HIMACHAL PRADESH TECHNICAL UNIVERSITY HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.

Computer Science & Engineering (CSE)

3rd to 8th Semester

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2024-2025)

Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	BS	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
2	PC	CSPC-311	Data Structure and Algorithms	3	1	0	4	40	60	100
3	PC	CSPC-312	Python Programming	2	0	0	2	40	60	100
4	PC	CSPC-313	Computer Organization and Architecture	3	1	0	4	40	60	100
5	PC	ECEPC-312	Digital System Design	3	0	0	3	40	60	100
6	HS	IKS-311	Indian Knowledge System	2	0	0	2	40	60	100
7	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	CSPC-311P	Data Structure and Algorithms Lab	0	0	2	1	30	20	50
2	PC	CSPC-312P	Python Programming Lab	0	0	2	1	30	20	50
3	PC	ECEPC-312P	Digital System Design Lab	0	0	2	1	30	20	50
			Total	**18**	**03**	**06**	**24**			**850**

Semester-IV

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	CSPC-411	Discrete Mathematics	3	0	0	3	40	60	100
2	PC	CSPC-412	Operating System	3	1	0	4	40	60	100
3	PC	CSPC-413	Design and Analysis of Algorithm	3	1	0	4	40	60	100
4	PC	CSPC-414	Introduction to Artificial Intelligence	3	1	0	4	40	60	100
5	PC	CSPC-415	Database Management System	3	1	0	4	40	60	100
6	PC	ECEPC-412	Microcontrollers	3	0	0	3	40	60	100
Labs:										
1	PC	CSPC-413P	DAA Lab	0	0	2	1	30	20	50
2	PC	CSPC-414P	AI Lab	0	0	2	1	30	20	50
3	PC	CSPC-415P	DBMS Lab	0	0	2	1	30	20	50
			Total	**18**	**04**	**06**	**25**			**800**
UG Diploma Exit Option										
1	EE	CSEE-416P	**Internship-I**	**8weeks/ 2months**			**6**			

***Note: Student can exercise exit option after 2nd Year for which he/she will be awarded UG Diploma provided they secure an additional 6 credits through summer internships/apprenticeship for 2 months after 4th semester. The concerned student has to apply for UG Diploma exit at the time of registration of 4th semester. Total Credits earned by the student opting UG Diploma exit after 4th Semester is 47+49+6=102 credits**

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Semester-V

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	FC	CSPC-511	Computer Networks	3	1	0	4	40	60	100
2	PC	CSPC-512	Theory of Computation	3	1	0	4	40	60	100
3	PC	CSPC-513	Introduction to Machine Learning	3	1	0	4	40	60	100
4	PC	CSPC-514	Software Engineering	3	0	0	3	40	60	100
Labs:										
1	PC	CSPC-511P	Computer Networks Lab	0	0	2	1	30	20	50
2	PC	CSPC-513P	Machine Learning Lab	0	0	2	1	30	20	50
			Total	**12**	**03**	**04**	**17**			**600**
Minor Degree Courses (Optional Additional Courses)										
1	MD	CSMD-5xx	**Course-I**	**4**	**0**	**0**	**4**	40	60	**100**
2	MD	CSMD-5xx	**Course-II**	**3**	**0**	**0**	**3**	40	60	**100**

Semester-VI

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	CSPC-611	Digital Image Processing	3	1	0	4	40	60	100
2	PC	CSPC-612	Information and Network Security	3	0	0	3	40	60	100
3	PC	CSPC-613	Compiler Design	3	1	0	4	40	60	100
4	PE	CSPE-611(x)	Professional Elective -I	3	0	0	3	40	60	100
5	PE	CSPE-612(x)	Professional Elective -II	3	1	0	4	40	60	100
Labs:										
1	PC	CSPC-611P	DIP Lab	0	0	2	1	30	20	50
2	EE	CSEE-612P	Capstone Project	0	0	4	2	30	20	50
			Total	**15**	**03**	**02**	**21**			**600**
Minor Degree Courses (Optional Additional Courses)										
1	MD	CSMD-6xx	**Course-III**	**4**	**0**	**0**	**4**	40	60	**100**
2	MD	CSMD-6xx	**Course-IV**	**3**	**0**	**0**	**3**	40	60	**100**
B.Sc. Degree Exit Option										
1	EE	CSPC-612P	**Internship-II**	**8weeks/2months**			**6**	50	50	**100**

***Note: Student can exercise exit option after 3rd Year for which he/she will be awarded B.Sc. Degree provided they secure an additional 6 credits through summer internships/apprenticeship for 2 months after 4th semester. The concerned student has to apply for UG Diploma exit at the time of registration of 4th semester. Total Credits earned by the student opting UG Diploma exit after 4th Semester is 96(1st and 2nd year) +38(3rd year) + 6=140 credits**

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List of Professional Electives

Professional Elective-I								
S.No.	Category	Subject Code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-611(i)	Distributed Operating Systems	3	0	0	3	CSE
2	PE	CSPE-611(ii)	Advanced Computer Networks	3	0	0	3	CSE
3	PE	CSPE-611(iii)	Advanced Algorithms	3	0	0	3	CSE

Professional Elective-II								
S.No.	Category	Subject code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-612(i)	Advanced Computer Architecture	3	1	0	4	CSE
2	PE	CSPE-612(ii)	Mobile Computing and Wireless Networks	3	1	0	4	CSE
3	PE	CSPE-612(iii)	Cloud Computing	3	1	0	4	CSE

Minor Degree in Artificial Intelligence and Machine Learning Courses								
S.No.	Category	Subject Code	Semester	Subject Title	Teaching Hours Per Week			Credits
					L	T	P/D	
1	MD	CSMD-511	V	Introduction to AI & ML	3	0	2	4
2	MD	CSMD-512	V	Applications of AI	3	0	0	3
3	MD	CSMD-611	VI	Deep Learning and Neural Networks	3	0	2	4
4	MD	CSMD-612	VII	Introduction to Data Analytics	3	0	0	3
5	MD	CSMD-711	VII	Special topics in Artificial Intelligence	4	0	0	4
							Total Credits	18

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Minor Degree in Data Science Courses								
S.No.	Category	Subject Code	Sem	Subject Title	Teaching Hours Per Week			Credits
					L	T	P/D	
1	MD	CSMD-511	V	Introduction to AI & ML	3	0	2	4
2	MD	CSMD-513	V	Introduction to Data Science	3	0	0	3
3	MD	CSMD-613	VI	Web Data Mining	4	0	0	4
4	MD	CSMD-612	VII	Introduction to Data Analytics	3	0	0	3
5	MD	CSMD-712	VII	Analysing, Visualization and applying Data Science with Python	3	0	2	4
							Total Credits	18

Minor Degree in IoT Courses								
S.No.	Category	Subject Code	Semester	Subject Title	Teaching Hours Per Week			Credits
					L	T	P/D	
1	MD	CSMD-514	V	Introduction to Internet of Things	4	0	0	4
2	MD	CSMD-515	V	Introduction to Security of Cyber-Physical Systems	3	0	0	3
3	MD	CSMD-614	VI	Ubiquitous Sensing, Computing and Communication	4	0	0	4
4	MD	CSMD-615	VII	Embedded Systems for IoT	3	0	0	3
5	MD	CSMD-713	VII	IoT with Arduino, ESP and Raspberry Pi	4	0	0	4
							Total Credits	18

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SEMESTER-III

MAFC-311 Probability Theory and Statistics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter: Question paper of end semester examination will be of 60 marks.The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each (Each subdivided into at least two equal sub-parts) and section E has short answer type questions consisting of six parts of 02 marks each or twelve parts of 01 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the section E will be compulsory. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus

Course Objective:

- To understand the basic probability concepts.
- To have an in-depth knowledge of standard distribution which can describe real life phenomena.
- To understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- To analyse the response of random inputs to linear time invariant systems.

Unit-I:

Probability Theory: Counting principles, probability axioms, sample space and events, conditional probability & Baye's Theorem. Random variable, discrete & continuous probability distribution, expectation, variance, standard deviation. Joint probability distribution, mass function, distribution function, marginal distribution function, covariance.

Probability Distributions: Discrete Probability Distributions: Uniform, Bernoulli, Binomial Distribution and Poisson distribution. Continuous Probability Distributions: Normal and exponential distribution.

Unit-II:

Sampling and Testing of Hypothesis:

Basic sampling models, sampling distribution of mean and standard deviation, testing of hypothesis, level of significance, confidence intervals for known and unknown means, simple sampling of attributes, tests of significance for large samples, comparison of large samples, central limit theorem, test of significance for two large samples. Student's t- test, Chi-square test, Goodness of fit, F-distribution..

Unit-III:

Solution of System of Linear, Transcendental Equations & Interpolation

Bisection method, Regula-Falsi method Newton Raphson's method, Gauss elimination method, LU factorization method.

Introduction to Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Difference operators and relations.

Unit-IV:

Numerical Differentiation& Integration: Numerical differentiation using forward difference, backward difference and central difference formula. Integration by trapezoidal and Simpson's rules $1/3^{rd}$ and $3/8^{th}$ rule.

Numerical Solution of Ordinary Differential Equations: Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge's and Runge- Kutta method.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

1. Develop understanding of basics of probability theory.
2. Identify different distribution functions and their relevance.
3. Apply the concepts of probability theory to different problems.
4. Understand different numerical integration techniques, and numerically solve differential equations.

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Textbooks:

R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.
B.S. Grewal, —Higher Engineering Mathematic, Khanna Publishers.
S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989.
S.S. Sastry , Introductory Methods of Numerical Analysis, fifth Edition ,PHI learning Pvt. Ltd.

References:

Seymour Lipschutz, and John J. Schiller, Introduction to Probability and Statistics, Schaum's Outlines by Mc Graw Hill Education.
E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
H.K. Dass and Rajnish Verma, —Engineering Mathematic, S. Chand Publications.

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CSPC- 311 Data Structure and Algorithms							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: To become familiar with different types of data structures and them applications.

Unit-I:
Data Structures: Definition, primitive and derived data types, abstract data types, need for data structures, types of data structures. **Algorithm:** Definition, characteristics, development of algorithm, Analysis of complexity: - time complexity, space complexity, order of growth, asymptotic notation with example, obtaining the complexity of the algorithm. **Arrays:** Definition, 1d and 2d arrays, operations on arrays, sparse matrices, structures and arrays of structures.
Unit-II:
Linked list: Representation of linked list in memory, allocation & garbage collection, operations on linked list, doubly linked lists, circular linked list, linked list with header node, applications. **Stacks:** representation of stack in memory, operations on stack and applications. **Queues:** Representation of queues in memory, operations on queues, circular queues, double ended queues, priority queues, applications.
Unit-III:
Trees: Introduction, representation of tree in memory. **Binary Trees:** Terminology, binary tree traversal, binary search tree, insertion, deletion & searching in binary search tree, heap trees, types of heap trees, insertion, deletion in heap tree with example, heap sort algorithm, introduction of AVL trees & B-trees. **Graphs:** Definition, representation of graph (adjacency matrix, adjacency list), traversing a graph (DFS & BFS), dijkstra's algorithm for shortest distance, minimum spanning tree.
Unit-IV:
Searching and sorting: Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

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Course Learning Outcomes (CLOs):

On completion of this course, the students will be able to

1. Implement basic data structures in solving fundamental problems.
2. Implement various searching and sorting techniques.
3. Implement tree and graph data structures along with their related operations.
4. Evaluate and apply appropriate data structure(s) for real-world problems.

Text Books:

1. Seymour Lipschutz : Theory and practice of Data structure , Tata Mc. Graw Hill 1998
2. Tenebaum, A. Langsam Y and Augenstein , A. J: Data structures using C++ , Prentice Hall Of India.

Reference Books:

1. Data structures and Algorithms in C++ by Micheal T. Goodrich, Wiley India publication.
2. Data structures, R.Venkatesan, S.Lovelyn Rose, Wiley India publication.
3. Data Structures using C++ By Patil, Oxford University press.
4. Data Structures, Algorithm and Object-Oriented programming, Gregory L.Heileman, TataMc-Graw Hills.
5. S. Sahni, Data structure Algorithms ad Applications in C++, WCB/McGraw Hill.
6. J.P. Tremblay and P.G. Sorenson, —An Introduction to Data Structures with applications‖, Tata McGraw Hill.

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CSPC-312 Python Programming							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: This course will help you to understand the basics of Data Science which includes Programming, Mathematics, and Statistics before getting started with advanced machine learning techniques. Students will also gain knowledge in various data pre-processing techniques and data visualization techniques.

Unit-I:
Introduction to Python: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, type () Function and Is Operator, Dynamic and Strongly Typed Language. **Control Flow Statements:** if Decision Control Flow Statement, the if…else Decision Control Flow Statement, the if-elif-else, Decision Control Statement, Nested if Statement, the while Loop, The for Loop, The continue and break Statements.
Unit–II:
Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.**Strings,** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Unit–III
Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. **Dictionaries**, Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement
Unit-IV
Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries.**Files,** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files. Reading and Writing CSV file.

Course Learning Outcomes (CLO):

On completion of this course, the students will be able to:

1. To know the concept of functions in Python, like "if" and different types of loops.
2. Be able to convert data types and work with lists.
3. To know the difference between running Python programs on Mac and Windows
4. Be able to work with CSV files.

Textbooks:

1. Gowri Shankar S, Veena A, **"Introduction to Python Programming",** 1st edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372.

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CSPC-313 Computer Architecture & Organisation							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:
Register Transfer and Micro operations: Register transfer language, register transfer, bus & memory transfer, logic micro-operations, shift micro-operation. **Basic Computer Organization:** Instruction codes, computer instructions, timing & control, instruction cycles, memory reference instruction, input/output & interrupts, complete computer description & design of basic computer.
Unit–II:
Control Unit: Hardwired vs Micro programmed control unit. **Central Processing Unit:** General register organization, stack organization, instruction format, addressing modes, data transfer & manipulation, program control, RISC, CISC. **Input-Output Organization:** Peripheral devices, I/O interface, Modes of data transfer: Programmed I/O, Interrupt-Initiated I/O, DMA transfer, I/O processor. Serial Communication.
Unit–III
Computer Arithmetic: Unsigned, signed and floating-point data representation, addition, subtraction, multiplication and division algorithms. Booth's multiplication algorithm. **Memory Unit:** Memory hierarchy, processor vs. memory speed, main memory, auxiliary memories, high-speed memories, cache memory, associative memory, virtual memory, and memory management hardware.
Unit-IV:
Introduction to Parallel Processing: Flynn's classification, pipelining, arithmetic pipeline, instruction pipeline, characteristics of multiprocessors, inter connection structures, inter processor arbitration, inter processor communication & synchronization.

Text Books:

1. Mano, Morris M., Computer System Architecture, Prentice Hall.
2. Hayes, J.P., Computer Architecture and Organization, Mc Graw Hill.

Reference Books:

- Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture A Quantitative Approach, Pearson Education Asia.
- Leigh, W.E. andAli,D.L.,SystemArchitecture:softwareandhardwareconcepts,SouthWester Publishing Co.

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ECEPC-312 Digital System Design							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- To understand the fundamentals of number systems and Boolean Algebra.
- To understand the concepts of MSI Devices and Applications.
- To understand the concepts of Combinational Logic Design, Programmable Logic Devices.
- To conceptualize the working of Sequential Circuits, Synchronous Sequential Circuits.
- To gain the knowledge in VLSI Design flow.

Unit-I
Number system and codes: Review of Boolean Algebra, Binary arithmetic (Addition, Subtraction, Multiplication and Division), Floating point numbers. BCD codes, 8421 code, Excess-3 code, Gray code, Error detection and correction: Parity code, Hamming code. **Logical Simplification:** De Morgan"s Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables. The tabulation method, Determination of prime implicants, Selection of essential prime implicants. Quine Mccluskey method.
Unit-II
Combinational Logic Design: MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU. **Logic families:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of programmable logic devices like FPGA, Logic implementation using programmable Devices.
Unit-III
Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.
Unit-IV
VLSI Design flow: Design entry: Schematic, FSM & HDL, different modelling styles in VHDL, Data types and objects, Dataflow, Behavioural and Structural Modelling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Course Learning Outcomes (CLOs): On successful completion of the course

- The student can acquire the basic knowledge of measurement principles and their application in electrical engineering.
- The students will be able to effectively employ electrical and electronics instruments for measurements of various electrical quantities.

Textbooks:

- Digital Fundamentals by Morris and Mano, PHI Publication.
- Fundamental of digital circuits by A.ANAND KUMAR, PHI Publication.
- Digital Fundamentals by FLOYD & JAIN, Pearson's Pub

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IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Learning Objectives:

- To equip the students with the knowledge and understanding related to Indian knowledge systems, origin, evolution and the approaches used in ancient and modern times.
- To promote the youths to do research in the various fields of Bhāratīya knowledge system.

Unit-I: Bhāratīya Civilization and Development of Knowledge System.
Genesis of the Bharat bhumi and Civilization ,Discovery of the Saraswatī River, The Saraswatī-Sindhu civilization, Traditional knowledge system, The ancient education system, Brief introduction of the Takṣaśilā University,The Nālandā University, Knowledge export from Bharata.
Unit-II: Art, Literature and Scholars
Natraja- A masterpiece of Bhartiya Art, Introduction to Vedas and Vedic Literature, Life and works of Agastya, Vālmīki, Patañjali, Vedvyāsa, Loapmudra, Maitreyi, Gārgī, Caraka, Suśruta, Kaṇāda, Kauṭīlya, Pāṇini, Āryabhaṭa, Varahmihira, Bhāskarācārya.
Unit-III: Engineering Science and Technology
Engineering, science and technology in the Vedic Age, Post-Vedic period, History of Mathematics in Bharata, Concepts of Zero, History and Culture of Astronomy in India,Kerala School of Astronomy and Mathematics.
Unit-IV: Cultural Heritage and Indian Traditional Practices
Temple architecture in ancient India, Fairs and festivals, Yoga, Āyurveda, Integrated apporach to healthcare, Agriculture in Ancient India, Approaches and strategies to the protection and conservation of environment.

Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- The students will be able to understand and appreciate the rich heritage that resides in our traditions.
- The students will be able to improve mindfulness and more maturity leading to effective process of learning.

Textbooks:

- Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
- Pradeep Kohle et. Al. Pride of India- A Glimpse of India's Scientific Heritage edited by Sanskrit Bharati, 2006.
- Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
- Sibaji Rah, et al, History of Science in IndiaVolume-1,Part-I, Part-II, Volume VIII, National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

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Hamirpur - 177 001, HP

HS-311 Engineering Economics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sectionsA, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Learning Objectives:

- Understand the basic definitions, nature, scope, and significance of economics.
- Learn about the elasticity of demand, its types, methods of measurement, and its importance in economicanalysis.
- Examine price determination under different market structures, including perfect competition, monopoly,monopolistic competition, and oligopoly.
- Explore the meaning, types, theories, causes, effects, and control measures of inflation.

Unit-I
Introduction: Definition, Nature, Scope, Importance and significance of Economics, Distinction between Microeconomics and Macroeconomics. Concept of Utility and Its Types.**Demand and Supply:** Meaning, Demand Function, Law of Demand. Elasticity of Demand, Types, Measurement and importance. Demand Forecasting and itstechniques. Concept of Supply, Law of supply.
Unit-II
Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions. **Cost and Revenue:** Concept of Cost, Short run and Lung-run Cost Curves, Relationships among various costs,Break-even Analysis. Revenue: Concept and its types.
Unit-III
Market Structure: Price Determination under Different Market Structure i.e. Perfect Competition, Monopoly, Monopolistic Competition Oligopoly. **Reserve Bank of India:** Nature, Organisation Structure, Objectives, Function of RBI.**Monetary Policy and Fiscal Policy:** Meaning, Objectives and Its tools and Techniques of Monetary and Fiscal Policy.
Unit-IV
National Income: Definition of National Income and its Aggregates, Methods of Calculating National Income. **Inflation:** Meaning, Types, Theories, Causes, Effects and Control. **Business Cycle** – Meaning- Phases of businesscycle.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply anddemand curves on equilibrium price and output.
- Determine the roles that prices and markets play in organizing and directing economic activity
- Calculate and graph the short-run and long-run costs of production, supply and demand elasticities.
- Describe governmental efforts to address market failure such as monopoly power, externalities, and public goods.
- Examine and interpret a nation's economic performance indicators such as economic growth, unemployment and inflation from a macroeconomic perspective.
- Articulate the mechanics and institutions of international trade and their impact on the macro economy.

Textbooks:

1. Steven A. Greenlaw, David Shapiro, **"Principles of Economics"**,2nd Edition, Rice University Open Stax, 2020.ISBN-13: 978-1947172371.
2. Managerial Economics, 8/e, D N Dwivedi, Vikas Publishing.
3. N. Gregory Mankiw, **"Principles of Economics"**,8th Edition, Cengage Learning, 2016.ISBN-13:978-0357038314.
4. Niall Kishtainy, **"The Economics Book: Big Ideas Simply Explained"**,1st Edition, DK Publishers,2012.ISBN-13:978-0756698270.

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CSPC-311P Data Structure and Algorithms Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to implement linear search using arrays.
2. Write a program to implement binary search using arrays.
3. Write c program to implement bubble sort, to sort a given list of integers in ascending order.
4. Program to implement insertion sort to sort a given list of integer in ascending order.
5. Program to implement INSERTION SORT to sort a list of numbers.
6. Write a C program that implement merge sort, to sort a given list of integers in ascending order.
7. Write C programs that implement stack using arrays.
8. Write C programs that implement stack using linked list Program.
9. Write c programs that implement Queue using array.
10. Write C programs that implement Queue using linked lists.
11. Write program to implement linked list operations (Creation, Insertion, Deletion, reversing).
12. Write a program to implement binary tree.
13. Write a program to implement heap sort using arrays.

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CSPC-312P Python Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

NOTE: - Following is the list of experiments out of which 8-10 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure and student intake.

List of experiments:

1. Demonstrate about Basics of Python Programming
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types) Demonstrate the working of following functions in Python. i) id () ii) type() iii)range()
3. Write a Python program to demonstrate various base conversion function
4. Write a Python program to demonstrate various type conversion functions
5. Demonstrate the following Operators in Python with suitable examples: i) Arithmetic Operators
   ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators.
   Write Python programs to demonstrate the following:
   1. Input() ii)print()iii)'sep'attributeiv)'end'attributev)replacementOperator({})
6. Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if-else-if statement
7. Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop
8. Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator
9. Python program to perform read and write operations on a file.

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ECEPC-312P Digital System Design Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Verify the truth table of AND, OR, NOT, X-OR and X-NOR gates
2. Verify the NAND and NOR gates as universal logic gates.
3. Verify the AND and OR gates as universal logic gates.
4. Design and verification of the truth tables of Half and Full adder circuits.
5. Design and verification of the truth tables of Half and Full subtractor circuits.
6. Verification of the truth table of the Multiplexer 74150.
7. Verification of the truth table of the De-Multiplexer 74154.
8. Design and test of an S-R flip-flop using NOR/NAND gates.
9. Verify the truth table of a S-R flip-flop
10. Verify the truth table of a J-K flip-flop
11. Verify the truth table of a D flip-flop
12. Design of 4-bit shift register.
13. Design of modulo-4 counter using J K flip flop
14. To study a BCD to 7 Segment LED display using 7447IC

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2e

B.Tech (SEMESTER –III)

Probability Statistical and Numerical Techniques (MAFC-311)

Time Allowed: 03 (Three hours) **Max. Marks: 60**

Note: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in section E. Use of statistical tables and non-programmable calculator is allowed.

Section-A

1. (a) A problem in statistics is given to two students A and B the odds in favour of A solving the problem are 6 to 9 and against B solving the problem are 12 to 10. If both A and B attempt find the probability of the problem being solved. (6)

(b) If x and y are two independent random variables having joint density function:

$$f(x,y) = \begin{cases} \frac{1}{8}(6-x-y); & 0 \le x < 2,\ 2 \le y < 4 \\ 0, & Otherwise \end{cases}$$

Find (i) $P(x < 1 \cap y < 3)$ (ii) $P(x + y < 3)$ (iii) $P(x < 1|y < 3)$. (6)

2. (a) If 5% of the electric bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs (i) none is defective (ii) 5 bulbs will be defective. (6)

(b) In a distribution exactly normal 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? (Use normal table) (6)

Section-B

3. (a) A coin was tossed 400 Times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. (6)

(b) The mean of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the sample be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% level of significance). (6)

4. (a) A drug is given to 10 patients, and the increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 6, 0, 0, 2. Is it reasonable to believe that the drug has no side effect on change of blood pressure? (6)

(b) In one sample of 8 observations, the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5 per cent level using F- test. (6)

Section-C

5. (a) Using, Newton's Raphson method, find the real root of the equation $3x = cosx + 1$. Also, evaluate the value of $\sqrt{5}$ by using Newton's method. (6)

(b) Solve the system of equations $10x - 7y + 3z + 5u = 6$,
$-6x + 8y - z - 4u = 5$,
$3x + y + 4z + 11u = 2$,
$5x - 9y - 2z + 4u = 7$

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by using Gauss elimination method. (6)

6. (a) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for the given data:

x	0	1	2	5
$f(x)$	2	3	12	147

(6)

(b) Find the missing term by using Newton's divided difference formula

x	0	1	2	3	4
y	1	3	9	...	81

(6)

Section-D

7. (a) Evaluate $\int_0^1 \frac{1}{1+x^2}$ by using Simpson's $\frac{1}{3}rd$ rule , taking $h = 1/4$ and by Simpson's $\frac{3}{8}th$ rule , taking $h = 1/6$. (6)

(b) Evaluate $\int_0^6 xsecx\ dx$ using six intervals by Trapezoidal rule.

(6)

8. (a) Using Taylor series method of order four to solve the initial value problem $y' = (x - y)/2$, on $[0,3]$ with $y(0) = 1$. Compare solutions for $h = 1, \frac{1}{2}, \frac{1}{4}$ and $\frac{1}{8}$. (6)

(b) Consider an ordinary differential equation $\frac{dy}{dx} = x^2 + y^2,\ y(1) = 1.2$. Find $y(1.05)$ using the fourth order Runge-Kutta method. (6)

Section-E

9. (i) State Bayes theorem for probability.
(ii) Write the importance of Normal distribution.
(iii) A card is drawn from a well shuffled pack of cards. What is the probability that it is a heart or a queen?
(iv) Differentiate between null and alternate hypothesis?
(v) Define F- distribution.
(vi) Write Newton iterative formula to find the value of $\sqrt[3]{N}$.
(vii What is nth difference of a polynomials of degree n.
(viii) Out of Regula-Falsi and Newton –Raphson method whose rate of convergence is faster and why?
(ix) How Gauss Quadrature formula for two point and three point scale varies?
(x) Find the value of $E^{-1}\nabla$.
(xi) Define discrete distribution?
(xii) Explain the term Covariance.

$(12 \times 1 = 12)$

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SEMESTER-IV

CSPC-411 Discrete Mathematics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:

Sets, Relations and Functions: Operations on Set, Inclusion -exclusion principle, Representation of Discrete Structures, Fuzzy Set, Multi-set, bijective function, Inverse and Composition of functions, Floor and Ceiling functions, Growth of functions: Big-O notation, functions, Recursive function, Functions applications.

Unit-II:

Relations: Reflexivity, Symmetry, transitivity, Equivalence, and partial ordered relations, Asymmetric, Irrelexivity relation, Inverse and Complementary relations, partitions and Covering of a set, N-ary Relations and database, Representation relation using matrices and digraph, Closure of relations, Warshall's algorithms, Lexicographic Ordering, Hasse diagram, Lattices, Boolean algebra, Application of transitive Closure in medicine and engineering. Application: Embedding a partial order.

Unit-III:

Graph Theory: Representation, Type of Graphs, Paths, and Circuits: Euler Graphs, Hamiltonians Paths &Circuits: Cut Sets, Connectivity and Separability, Planar Graphs, Isomorphisms, Graph Coloring, Covering and Partitioning, Max flow: Ford -Fulkerson algorithm, Application of Graph Theory in real life applications. **Basic Logic:** Propositional Logic, Logical connectives, Truth Tables, Normal Forms (Conjunctive and Disjunctive), Validity of well-formed formula, Propositional inference rules (Concepts of modus ponens and modus tollens), Predicate Logic, Universal and existential quantification.

Unit-IV:

Proof Techniques and Counting: notions of Implications, equivalence, converse, inverse, contra positive, negation and contradiction, The structure of mathematical proofs, Direct proofs, disproving by counter example, Proof by contradiction, Induction over natural numbers, structural induction, weak and strong induction, The pigeonhole principle, solving homogenous and heterogenous recurrence relations. **Algebraic Structure:** Group, Semi-group, Monoids, Homomorphism, Congruencies, Ring, Field, Homomorphism, Congruencies, Applications of algebra to control structure of a program, the application of Residue Arithmetic to Computers.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Perform operations on various discrete structures such as set, function and relation.
- Apply basic concepts of asymptotic notation in analysis of algorithm.
- Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real world problems.
- Comprehend formal Logical arguments and translate statements from a natural language into its symbolic structures in logic.
- Identify and prove various properties of rings, field, and groups.

Textbooks:

- Rosen H.K., Discrete mathematics and its Applications, McGraw Hill (2011)7th ed.
- Tremblay P.J. and Manohar, R., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill (2008).

Reference Books:

- Gallian A.J., Contemporary Abstract Algebra, Cengage Learning (2017) 9th ed.
- Lipschutz S., Lipson M., Discrete Mathematics, McGraw Hill (2007) 3rd ed.

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CSPC-412 Operating System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives (COs): To understand the role, responsibilities and the algorithms involved for achieving various functionalities of an Operating System.

Unit-I
Introduction and System Structures: Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Functions, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Design and Implementation. **Process Management:** Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, **Multi-threaded programming:** Multi-core Programming, Multithreading Models.
Unit-II
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling. **Concurrency:** The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors. **Deadlock:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
Unit-III
Memory Management: Basic Hardware, Address Binding, Logical and Physical Address, Dynamic linking and loading, Shared Libraries, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table, Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing. **File Systems:** File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.
Unit-IV
Disk Management: Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **Networks, Security and Design Principles:** Overview of network operating system, distributed operating system, security attacks, security mechanisms and policies, OS Virtualization, Unix/Linux Case study.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Explain the basic of an operating system viz. system programs, system calls, user mode and kernel mode.
- Select particular CPU scheduling algorithms for specific situation and analyses the environment leading to deadlock and its rectification.
- Explicate memory management techniques viz. caching, paging, segmentation, virtual memory, and thrashing.
- Understand the concepts related to file systems, disk scheduling and security, protection.
- Comprehend the concepts related to concurrency.

Text Books/ Reference Books:

1. Silberschatz A., Galvin B. P. and Gagne G., Operating System Concepts, John Wiley & Sons Inc (2013) 9 th ed.
2. Stallings W., Operating Systems Internals and Design Principles, Prentice Hall (2018)9 th ed.
3. Bovet P. D., Cesati M., Understanding the Linux Kernel, O'Reilly Media (2006), 3 rd ed.
4. Kifer M., Smolka A. S., Introduction to Operating System Design and Implementation: The OSP 2 Approach, Springer (2007).

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CSPC-413 Design and Analysis of Algorithm							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives

- To impart knowledge about the asymptotic notations to analyze the performance of algorithms.
- To introduce the fundamental concepts various problem-solving techniques such as divide and conquer, greedy algorithm, etc.
- To enable the students to understand the concepts of P, NP, NP-hard and NP-complete problems.

Unit-I:
Introduction: Algorithms Introduction: Algorithm Design paradigms- motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. **Divide and Conquer Approach:** Structure of divide-and-conquer algorithms: sets and disjoint sets: Union and Find algorithms, quick sort, Finding the maximum and minimum, Quick Sort, Merge sort, Heap and heap sort.
Unit-II:
Greedy Algorithms: Optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Minimum Spanning trees: Prim's algorithm and Kruskal's algorithm, Huffman codes. **Graph Algorithms**: Representation of graphs, BFS, DFS, Topological sort, strongly connected components; single source shortest paths: Bellmen-Ford algorithm, Dijkstra's algorithm; All pairs shortest path: The Warshall's algorithm
Unit-III:
Dynamic Programming: Overview, difference between dynamic programming and divide and conquer, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence, 0/1 knapsack. Backtracking: 8-Queen Problem, Sum of subsets, graph coloring, Hamiltonian cycles
Unit-IV:
Branch and Bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem. **Computational Complexity**: Complexity measures, Polynomial vs. nonpolynomial time complexity; NP-hard and NP-complete classes, examples

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Course Outcomes: Upon successful completion of the course, the students will be able to

CO1: Understand asymptotic notations to analyze the performance of algorithms.

CO2: Understand and apply various problem-solving techniques

CO3: Solve given problem by selecting the appropriate algorithm design technique and justify the selection.

CO4: Know the concepts of P, NP, NP-hard and NP-complete problems.

Books and References

1. Fundamentals of Computer Algorithms by E. Horowitz and S. Sahni, Galgotia.
2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press, Cambridge.
3. The Design and Analysis of Computer Algorithms by A.V. Aho, J.E. Hopcroft and J.D. Ullman, Addison Wesley.

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CSPC- 414 Introduction to Artificial Intelligence							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:
Introduction: Introduction to artificial intelligence, background, possible approaches in AI, Turing test and rational agent approaches, introduction to intelligent agents, their structure, behaviour and environment, applications, Future of AI. **Problem Solving and Searching Techniques**: Problem characteristics, production systems, breadth first search, depth first search, heuristics search techniques, best first search, A*algorithm, hill climbing, AND/OR graph AO*, constraint satisfaction problem, means-end analysis.
Unit–II:
Game Playing: introduction to game playing, min max and alpha beta pruning. **Knowledge Representation:** Knowledge Representation: Representation, introduction to first order predicate logic, well-formed formulas, quantifiers, rule-based system, Syntax and Semantics of First-Order logic, knowledge engineering in first-order Logic. Inference in first order logic: resolution principle, unification, forward reasoning: conflict resolution, backward reasoning, structured knowledge representation.
Unit–III:
Introduction to Neural Network: Introduction, importance of neural network, Types of neural network, Hop field network, single and multi layer networks, perceptions, types of learning in neural networks. **Introduction to genetic algorithm:** The genetic algorithm, genetic operators, working of genetic algorithm, problem with genetic algorithm.
Unit-IV:
Expert System: Expert Systems: introduction, skills/knowledge, characteristics of expert system, applications and future scope, Expert system tools – MYCIN – EMYCIN. **Natural language processing:** Introduction, language parsing, syntactic and semantic analysis, top down and bottom-up parsing, chart parsing, knowledge representation languages, ELIZA.

Text Books:

- Russell and Norvig, ***Artificial Intelligence- A Modern Approach***, Pearson Prentice Hall.
- DW Patterson, ***Artificial Intelligence and Expert Systems***, Prentice Hall of India.
- B. Vegnanarayana, ***Artificial neural networks,*** Prentice Hall of India P Ltd.
-

Reference Books:

- Elaine Rich, Kevin Knight, ***Shivashankar B. Nair, Artificial Intelligence***, Tata Mc Graw Hill.
- Nils J Nilsson, ***Artificial Intelligence A New Synthesis***, Morgan Kaufmann

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CSPC-415 Database Management System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To Understand the basic concepts and the applications of database systems
- To Master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques
-

Unit-I:
Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base Architecture – Storage Manager – the Query Processor Data base design and ER diagrams – ER Model - Entities, Attributes and Entity sets – Relationships and Relationship sets – ER Design Issues – Concept Design – Conceptual Design for University Enterprise. Introduction to the Relational Model – Structure – Database Schema, Keys – Schema Diagrams
Unit-II:
Relational Query Languages, Relational Operations. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus. Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers.
Unit-III:
Normalization – Introduction, Non loss decomposition and functional dependencies, First,
Second, and third normal forms – dependency preservation, Boyee /Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form

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Unit-IV:
Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity. Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage- Advance Recovery systems- Remote Backup systems.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Explain the features of database management systems and Relational database.
- Create and populate a RDBMS for a real life application, with constraints and keys, using SQL and retrieve any type of information from a data base by formulating complex queries in SQL.
- Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database and build indexing mechanisms for efficient retrieval of information from a database.

Textbooks:

- Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.
- A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill.
- Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.

Reference Books:

- Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
- An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition.

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ECEPC-412 Microcontrollers							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: The educational objectives of this course are to understand the basics of processors and microprocessors and interfacing with real world to study basic programming.

Unit-I:
Microprocessor 8085: Evolution of Microprocessor, The 8085 MPU- features, architecture and Pin configuration, 8085 machine cycle and timing diagrams, Addressing modes, Interrupts**. Instruction set and Programming concepts:** Data transfer operations, Arithmetic operations, Logic operations, Branch operation, and Machine control instruction. Flow chart symbols, Development of assembly language programmes
Unit–II:
16-bit Microprocessors (8086): Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes. Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254 programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C. Advanced coprocessor Architectures- 286, 486, Pentium.
Unit–III
Microcontroller 8051 - Building Blocks: Microprocessor vs microcontroller; RISC vs CISC architectures, 8051 Architecture, Internal memory organization, Internal RAM structure, Processor status word, Types of Special Function Registers and their uses in 8051.architecture, pin configuration, flag-bits and PSW register, input-output ports, register banks and stack. **Instruction set of 8051:** Addressing modes, Data transfer instructions, Arithmetic 9 instructions, Logic instructions, branching instructions and Bit manipulation instructions.
Unit-IV:
Programming concept of 8051: Introduction to 8051 assembly programming, Jump, loop and call instructions programming, Programming 8051 Timers, Interrupts Programming, Serial communication programming. **Advance Microcontroller:** Introduction features and block diagram of PIC and ARM microcontroller.

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Course Outcomes: On completion of this course the student will be able to:

- Describe the architecture & organization of 8085 & 8086 Microprocessor.
- Understand and classify the instruction set of 8085/8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
- Relate the addressing modes used in the instructions.
- Realize the Interfacing of memory & various I/O devices with 8085/8086 microprocessor.
- Familiarize the architecture and operation of Programmable Interface Devices and realize the programming & interfacing of it with 8085 microprocessors.
- Interface various peripheral IC's with Intel 8085/8086 microprocessor for its various applications

Textbooks & References:

- Fundamentals of Microprocessors and Microcomputers by B. Ram, Dhanpat Rai and Sons.
- Microprocessor Architecture, Programming and applications with the 8085/8080A by R.S. Gaonkar, Wiley.
- Microprocessors& Interfacing by Douglas V Hall, McGraw Hill.
- Microprocessors and Digital Systems by Douglas V Hall, McGraw Hill.
- Introduction to Microprocessor by A.P. Mathur, Tata McGraw Hill.

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CSPC- 413P DAA Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to perform Insertion sort for any given list of numbers.
2. Write a program to perform Quick Sort for the given list of integer values.
3. Write a program to find Maximum and Minimum of the given set of integer values.
4. Write a Program to perform Merge Sort on the given two lists of integer values.
5. Write a Program to perform Binary Search for a given set of integer values recursively and non-recursively.
6. Write a program to find solution for knapsack problem using greedy method.
7. Write a program to find minimum cost spanning tree using Prim's Algorithm.
8. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
9. Write a program to perform Single source shortest path problem for a given graph.
10. Write a program to find solution for job sequencing with deadlines problem.
11. Write a program for all pairs shortest path problem.
12. Write a program to solve N-QUEENS problem.

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CSPC-414P AI Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to implement breadth first search algorithm.
2. Write a program to implement depth first search algorithm.
3. Write a program to implement the Hill Climbing algorithm.
4. Write a program to build and display Neural network using Tenser flow Keres.
5. Write a program to implement Genetic algorithm.
6. Study of expert system tools and its applications.
7. Write a program to implement Traveling salesman problem.
8. Write a program to implement four queen problem.
9. Write a program to solve monkey banana problem.
10. Write a program to implement Tower of Hanoi.

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CSPC-415P DBMS Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objectives:

- To present an introduction to database management systems using programming.
- To provide skills for writing programs.
- Familiar with basic database storage structures and access techniques.

Course Outcomes:

- Describe the fundamental elements of relational database management systems.
- Design ER-models to represent simple database application scenarios.
- Improve the database design by normalization.

List of Experiments

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key , Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER,UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the query for implementing the following functions: MAX(), MIN(), AVG(), COUNT().
6. Write the query to implement the concept of Integrity constraints.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints.
10. Write the query for creating the users and their role.

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SEMESTER V

CSPC-511 Computer Networks							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Unit-I:
Introductory Concepts: Goals and Applications of Networks, LAN, WAN, MAN, Wireless network, Network software: Protocol hierarchies, design issues of layers, Interfaces and services. Reference Model: The OSI reference model, TCP/IP reference model **Physical Layer**: Data Modems, Multiplexing Techniques, Frequency Division, Multiplexing Hierarchies, Transmission Media, Error Detection: Parity Check Codes, Cyclic Redundancy Codes.
Unit-II:
Data Link Layer: Data link layer design issues, services provided to network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A one-bit Sliding protocol, A protocol using go-back-N, A protocol using selective repeat, Protocol specification and verification, Example data link protocol-HDLC, PPP and SLIP
Unit-III:
Network Layer: Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking. **Transport Layer:** Transport services, Design issues, elements of transport protocols, simple transport protocols, Connection management, TCP, UDP.
Unit-IV:
Session, Presentation and Application Layer: Session Layer, Design issues, remote procedure call. Presentation Layer, Design issues, Data compression techniques, cryptography. Application Layer - File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other applications

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain the skills of sub netting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

Textbooks:

- Computer Networks—Andrew S Tanenbaum, David.j. Wetherall,5th Edition. Pearson Education/PHI

Reference Books:

- An Engineering Approach to Computer Networks- S.Keshav, 2nd Edition, Pearson Education
- Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

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CSPC-512 Theory of Computation							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
- To introduce the fundamental concepts of formal languages, grammars and automata theory, classify machines by their power to recognize languages.
- Employ finite state machines to solve problems in computing, and to understand deterministic and non-deterministic machines.
- To understand the differences between decidability and undecidability.

Unit-I:
Machines: Basic machine, FSM, Transition graph, Transition matrix, Deterministic and nondeterministic FSMS, Equivalence of DFA and NDFA, Mealy and Moore machines, minimization of finite automata, Two-way finite automata.
Unit-II:
Regular Sets and Regular Grammars: Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.
Unit-III:
Formal Grammars and Languages: Basic definitions and examples of languages, Chomsky hierarchy, Regular grammars, context free & context sensitive grammars, context free languages, non-context free languages, Chomsky normal forms, binary operations on languages. Simplification of CFG, Elimination of Useless symbols, Unit productions, Null productions, Greiback Normal form, Chomsky normal form – Problems related to CNF and GNF
Unit-IV:
Turing Machines and Pushdown Automata: TM model, representation and languages acceptability of TM Design of TM, Universal TM and Other modification, composite and iterated TM, Pushdown automata, Acceptance by PDA.

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Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- Able to understand the concept of abstract machines and their power to recognize the languages.
- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Able to gain proficiency with mathematical tools and formal methods.

Textbooks:

- Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
- Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

Reference Books:

- Introduction to Languages and The Theory of Computation, John C Martin, TMH.
- Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
- A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
- Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
- Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
- K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

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CSPC-513 Introduction to Machine Learning							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To review and strengthen important mathematical concepts required for ML.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Unit-I:
Introduction: Machine Learning Paradigms: Introduction to machine learning, data sets, feature sets, data set division-test, train and validation sets, Cross Validation, applications of Machine Learning, process involved in machine learning, Types.
Unit-II:
Supervised Learning: Classification and Regression: K- Nearest neighbor, Linear regression, multi-linear Regression, Logistic Regression, Support Vector Machine (SVM), Decision Trees, Naïve Bayes algorithm, Random Forest Algorithm.
Unit-III:
Unsupervised learning: Types: Clustering, Association, dimensionality reduction, Clustering Hierarchical- Agglomerative clustering and divisive clustering, Partitional clustering. Clustering Algorithms: K-means clustering, mean -shift algorithm, hierarchical clustering. Association rules. Dimensionality Reduction: PCA, k-nearest neighbors and discriminant analysis.
Unit-IV:
Reinforcement learning: Types of reinforcement learning: positive and negative, reinforcement learning. **Algorithms models:** model based and model free algorithms, on policy and off policy, Markov decision process, Q Learning, Application of reinforcement Learning.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Design and implement machine learning solutions to classification, regression and clustering problems.
- Evaluate and interpret the results of the different ML techniques.
- Design and implement various machine learning algorithms in a range of Real-world applications.

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Textbooks:

- Machine Learning, Tom M. Mitchell, MGH.
- Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2011.
- RS Suttonand, A. G. Barto., "Reinforcement Learning-An Introduction", MIT Press.1998
- Vaibhav, "Supervised Larning with Python: Concepts and Practical Implementation using Python".
- Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
- Tom Mitchell, Machine Learning, McGraw Hill, 2017.
- Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

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CSPC-514 Software Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams.
- These practices help in developing large size and complex software.
- With concepts and knowledge gained from this course, one can easily become part of industrial software production.

Unit-I:
Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. **Software Development Processes:** Waterfall model, Incremental Models – Iterative Model and RAD Model, Evolutionary Models – Prototype and Spiral Model, Component Based Development, Unified Process, Rapid Software Development. **Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Unit-II:
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods. Software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
Unit-III:
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

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Unit-IV:
Metrics for Process and Products: Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. **Quality Management**: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Get familiar with various software development process models, requirement engineering concepts and software design principles.
- Understand software project metrics, quality concepts and estimate effort in software development.
- Understand software design and principles.
- Understand coding practices, styles and software testing approaches.
- Develop software cooperatively in a team with an understanding about software risk.

Textbooks:

- Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
- Software Engineering- Sommerville, 7th edition, Pearson Education.
- The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

Reference Books:

- Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
- Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
- Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

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CSPC-511P Computer Networks Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. To become familiar with networking accessories and facilities in the Department of Computer Science and Engineering:
   - Find out what networking devices are installed in the department
   - Describe the network type and topology of the department
   - File and printer sharing in different OSs
   - Network address configuration in different OSs
   - Finding IP and MAC address in different OSs
   - Workgroup and domain configuration
   - Use of utilities: arp, ipconfig/ifconfig, tracert, nslookup
2. Examine packets flow across a network segment and see the operation of various Internet protocols across the different layers in TCP/IP stack. (Hint: Use utilities netstat, snoop, tcpdump, …)
3. Use UNIX sockets to implement a simple client and server that communicate over the network. (Reference: Unix Network Programming by W. Richard Stevens, Prentice Hall)
4. Simulate various multiple access protocols (Aloha, slotted Aloha, p-persistent and non-persistent) and compare their performance at different loads.
5. Write a program to display the IP address and MAC address of a machine.
6. Implement ARP and RARP protocols for CSE LAN.
7. Install Ethereal on a computer. Set Ethereal to capture with a filter option of your choice. Load a webpage or send an email to a friend and stop capturing. Analyze the packets. See if you can read any or all of the data transmitted. Write down your findings.
8. Write a program to simulate routing using flooding. Each packet should contain a counter that is decremented on each hop. When the counter gets to zero, the packet is discarded. Time is discrete, with each line handling one packet per time interval. Make three versions of the program: all lines are flooded, all lines except the input line are flooded, and only the (statically chosen) best k lines are flooded. Compare flooding with deterministic routing (k = 1) in terms of both delay and the bandwidth used.

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9. Write a program that simulates a computer network using discrete time. The first packet on each router queue makes one hop per time interval. Each router has only a finite number of buffers. If a packet arrives and there is no room for it, it is discarded and not transmitted. Instead, there is an end-to-end protocol, complete with timeouts and acknowledgement a packet, which eventually regenerates the packet from the source router. Plot the throughput of the network as a function of the end-to-end timeout interval, parameterized by error rate.

10. Design and implement a chat system that allows multiple groups of users to chat. A chat coordinator resides at a well-known network address, uses UDP for communication with chat clients, sets up chat servers for each chat session, and maintains a chat session directory. There is one chat server per chat session. A chat server uses TCP for communication with clients. A chat client allows users to start, join, and leave a chat session. Design and implement coordinator, server, and client code.

11. Study different networking devices such as repeaters, bridge, switch, router, gateways, firewall, proxy server.

12. Study different networking tools like, crimping tool, LAN tester, connecting cables, screw driver, NIC, LAN card, RJ45, RJ11, I/O box etc.

13. Create and connect straight and cross ethernet cable in Lab.

14. Study and implement LAN in Lab using switch.

15. Study and implement firewall setting in Lab.

16. Study and implement router configuration using simulation software like packet tracer, network simulator (ns2/ns3) etc.

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CSPC-513P Machine Learning Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a python program to import and export data using Pandas library functions.
2. Demonstrate various data pre-processing techniques for a given dataset scaling
3. Implement Dimensionality reduction using Principle Component Analysis (PCA) method.
4. Write a Python program to demonstrate various Data Visualization Techniques.
5. Implement Simple and Multiple Linear Regression Models.
6. Develop Logistic Regression Model for a given dataset.
7. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
8. Implement Naïve Bayes Classification in Python
9. Build KNN Classification model for a given dataset.
10. Build Artificial Neural Network model with back propagation on a given dataset.
11. a) Implement Random Forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset.
12. Write a python program to implement K-Means clustering Algorithm.

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SEMESTER VI

CSPC-611 Digital Image Processing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement) and advanced image analysis (e.g. image compression, image segmentation, Pattern Recognition).
- To assess the performance of image processing algorithms and systems.

Unit-I:
Introduction: Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Image sampling and quantization, Relationship between pixels, Imaging geometry. Basics of spatial filtering, Smoothing and Sharpening Spatial, Discrete Fourier Transform, Smoothing and Sharpening Frequency-Domain filters
Unit-II:
Image Degradation/Restoration Process, Types of degradations in digital images, Noise models, Restoration in presence of noise using filters. Image Compression: Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real Time image transmission, JPEG and MPEG.
Unit-III:
Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Otsu's threshold, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, and Frequency domain techniques.
Unit-IV:
Pattern Recognition: Classification, description and structure of a pattern recognition system, feature extraction, Decision regions and boundaries, discriminate functions, PR Approaches, Statistical PR: Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayesian parameter estimation approach, clustering for unsupervised learning and classifiers.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Learn different techniques employed for the enhancement of images.
- Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
- Learn different feature extraction techniques for image analysis and recognition.
- Understand the rapid advances in Machine vision.

Textbooks:

- Digital Image Processing by R. Gonzalez and R. E. Wood, Prentice Hall of India.
- Digital Image Processing by W.K. Pratt, McGraw Hill.
- Fundamentals of Digital Image Processing by A. K. Jain, Prentice Hall of India.
- Pattern Recognition-Statistical, Structural and neural approach by R. Schalkoff, John Willey & Sons.

Reference Books:

- Feature Extraction and Image Processing for Computer Vision by M. Nixon, Academic Press.
- Introductory Computer Vision and Image Procession by A. Low, McGraw Hill.
- Image Processing: Analysis and Machine Vision by Milan Sonka, Roger Boyle, and Vaclav Hlavac.

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CSPC-612 Information and Network Security							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

Unit-I:
Information Security Management introduction, Information Sensitivity Classification, Information Security Governance, Security of Various Components in the Computing Environment, Security Interdependence, CIA Triad, Security Goals versus Business Goals, The Security Star Parker's View: Defence In Depth Security, Information Security Management Cycle.
Unit-II:
Information Security Life Cycle, Security Planning in the SLC, Security Analysis, Security Design, Security Implementation, Security Review, Continual Security, Security Policy, Standards, and Guidelines, Methodologies - on Computing Environment Partition - on Computing Boundaries - Benson's Security Policy Methodology, Disaster Recovery.
Unit-III:
Network Security Introduction, Model for network access security, TCP/IP protocol stack, Implementation layers for security protocols, Media- Based-Vulnerabilities, Network Device Vulnerabilities, Back Doors, Denial of Service, Man-in-the-Middle and replay, Protocol Based Attacks: DNS Attack, DNS Spoofing, DNS Poisoning, ARP Poisoning, TCP/IP Hijacking, Virtual LAN, Network Access Control, Proxy Server , Honey Pot , Network Intrusion Detection Systems.
Unit-IV:
Authentication: Kerberos, X.509 Authentication Service, Scanning: Port Scanning, Port Knocking-Advantages, Disadvantages. Peer to Peer security. Electronic Mail Security, Pretty Good Privacy (PGP). Firewalls and Web Security: Packet filters, Application level gateways, Encrypted tunnels, Cookies, assignments on latest network security techniques, Security applications in wireless networks.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Provide security of the data over the network.
- Do research in the emerging areas of information and network security.
- Implement various networking protocols.
- Protect any network from the threats in the world.

Textbooks:

- Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, First Edition, Wiley India Pvt Ltd, 2009.
- Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson,2010.
- Michael Whitman and Herbert Mattord, Management of Information Security, Fourth Edition, Cengage Learning, 2014.

Reference Books:

- Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
- Behrouz A Fourouzan, Debdeep Mukhopadhyay, Cryptography and Network, 2nd Edition,TMH,2011.
- Harold F. Tipton, Information Security Management Handbook, Sixth edition, CRC Press, 2012.
- Atul Kahate, Cryptography and Network Security, Tata McGraw-Hill, 2013.
- Michael Whitman and Herbert Mattord, Principles of Information Security, Fifth Edition, Cengage Learning, 2015.

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CSPC-613 Compiler Design							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To teach concepts of language translation and phases of compiler design.
- To describe the common forms of parsers.
- To inculcate knowledge of parser by parsing LL parser and LR parser.
- To demonstrate intermediate code using technique of syntax directed translation.
- To illustrate the various optimization techniques for designing various optimizing compilers.

Unit-I:
Introduction to compilers: Definition of compiler, interpreter and its differences, the phases of a compiler, role of lexical analyzer, regular expressions, finite automata, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyzer generator. PARSING: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, classes of parsing, top down parsing - backtracking.
Unit-II:
Top down parsing methods, elimination of left recursion, recursive descent and predictive parsers; Bottom up parsing, shift-reduce parsing, precedence parsing, LR parsers, SLR (1) table construction, limitations of S LR parsing, non -SLR (1) grammars; Introduction t o canonical and LALR parsing. Type checking, type systems, type expressions, type conversion and overloading.
Unit-III:
Run time environments, storage organization and allocation strategies, parameter passing, symbol tables. Intermediate code generation, interpreters, intermediate languages, syntax trees, postfix code, triples and indirect triples, syntax directed translation of simple statements.
Unit-IV:
Issues in code generation, basic blocks and flow graphs, next use information, register allocation and assignment, simple code generation. Sources of optimization, optimization of basic blocks, data flow analysis, code improving transformations.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Use compiler construction tools and describes the Functionality of each stage of compilation process.
- Construct Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques.
- Analyze different representations of intermediate code.
- Construct new compiler for new languages

Textbooks:

- Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.
- Tremblay, J .P. a nd Sorenson, P .G., " Theory and Practice o f Compiler Writing", SR Publications.
- K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India.

Reference Books:

- Louden, K .C., "Compiler Construction: Principles and Practice", Course Technology.
- Tremblay, J.P. and Sorenson, P.G., "Parsing Techniques: A Practical Guide", Ellis Horwood.
- Andrew W. Appel (2004), Modern Compiler Implementation C, Cambridge University Press, UK.
- Cooper, K .D. a nd T orczon, L., "Engineering a Compiler", M organ Kaufmann.

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CSPC-611P Digital Image Processing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. To acquire an image, store in different formats and display the properties of the images
2. To find the discrete Fourier transform of a gray scale image and perform inverse transform to get back the image.
3. Analyze the rotation and convolution properties of the Fourier transform using any gray scale image.
4. Find the discrete cosine transform of a given image. Compare discrete Fourier transform and discrete cosine transforms.
5. Apply histogram equalization for enhancing the given images.
6. Perform image enhancement, smoothing and sharpening, in spatial domain using different spatial filters and compare the performances.
7. Perform image enhancement, smoothing and sharpening, in frequency domain using different filters and compare the performances.
8. Perform noise removal using different spatial filters and compare their performances.
9. For any image perform edge detection using different operators and compare the results.
10. For any image, compress and decompress using wavelets. Study and compare the efficiency of the scheme with any two schemes.

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