HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B.Tech.

in

Computer Science & Engineering

3rd to 4th Semester

As per National Education Policy (NEP)- 2020

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

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Hamirpur - 177 001, HP

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	Artificial Intelligence in Engineering	3	0	0	3	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**	**03**	**06**	**24**			**700**
UG Diploma Exit Option										
1	INT	CSE-416P	**Internship-I (Exit)****	**8weeks/ 2months**			**6**	30	20	50

Note:

***Common Subject**

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****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may 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 two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5thsem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years' Diploma if has cleared all the four semesters without any back log in accordance with fulfillment of above requirements

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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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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

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	Artificial Intelligence in Engineering	3	0	0	3	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**	**03**	**06**	**24**			**700**
UG Diploma Exit Option										
1	INT	CSE-416P	**Internship-I (Exit)****	**8weeks/ 2months**			**6**	30	20	50

Note:

***Common Subject**

****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may 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 two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5th sem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years'Diploma if has cleared all the four semesters without any back log in accordance with fulfillment of above requirements

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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: Introduction, Types of operating systems Computer System Operation, Operating-System Services, System Calls, Types of System Calls. **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, Synchronization Hardware, 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. **Protection and Security:** Goals of Protection, Domain of protection, Access rights, 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:

1. Silberschatz A., Galvin B. P. and Gagne G., Operating System Concepts, John Wiley & amp; Sons Inc (2013) 9 th ed.
2. Stallings W., Operating Systems Internals and Design Principles, Prentice Hall (2018)9 th ed.

Reference Books:

1. Bovet P. D., Cesati M., Understanding the Linux Kernel, O'Reilly Media (2006), 3rd ed.
2. Kifer M., Smolka A. S., Introduction to Operating System Design and Implementation: The OSP 2 Approach, Springer (2007).

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 colouring, 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.

CSPC- 414 Artificial Intelligence in Engineering							
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.

Unit-I
Fundamentals of Artificial Intelligence (AI): Introduction to AI, History of AI, General applications of AI, Need of AI in Engineering, Problem solving, Process of problem solving, breadth first search, depth first search, heuristics search techniques, best first search, Introduction to intelligent systems, Various approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. **Ethical and Social Implications of AI:** Ethical considerations in AI development and deployment, Impact of AI on jobs and society, Regulatory and policy issues.
Unit–II
Fundamentals of Machine Learning (ML): Introduction to Machine Learning, datasets, Forms of Learning: Supervised and Unsupervised Learning, reinforcement learning, processes involved in Machine Learning, Applications of ML in Engineering. **Data Preprocessing, cleaning and normalization Approaches in Machine Learning (ML):** Data preprocessing, Data cleaning, Feature selection and extraction, Data normalization and scaling.
Unit–III
Artificial Neural Networks: Introduction to Artificial Neural Networks (ANNs): Definition and history of ANNs, Types of ANNs architectures, Basic architecture of ANNs, Activation functions, Singled-Layered and Multi-Layered Perceptron, Backpropagation algorithms, Applications of ANNs in Engineering.
Unit-IV
Fuzzy Logic and Genetic Algorithm: Introduction to Fuzzy Logic: Basic concepts, history, and fuzzy set theory. Processes in a fuzzy logic system, Applications of Fuzzy Logic in Engineering. **Genetic Algorithm (GA)**: Basics of GA, Main operations of GA, Flowchart of GA, Working principle of GA in step by step, Applications in Engineering.

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

1. Remember the fundamentals, history, and applications of AI in mechanical engineering.
2. Understand various AI approaches, including cybernetic, symbolic, sub-symbolic, and statistical methods, in mechanical engineering.
3. Apply data preprocessing techniques like cleaning, feature selection, and normalization in machine learning.
4. Analyze the ethical and social implications of AI, including job impacts and regulatory issues.
5. Evaluate machine learning algorithms, neural networks, and fuzzy logic systems for mechanical engineering applications.

Text Books:

- Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
- B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
- Parag Kulkarni and Prachi Joshi, Artificial Intelligence – Building Intelligent Systems, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015.

Reference Books:

- Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
- Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018.
- Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.
- Zsolt Nagy - Artificial Intelligence and Machine Learning Fundamentals-A press (2018).
- Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH.

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
Database Management System: Introduction, 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, Boyce 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, Introduction to NOSQL.

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:

- *To understand the Architecture of 8085 and its assembly language Programming*
- *To study the interfacing of peripheral devices*
- *To understand the features of 8-bit Microcontroller and system design*
- *To explore the features of 16 bit and higher Microprocessors' architectures*
- *To Design and Implement Microcontroller based Systems.*

Unit-I

8085 Architecture and Organization: Introduction to Microprocessor, Microcomputer system, Microprocessor operations, Internal Architecture of 8085, System Bus, Pin description of 8085, Need and generation of control signals, types of Registers & Timing and Control Unit. **Instruction set of 8085:** Instruction formats, addressing Modes, Timing effect of Addressing modes, Instruction set classification, Instruction Cycle, Machine cycles, Timing diagram, Stack and Subroutine, Interrupt types, interrupt systems and polling, Interrupt control logic, Assembly language programming.

Unit–II

Memory and I/O devices interface: Serial and Parallel communication interface, Hardware (Circuit level) description of Registers, RAM, ROM and Secondary memories, DMA controller, memory mapped I/O & I/O mapped I/O, Generating Control Signals, Interfacing 2KX8 EPROM, 2KX8 RAM, Interfacing I/O ports to 8085, Hand shake Signals, Block diagram and working of PPI-8255, Interfacing 8255 to 8085 and LED Interface.

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 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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the architecture of microprocessors and microcontrollers
2. Develop programmes for various microcontrollers.
3. Interface various peripherals with microcontrollers and programmes it for various systems
4. Design and implement real-life engineering applications

Textbooks & References:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardwareand software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J.Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
5. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and SystemDesign 8085, 8086, 8051, 8096", PHI Learning Pvt. Ltd., Second Edition, 2013.
6. A.K. Ray and K.M.Burchandi, and A.K.Ray, "Advanced Microprocessor and Peripherals", McGraw Hill International Edition, Third Edition, 2017.
7. John B. Peatman, "Design with PIC Microcontrollers", Pearson Education, 2013.
8. Andrew N. Sloss Dominic Symes and Chris Wright, "ARM System Developer"s Guide Designing andOptimizing System Software", Morgan Kaughmann/Elsevier Publishers, 2006.
9. Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi, and Janice Mazidi, "ARM Assembly Language Programming & Architecture", II Edition, 2016.

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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.

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.
11. Case study related to implementation of algorithms in respective discipline for which lab is being run.

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	

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. 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 roles.

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Exit option for UG Diploma in Computer Science and Engineering

CSE-416P Internship-I				
Credit	**Marks Distribution**			**Duration of End Semester Examination**
	Internal Assessment	**End Semester Examination**	**Total**	
6	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**3 Hours**

Eligibility for Exercising Exit Option and Pursuing Internship-I:

Those students without any backlogs who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Engineering during registration for 4th semester (only for regular students (admitted in first year) and not applicable for lateral entry students). They will be required to obtain additional 6 credits summer internship (Internship-I (Exit)) of 8-weeks/2-months duration during summer term/summer vacations after 4th semester. The evaluation of such candidates shall be done within the first-two months of the running next semester i.e. 5th sem. The internship shall be completed by student during summer vacations after 4th semester, in local industry, government/private organization, entrepreneurs, craft and skilled persons for on-site experiential learning.

List of activities/projects to be completed by student:

1. The appropriate ***area of internship shall be identified by student in consultation with the faculty mentor and industrial supervisor*** (if any) during the course of 4th semester, ***by learning all concepts being taught in previous semesters and demonstrating hard work and genuine desire to learn.***
2. The student shall clearly state in his brief report to faculty supervisor regarding (a)What he/she intends to learn, acquire and clarify through this internship? (b) Use of try to use concrete, measurable terms in listing his/her learning objectives under each of the following categories:
   a) ***Knowledge and Understanding***
   b) ***Skills***
3. The student will clearly state and describe in his brief reports regarding
   a) ***Learning Activities***: How will internship activities enable him/her to acquire the knowledge/understanding, and skills listed to be acquired by students (above)?
   b) ***On the job***: How internship activities will enable him/her to meet his/her learning objectives. Student should include *projects, research, report writing, conversations, etc., which student will do while working, relating them to what he/she intends to learn.*
   c) ***Teaching/Mentoring Activities:*** How his/her technical knowledge can be applied at the site of the internship to create value through mentoring/help people learn new things.
   d) ***Off the job:*** List of appropriate study material for reading, writing, method to keep contact with faculty supervisor, peer group discussion, field trips, observations, etc., he/she will make and carry out which will help him/her to meet his/her learning objectives.
   e) ***Evidences:*** *Student will describe* in detail what other evidence he/she will provide to attached faculty mentor to document what was learnt (e.g. journal, analytic paper, project, descriptive paper, oral presentation, etc.) Deadline dates should be included.
   f) ***Evaluation:*** The faculty or internship supervisor will provide a written evaluation, preferably in a tabular format, and by defining rubrics used for evaluation of internship.
   g) ***The Internship Job Description***: Student will describe about role and responsibilities while on his/her internship. (in as much detail as possible), about list of assigned /expected duties, project to be completed, deadlines, etc., and description of contribution expected by the organization/site of internship.
4. The internship will be defended by student during 5th semester in front of appropriate committee (including faculty/ internship supervisor) as per schedule notified by academic department. The concerned department will review the Internship-I rigorously to discourage low quality internship work and to avoid exit options as an escape route, rather than a genuine learning curve.

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