Process Communication, Process Synchronization	**CO3**	**02**	**09**
	Mutual Exclusion: Requirements Hardware Support (TSL), Operating System Support (Semaphores), Producer and Consumer problem		**03**	

	Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm		**02**	
	Deadlock Detection and Recovery, Dining Philosophers Problem		**02**	
4. Memory Management	Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, DynamicPartitioning	**CO4**	**02**	**09**
	Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit		**02**	
	Paging and Segmentation, TLB		**02**	
	Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing		**03**	
5. File Management	Overview, File Organization and Access	**CO5**	**02**	**04**
	File Directories		**01**	
	File Sharing		**01**	
6. IO Management	I/O devices, Organization of the I/O Function, Disk Organization	**CO6**	**01**	**04**
	I/O management		**01**	
	Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK		**02**	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**--**	**01**	**01**
Total Hours				**42**

Books:

Text Books	1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913, ISBN-13: 9780133805918. 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0
Reference Books	1. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition. 2. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition 3. Maurice J. Bach, "Design of UNIX Operating System", PHI 4. Sumitabha Das, "UNIX: Concepts and Applications", McGraw Hill, 4th Edition

Useful Links:

1. https://swayam.gov.in/nd1_noc19_cs50/preview
2. https://nptel.ac.in/courses/117/106/117106113/
3. https://nptel.ac.in/courses/117/106/117106113/
4. https://www.classcentral.com/course/swayam-introduction-to-operating-systems-6559
5. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/CRUX/labs/exp1/theory.html

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 30 marks
2. Test 2 – 30 marks
3. Internal assessment –10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60 marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEC405	**Microprocessor**	3 +0 +0

Prerequisite:	Digital Logic and Computer Architecture.
Course Objectives:	1. To equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors. 2. To emphasize on instruction set and logic to build assembly language programs 3. To prepare students for higher processor architectures and embedded systems.
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Describe core concepts of 8086 microprocessor. 2. Interpret the instructions of 8086 and write assembly language programs. 3. Identify the specifications of peripheral chip 4. Design 8086 based system using memory and peripheral chips. 5. Explain the architecture of advanced processors 6. Describe hyper threading technology

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and course outlines	Prerequisite Concept and Introduction	**--**	**02**	**02**
1. The Intel Microprocessors 8086 Architecture	8086CPU Architecture, Programmer's Model, Functional Pin Diagram	**CO1**	**02**	**08**
	Memory Segmentation Banking in 8086, Demultiplexing of Address /Data bus		**02**	
	Functioning of 8086 in Minimum mode and Maximum mode		**02**	
	Timing diagrams for Read and Write operations in minimum and maximum mode, Interrupt structure and its servicing		**02**	
2. Instruction Set and Programming	Addressing Modes, Instruction set-Data Transfer Instructions, String Instructions, Logical Instructions, Arithmetic Instructions, Transfer of Control Instructions, Processor Control Instructions	**CO2**	**03**	**06**

	Assembler Directives and Assembly Language Programming, Macros, Procedures. Simulation of small program on different instruction set.		**03**	
3. Memory and Peripherals interfacing	Memory Interfacing - RAM and ROM Decoding, Techniques – Partial and Absolute 8255-PPI-Block diagram, CWR, operating modes, interfacing with 8086	**CO3**	**03**	**08**
	8257-DMAC-Block diagram, DMA operations and transfer modes		**02**	
	Programmable Interrupt Controller 8259-Block Diagram, Interfacing the 8259 in single and cascaded mode		**03**	
4. Intel 80386DX Processor	Architecture of 80386 microprocessor	**CO4**	**01**	**07**
	80386 registers–General purpose Registers, EFLAGS and Control registers		**02**	
	Real mode, Protected mode, virtual 8086 mode		**02**	
	80386 memory management in Protected Mode – Descriptors and selectors, descriptor tables, the memory paging mechanism		**02**	
5. Pentium Processor	Pentium Architecture, Superscalar Operation,	**CO5**	**02**	**06**
	Integer &Floating-Point Pipeline Stages, Branch Prediction Logic		**02**	
	Cache Organization and MESI protocol		**02**	
6. Pentium 4 and ARM Processor	Comparative study of 8086, 80386, Pentium I, Pentium II and Pentium III, Pentium 4: Net burst micro architecture	**CO6**	**02**	**04**
	Instruction translation look aside buffer and branch prediction, Hyper threading technology and its use in Pentium 4, Application and Features of ARM processors		**02**	
ii. Course Conclusion	Recap of modules, Outcomes, Applications and summarization.		**01**	**01**
Total Hours				**42**
Books:				
Text Books:	1. John Uffenbeck, "8086/8088 family: *Design Programming and Interfacing",* PHI. 2. Yu-Cheng Liu, Glenn A. Gibson, *"Microcomputer System: The 8086/8088 Family, Architecture, Programming and Design",* Prentice Hall 3. Walter A. Triebel, *"The 80386DX Microprocessor: hardware, Software and Interfacing",* Prentice Hall *4.* Tom Shanley and Don Anderson, *"Pentium Processor System*			

	Architecture", Addison-Wesley.
Reference Books	1. Barry B. Brey*, "Intel Microprocessors",* 8thEdition, Pearson Education India 2. Intel Manual Peter Abel*, "IBM PC Assembly language and Programming",* 5th Edition, PHI 3. James Antonakons, *"The Pentium Microprocessor*", Pearson Education 4. K. M. Bhurchandani and A. K. Ray*, "Advanced Microprocessors and Peripherals",* McGraw Hill 5. Douglas Hall, *"Microprocessor and Interfacing"*, Tata McGraw Hill.

Useful Links:

1. https://swayam.gov.in/nd1_noc20_ee11/preview
2. https://nptel.ac.in/courses/108/105/108105102/
3. https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894
4. https://www.mooc-list.com/tags/microprocessors

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 30 marks
2. Test 2 – 30 marks
3. Internal assessment –10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60 marks for 02 hrs 30 min duration.

Lab Code	Lab Name	Credits (P+TUT)
CEL402	Analysis of Algorithms Lab	1+ 0

Prerequisite:	Basic knowledge of programming and data structure
Lab Objectives:	1. To introduce the methods of designing and analyzing algorithms 2. Design and implement efficient algorithms for a specified application 3. Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem. 4. Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.
Lab Outcomes (LOs):	**At the end of the course, the student will be able to** 1. Implement the algorithms using different approaches 2. Analyze the complexities of various algorithms 3. Compare the complexity of the algorithms for specific problems 4. Apply ethical principles like timeliness and adhere to the rules of the laboratory

Lab No.	Experiment Title	LO mapped	Hrs/ Lab
0	Lab Prerequisites	**-**	**02**
1	**Introduction:(Implement any 2)** Selection sort, Insertion sort	**LO1, LO2, LO3, LO4**	**04**
2	**Divide and Conquer Approach :(Implement any 2)** Finding Minimum and Maximum, Merge sort, Quick sort, Binary search	**LO1, LO2, LO3, LO4**	**04**
3	**Greedy Method Approach :(Implement any 2)** Single source shortest path-Dijkstra Fractional Knapsack problem Job sequencing with deadlines Minimum cost spanning trees-Kruskal and Prim's algorithm	**LO1, LO3, LO4**	**04**
4	**Dynamic Programming Approach:(Implement any 2)** Single source shortest path- Bellman Ford All pair shortest path- Floyd Warshall , 0/1 knapsack, Travelling salesperson problem Longest common subsequence	**LO1, LO4**	**04**
5	**Backtracking and Branch and bound:(Implement any 2)** N-queen problem Sum of subsets Graph coloring	**LO1, LO4**	**04**
6	**String Matching Algorithms:(Implement any 2)** The Naïve string-matching Algorithms The Rabin Karp algorithm The Knuth-Morris-Pratt algorithm	**LO1, LO4**	**06**

Text Books	1. T. H. Cormen, C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005. 2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.
Reference Books	1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition. **2.** S. K. Basu, "Design Methods and Analysis of Algorithm", PHI**.**

Useful Links:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://swayam.gov.in/nd1_noc19_cs47/preview
3. https://www.coursera.org/specializations/algorithms
4. https://www.mooc-list.com/tags/algorithms

Term work:

1. Term work should consist of at least 10 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course "Analysis of Algorithms"
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Oral & Practical Exam:

Oral & practical examination will be based on entire syllabus of CEC402 and CEL402

Lab Code	Lab Name	Credits (P+TUT)
CEL403	**Database Management System Lab**	**1-0**
Prerequisite:	Data structures	
Lab Objectives:	1. To explore design and develop of relational model 2. To present SQL and procedural interfaces to SQL comprehensively 3. To introduce the concepts of transactions and transaction processing	
Lab Outcomes (LOs):	**At the end of the course, the students will be able to** 1. Design ER /EER diagram and convert it to a relational model for the real world application. 2. Apply DDL, DML, DCL and TCL commands 3. Write simple and complex queries 4. Use PL / SQL Constructs. 5. Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.	

Suggested List of Experiments		**LO Mapped**	**Hrs /Lab**
Lab No.	**Title of Experiment**		
0	Prerequisite	**-**	**02**
1	Identify the case study and detailed statement of the problem. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.	**LO1, LO6**	**02**
2	Mapping ER/EER to Relational schema model.	**LO1, LO6**	**02**
3	Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System	**LO2, LO6**	**02**
4	Apply DML Commands for the specified system	**LO2, LO6**	**02**
5	Perform Simple queries, string manipulation operations and aggregate functions.	**LO3, LO6**	**02**
6	Implement various Join operations.	**LO3, LO6**	**02**
7	Perform Nested and Complex queries	**LO3, LO6**	**02**
8	Perform DCL and TCL commands	**LO2, LO6**	**02**
9	Implement procedure and functions	**LO4, LO6**	**02**
10	Execution of CRUD operations from front end using Database connectivity.	**LO5, LO6**	**02**
11	Implementation of Views and Triggers.	**LO4, LO6**	**02**
12	Implementation and demonstration of Transaction and Concurrency control techniques using locks.	**LO5, LO6**	**02**

Term Work:

1. Term work should consist of 10 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of "Database Management System"
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Oral & Practical Exam:

Oral & Practical Exam will be conducted based on the entire syllabus of CEC403 and CEL403

Lab Code	Lab Name	Credits (P+TUT)
CEL404	**Operating Systems Lab**	**1-0**

Prerequisite:	1. Computer Organization 2. Data Structures and Algorithms
Lab Objectives:	1. To gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management, memory management, file systems and deadlock handling using C language in Linux environment. 2. To familiarize students with the architecture of Linux OS. 3. To provide necessary skills for developing and debugging programs in Linux environment. 4. To learn programmatically to implement simple operation system mechanisms
Lab Outcomes (LOs):	**At the end of the course, the student will be able to:** 1. Demonstrate basic Operating system Commands, Shell scripts, System Calls and API with respect to Linux 2. Implement various process scheduling algorithms and evaluate their performance. 3. Implement and analyze concepts of synchronization and deadlocks. 4. Implement various Memory Management techniques and evaluate their performance. 5. Implement and analyze concepts of virtual memory, concepts of file management and I/O management techniques. 6. Apply ethical principles like timeliness and adhere to rules of laboratory.

Lab No.	Experiment Title	LO mapped	Hrs/ Lab
0	Prerequisite	**-**	**02**
1	**<u>Explore Linux Commands</u>** **Explore usage of basic Linux Commands and system calls for file, directory and process management.** Commands: mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc. System Calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid. sort, grep, awk, etc.	**LO1, LO6**	**02**
2	**<u>Linux shell script</u>** Write shell scripts to do the following: a. Display OS version, release number, kernel version b. Display top 10 processes in descending order c. Display processes with highest memory usage. d. Display current logged in user and log name. e. Display current shell, home directory, operating system type, current path setting, current working directory	**LO1, LO6**	**02**

3	**<u>Linux- API</u>** Implement any one basic commands of Linux like ls, cp, mv and others using kernel APIs.	**LO1, LO6**	**02**
4	**<u>Linux- Process</u>** a. Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system call. b. Explore wait and waitpid before termination of process.	**LO2, LO6**	**02**
5	**Process Management: Scheduling** a. Write a program to demonstrate the concept of non-preemptive scheduling algorithms. b. Write a program to demonstrate the concept of preemptive scheduling algorithms	**LO2, LO6**	**02**
6	**Process Management: Synchronization** a. Write a C program to implement solution of Producer consumer problem through Semaphore b. Write a C program to implement solution of Reader's Writer's problem through Semaphore	**LO3, LO6**	**02**
7	**<u>Process Management: Deadlock</u>** a. Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm b. Write a program demonstrate the concept of Dining Philosopher's Problem c. Simulate deadlock detection using CPU-OS Simulator	**LO3, LO6**	**02**
8	**<u>Memory Management</u>** a. Write a program to demonstrate the concept of MVT and MFT memory management techniques b. Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e., Best Fit, First Fit, Worst-Fit etc.	**LO4, LO6**	**02**
9	**<u>Memory Management: Virtual Memory</u>** a. Write a program to demonstrate the concept of demand paging for simulation of Virtual Memory implementation b. Write a program in C demonstrate the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.	**LO5, LO6**	**02**
10	**<u>File Management & I/O Management</u>** a. Write a C program to simulate File allocation strategies typically sequential, indexed and linked files b. Write a C program to simulate file organization of multi-level directory structure. c. Write a program in C to do disk scheduling - FCFS, SCAN, C-SCAN	**LO5, LO6**	**02**
Virtual Lab Links:			
1. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/CRUX/labs/exp1/theory.html			

Term work:

1. Term work should consist of a minimum of 10 experiments covering all modules.
2. Journal must include at least 2 assignments on content of theory and practical of the course "Operating Systems"
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Practical & Oral Exam:

Oral & Practical Exam will be conducted based on the entire syllabus of CEC404 and CEL404

Course code	Course Name	Credits
CEPR42	Project Based Learning: Mini Project Lab-II	01

Objectives:	1. To acquaint yourself with the process of identifying the needs and converting it into the problem. 2. To familiarize the process of solving the problem in a group. 3. To acquaint yourself with the process of applying basic engineering fundamentals to attempt solutions to the problems. 4. To inculcate the process of self-learning and research.
Outcome:	**After successful completion of this course learner will be able to…** 1. Identify problems based on societal /research needs. 2. Design solutions or system components or processes that meet the specified needs 3. Select appropriate tools to implement the project. 4. Develop interpersonal skills to work as a member of a group or leader 5. Excel in written and oral communication. 6. Demonstrate project management principles during project work. 7. Demonstrate capabilities of investigation and self-learning by oneself or as a team gaining life skills

Guidelines for Mini Project

1	Project based learning Mini Project Lab-1 should be implemented preferably using Python programming (CEXS45)
2	Students shall form a group of 2 to 3 students, while forming a group shall not be allowed less than two or more than three students, as it is a group activity.
3	Students should do survey and identify needs, which shall be converted into problem statements for mini project in consultation with faculty supervisor/internal committee of faculties.
4	Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
5	A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
6	Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
7	Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
8	Students shall convert the best solution into working model using Python Programming.
9	The solution to be validated with proper justification and report to be compiled in standard format of the college.

10	With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV.
11	However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.

Term Work

The review/ progress monitoring committee shall be constituted by senior faculty members. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester. Assessment also considers peer review and ethics observed by faculties and participation involvement.

Continuous Assessment

In continuous assessment focus shall also be on each individual student, log book maintained and weekly meeting based on the same.

	Distribution of Term work marks for both semesters shall be as below:	**Practical Marks**
1	Marks awarded by guide based on implementation	10
2	Peer assessment by team members	05
3	Marks awarded by review committee for presentation	05
4	Quality of Project report	05

Review / progress monitoring committee may consider following points for assessment based on project as mentioned in general guidelines

Project:

1	In this case in one semester students' group shall complete project in all aspects including, a. Identification of need/problem b. Proposed final solution c. Procurement of components/systems d. Building prototype and testing
2	Continuous assessment will be weekly based on logbook. Two presentations will be conducted for review before a panel. a. First shall be for finalization of problem and proposed solution b. Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project.

Mini Project shall be assessed based on following criteria:

1	Quality of survey and identification of problem statement
2	Innovativeness in solutions
3	Implementation

4	Team work
5	Project report
Guidelines for Assessment of Mini Project Practical/Oral Examination:	
1	Report should be prepared as per the guidelines issued by the University of Mumbai.
2	Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by head of Institution.
3	Students shall be motivated to publish a paper based on the work in Conferences/students competitions.
Mini Project shall be assessed based on following points:	
1	Quality of problem and Clarity
2	Innovativeness in solutions
3	Cost effectiveness and Societal impact
4	Full functioning of working model as per stated requirements
5	Effective use of skill sets
6	Effective use of standard engineering norms
7	Contribution of an individual's as member or leader
8	Clarity in written and oral communication

Total Marks = Term work +Oral & Practical = (25+25)

25 marks of Term work will be given on the basis of evaluation of project practical marks and Log book which is filled weekly by students as per their weekly progress.

25 marks of Oral and practical will be based on a project implementation.

Course Code	Course Name	Credits (TH+P+TUT)
CEXS45	Skill Based learning: Python Programming (SAT-V)	0 + 1 + 0

Prerequisite:	Knowledge of programming language like C and Java
Skill Objectives:	1. Basics of Python programming 2. Decision Making, Data structure and Functions in Python 3. Object Oriented Programming using Python 4. Web framework for developing
Skill Outcomes:	**After successful completion of this course learner will be able to…** 1. To understand basic concepts in python. 2. To explore contents of files, directories and text processing with python 3. To develop program for data structure using built in functions in python. 4. To explore django web framework for developing python-based web application and basics of NumPy and Pandas 5. To understand Multithreading concepts using python. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Module	Sub Topics	SO mapped	Hrs / Sub topics	Total Hrs / Module
i. Prerequisites and Course Outline	**Introduction to python, Features, Applications, Comparison with C and Java**			**02**
1. Python basics	Data types in python, Operators in python, Input and Output	**SO1, SO6**	**01**	**04**
	Control statement, Arrays in python		**01**	
	String and Character in python, Functions, List and Tuples, Dictionaries Exception		**01**	
	Introduction to OOP, Classes, Objects, Interfaces, Inheritance		**01**	
2. Advanced Python	Files in Python, Directories	**SO2, SO6**	**01**	**04**
	Building Modules		**01**	
	Packages, Text Processing		**01**	
	Regular expression in python		**01**	
3. Data Structure in Python	Link List, Stack	**SO3, SO6**	**02**	**04**
	Queues, Dequeues		**02**	
4. Python Integration Primer	Graphical User interface, Networking in Python	**SO4, SO6**	**01**	**04**
	Python database connectivity		**01**	
	Introduction to Django		**02**	
5.Multithreading	Thread and Process, Starting a thread	**SO5, SO6**	**01**	**04**
	Threading module, Synchronizing threads		**02**	
	Multithreaded Priority Queue		**01**	

6. NumPy and Pandas	Creating NumPy arrays, Indexing and slicing in NumPy, creating multidimensional arrays, NumPy Data types	**SO4, SO6**	**02**	**06**
	Array Attribute, Indexing and Slicing, Creating array views copies, Manipulating array shapes I/O		**02**	
	Basics of Pandas, Using multilevel series, Series and Data Frames, Grouping, aggregating, Merge Data Frames		**02**	
Total Hours				**28**

Books:	
Text Books	1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press 2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication 3. Anurag Gupta, G. P. Biswas, "Python Programming", McGraw-Hill 4. E. Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Education
Reference Books	1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series 2. Martin C. Brown," Python: The Complete Reference", McGraw-Hill Publication. 3. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication
Useful Links:	1. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/ 2. Beginning Perl, https://www.perl.org/books/beginning-perl/ 3. http://spoken-tutorial.org 4. https://starcertification.org/Certifications/Certificate/python

Suggested experiments using Python:

Sr. No.	Title of Experiments
1	Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements
2	Creating functions, classes and objects using python. Demonstrate exception handling and inheritance.
3	Exploring Files and directories a. Python program to append data to existing file and then display the entire file b. Python program to count number of lines, words and characters in a file. c. Python program to display file available in current directory
4	Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes.
5	Menu driven program for data structure using built in function for link list, stack and queue.
6	Program to demonstrate CRUD (**create, read, update and delete)** operations on database (SQLite/ MySQL) using python.
7	Creation of simple socket for basic information exchange between server and client.
8	Creating web application using Django web framework to demonstrate functionality of user login and registration (also validating user detail using regular expression).

9	Programs on Threading using python.
10	Exploring basics of NumPy Methods.
11	Program to demonstrate use of NumPy: Array objects.
12	Program to demonstrate Data Series and Data Frames using Pandas.
13	Program to send email and read content of URL.

Term Work for 25 Marks:

Programming labs to be conducted as 2 hrs continuous (theory + hands-on) session.
The assessment will be

- An online quiz conducted at the end of every 2-hr session consisting of 5 questions for a total of 10 marks. The average of best 10 quizzes will be considered toward 10 marks.

- Students should perform minimum 10 experiments. The programs performed along with the screenshot of output have to be submitted within two days. A cover page will be attached stating the aims and objectives. This will be considered towards 10 marks.
- Attendance= 05 marks

	Quiz	**Lab Submission**	**Total**
Marks Allotted	10	10	25

Exposure Course Code	Exposure Course Name	Credits			
		TH	P	TUT	Total
CEXS46	SAT – VI: Skill-Based Learning (Foreign and/or Indian Regional Languages-II)	-	01	-	01
SBL Objectives (SOBs):	1. Acquire reading and writing proficiency in the target language 2. Understand the common heritage of, and diversity among, countries that speak the target language. 3. Communicate and interact effectively with citizens of the target cultures.				
SBL Outcome (SOs):	Upon completion of the course, the learners will be able to: 1. Demonstrate communicative proficiency in the target language. 2. Write the target language in formal expository prose that impede communication. 3. Learn through MOOC online courses to adopt hybrid mode of learning				
Guidelines for Skill-Based Learning (SBL):	Each student has to complete any one Foreign and/or Indian Language MOOC course from NPTEL/Coursera/Udemy etc. sites referring the suggestive given list of course but are not limited to the list as it's a learner's choice for the interested course in the given semester time frame.				

Sr No.	Suggestive list of Courses-
1	Introduction to Japanese Language and Culture
2	German – II &III
3	The Psychology of Language
4	Spanish Vocabulary: Meeting People, Cultural Experience, Sports, Travel, and the Home, Careers and Social Events, Spanish Vocabulary Project
5	A Bridge to the World: Korean Language for Beginners, First Step Korean, Learn to Speak Korean 1, The Korean Alphabet: An Introduction to Hangeul
6	Complete French Course: Learn French for Beginners
7	Complete German Course: Learn German for Beginners
8	Spanish 1-4: Beginner, Elementary, Intermediate and Advanced
9	Complete Japanese Course: Learn Japanese for Beginners
10	Complete Korean Course: Learn Korean for Beginners
11	The Complete Russian Language Course
12	Spoken Sanskrit: Basic and Intermediate Levels
13	Applied Linguistics
14	Fundamental Concepts in Sociolinguistics
15	Introduction to Basic Spoken sanskrit and intermediate level to Basic Spoken Sanskrit

Online Resources:

Sr No	Suggestive Courses Link but are not limited to following resources only:
1	https://onlinecourses.nptel.ac.in/noc22_hs84/preview

2	https://onlinecourses.nptel.ac.in/noc22_hs89/preview
3	https://onlinecourses.nptel.ac.in/noc22_hs123/preview
4	https://www.coursera.org/learn/spanish-vocabulary-meeting-people https://www.coursera.org/learn/spanish-vocabulary-cultural-experience https://www.coursera.org/learn/spanish-vocabulary-sports-travel-home https://www.coursera.org/learn/spanish-vocabulary-careers https://www.coursera.org/learn/spanish-vocabulary-project
5	https://www.coursera.org/learn/korean-beginners https://www.coursera.org/learn/learn-korean https://www.coursera.org/learn/learn-speak-korean1 https://www.coursera.org/learn/the-korean-alphabet-an-introduction-to-hangeul
6	https://www.udemy.com/course/complete-french-course/
7	https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/
8	https://www.udemy.com/course/spanish-101-beginning-spanish-spanish-for-beginners/
9	https://www.udemy.com/course/complete-japanese-course-learn-japanese-for-beginners-lvl-1/
10	https://www.udemy.com/course/complete-korean-course-learn-korean-for-beginners-level-1/
11	https://www.udemy.com/course/the-complete-russian-language-course/
12	https://onlinecourses.nptel.ac.in/noc22_hs114/preview
13	https://onlinecourses.nptel.ac.in/noc22_hs85/preview
14	https://onlinecourses.nptel.ac.in/noc22_hs139/preview

Internship Code	Internship Name	Hours/Duration	Credits
INT43	**Internship-III**	**80-120 hrs (2 - 3 Weeks)**	

Prerequisite:	Skill sets of engineering and technology specific tools, instruments, devices and programming languages etc**.**
Internship Objectives:	**1.** To get the industrial environment expose for creating competent professionals for the industry. **2.** To understand the psychology of the workers and their habits, attitudes and approach to problem solving.
Internship Outcomes:	**Upon completion of the course, students will be able to:** 1. Get an expose to work with the future employers. 2. Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control in product development lifecycle.

Activity- Internship	**Supporting Activities to be completed under Internship**
	Internships in the field of:
	● Industries
	● Government Sector
	● Non-governmental Organization (NGO)
	● MSMEs
	● Rural Internship

Term Work Assessment:

Duration to be considered for assessment:
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)

Guidelines:	1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. 2. Students will submit the participation certificate of the activities to the faculty mentors. 3. For working in cells related activities, Cell coordinator will submit list of actively involved & participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare. 4. HOD will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities. 5. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data 6. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.

	Mining Social-Network Graphs Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, Case study on social network graphs.		**02**	
6. **Data Analytics with R**	Introduction to basics of R, Introduction toRStudio, Working directories in RStudio, datatypes, operators in R, Pipe operator		**01**	**06**
	Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and using Objects, Interacting with users,		**02**	
	Handling data in R workspace, Executing Scripts, Creating Plots, Accessing help and documentation in R,		**01**	
	Reading datasets and Exporting data from R, Manipulating and Processing Data in R, Using functions instead of script, built-in functions in R,		**01**	
	Data Visualization: Types, Applications		**01**	
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization	**--**		**01**
Total Hours				**42**

Books:	
Text Books	1. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press. 2. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press. 3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press 4. Dr. Bharti Motwani “Data Analytics with R”, Wiley
Reference Books	1. Bill Franks “Taming the Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics”, Wiley 2. Chuck Lam, “Hadoop in Action”, Dreamtech Press 3. Jared Dean, “Big Data, Data Mining and Machine Learning: Value Creation for Business Leaders and Practitioners”, Wiley India Private Limited, 2014. 4. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 3rd ed, 2010. 5. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer 2nd Edition, 2010 6. Ronen Feldman and James Sanger, “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Cambridge University Press, 2006

	7. Vojislav Kecman, “Learning and Soft Computing”, MIT Press, 2010. 8. Tom White “Hadoop: The Definitive Guide”, O'Reilly Media, Inc., June 2009
Useful Links:	
1. https://hadoop.apache.org 2. https://hadoop.apache.org/docs/r2.8.0/hadoop-project-dist/hadoop-common/core-default.xml	
Assessment:	
Continuous Assessment for 40 marks: 1. Test 1 – 30 marks 2. Test 2 – 30 marks Average of 2 tests out of 30 marks 3. Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 minutes duration.	