Study & Evaluation Scheme

of

Master of Computer Applications

[Applicable for the Batch 2018-19 till revised]

TEERTHANKER MAHAVEER UNIVERSITY
Delhi Road, Moradabad, Uttar Pradesh-244001.
Website: www.tmu.ac.in

STUDY & EVALUATION SCHEME
Programme: MCA

Semester – I

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA108	Concepts of C-Programming	4	0	0	4	40	60	100
2	MCA112	Digital Electronics & Computer Organization	4	0	0	4	40	60	100
3	MCA113	Environmental Studies	4	0	0	4	40	60	100
4	MCA114	Discrete Mathematics	4	1	0	5	40	60	100
5	MCA 150	English Communication and Soft Skills - I	2	0	2	3	40	60	100
6	MCA151	C-Programming Lab	0	0	4	2	50	50	100
7	MCA154	Digital Electronics & Computer Organization Lab	0	0	4	2	50	50	100
	Total		18	01	10	24	300	400	700

Semester – II

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA215	Data Structure using C++	4	0	0	4	40	60	100
2	MCA206	Operating System	4	1	0	5	40	60	100
3	MCA216	Database Management System	4	0	0	4	40	60	100
4	MCA211	Information Storage and Management	4	0	0	4	40	60	100
5	MCA214	Principles of Management	4	0	0	4	40	60	100
6	MCA 250	English Communication and Soft Skills - II	2	0	2	3	40	60	100
7	MCA254	Data Structure using C++ Lab	0	0	4	2	50	50	100
8	MCA255	Database Management System Lab	0	0	4	2	50	50	100
Total			22	01	10	28	340	460	800

Semester – III

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA304	Design & Analysis of Algorithms	4	1	0	5	40	60	100
2	MCA322	Digital Marketing	4	0	0	4	40	60	100
3	MCA323	Java Programming	4	1	0	5	40	60	100
4	MCA324	Introduction to Internet of Things	4	0	0	4	40	60	100
5	MCA 350	English Communication and Soft Skills - III	2	0	2	3	40	60	100
6	MCA359	Design & Analysis of Algorithms Lab	0	0	4	2	50	50	100
7	MCA360	Java Programming Lab	0	0	4	2	50	50	100
8	MCA358	Seminar I	0	0	0	2	50	50	100
Elective (Select Any One)									
9	MCA318	Operational Research	4	0	0	4	40	60	100
	MCA325	Data Warehouse & Mining							
	MCA314	Digital Image Processing							
	MCA311	Computer Based Accounting							
Elective (Select Any One)									
10	MCA326	Social implications of Information Technology	3	0	0	3	40	60	100
	MCA327	Human Values and Professional Ethics							
Total			25	2	10	34	430	570	1000
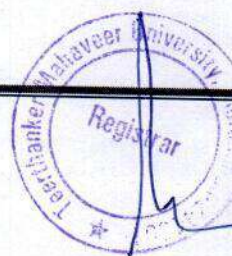
Semester – IV

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA402	Theory of Computation	4	1	0	5	40	60	100
2	MCA416	Linux System Administration	4	0	0	4	40	60	100
3	MCA424	Web Development using PHP	4	0	0	4	40	60	100
4	MCA418	Computer Networks	4	1	0	5	40	60	100
5	MCA 450	English Communication and Soft Skills - IV	2	0	2	3	40	60	100
6	MCA456	Linux System Administration Lab	0	0	4	2	50	50	100
7	MCA459	Web Development using PHP Lab	0	0	4	2	50	50	100
8	MCA458	Seminar II	0	0	0	2	50	50	100
Elective (Select Any One)									
9	MCA419	Advanced Distributed Operating System	4	0	0	4	40	60	100
	MCA420	Big Data Analytics							
	MCA425	Ethical Hacking							
	MCA426	Information Security and Cyber Laws							
Total			22	02	10	31	390	510	900

Semester – V

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA502	Dot Net Framework with C#	4	0	0	4	40	60	100
2	MCA520	Software Engineering and Project Management	4	1	0	5	40	60	100
3	MCA522	Cloud Computing	4	1	0	5	40	60	100
Elective (Select Any One)									
4	MCA523	Android Programming	4	0	0	4	40	60	100
	MCA524	Python							
5	MCA557	Dot Net Framework with C# Lab	0	0	4	2	50	50	100
6	MCA554	Minor Project							
Elective Lab (Select Any One)									
7	MCA558	Android Programming Lab	0	0	4	2	50	50	100
	MCA556	Python Lab	0	0	4	2	50	50	100
Elective (Select Any One)									
8	MCA514	Soft Computing	4	1	0	5	40	60	100
	MCA527	Cryptography and Network Security							
	MCA525	Mobile Computing							
	MCA526	Digital and Cyber Forensics							
		Total	20	03	12	29	350	450	800

Semester – VI

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MCA602	Internship Program	0	0	24	12	50	50	100
Total			0	0	24	12	50	50	100

Study & Evaluation Scheme

of

Master of Computer Applications

(Based on Choice Based Credit System)

[Applicable for the Batch 2019 - 20 till revised]

COLLEGE OF COMPUTING SCIENCES AND INFORMATION TECHNOLOGY

TEERTHANKER MAHAVEER UNIVERSITY

Delhi Road, Moradabad, Uttar Pradesh-244001.

Website: www.tmu.ac.in

PROPOSED STUDY & EVALUATION SCHEME (2019-20)
Programme: MCA
Semester – I

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-I	MCA108	Concepts of C-Programming	4	0	0	4	40	60	100
2	CC-II	MCA112	Digital Electronics & Computer Organization	4	0	0	4	40	60	100
3	AECC-I	MCA113	Environmental Studies	4	0	0	4	40	60	100
4	CC-III	MCA114	Discrete Mathematics	4	0	0	4	40	60	100
5	CC-IV	MCA115	Operating System	4	0	0	4	40	60	100
6	AECC-II	MCAE101	Business Communication	4	0	0	4	40	60	100
7	LC-I	MCA151	C-Programming Lab	0	0	4	2	50	50	100
8	LC-II	MCA154	Digital Electronics & Computer Organization Lab	0	0	4	2	50	50	100
	Total			24	0	08	28	340	460	800

Semester – II

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-V	MCA215	Data Structure using C++	4	0	0	4	40	60	100
2	CC-VI	MCA216	Database Management System	4	0	0	4	40	60	100
3	CC-VII	MCA219	Software Engineering	4	0	0	4	40	60	100
4	CC-VIII	MCA220	Computer Networks	4	0	0	4	40	60	100
5	AECC-III	MCA221	Management Concepts and Organizational Behavior	4	0	0	4	40	60	100
6	SEC-I	MCA222	Computer Graphics	3	0	0	3	40	60	100
7	AECC-IV	MCA223	Entrepreneurship	3	1	0	4	40	60	100
8	LC-III	MCA254	Data Structure using C++ Lab	0	0	4	2	50	50	100
9	LC-IV	MCA255	Database Management System Lab	0	0	4	2	50	50	100
10	SEC-II	MCA256	Computer Graphics Lab	0	0	2	1	50	50	100
			Total	26	1	10	32	430	570	1000

Syllabus as per CBCS (2019-20)

Semester – III

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-IX	MCA304	Design & Analysis of Algorithms	3	0	0	3	40	60	100
2	SEC-III	MCA322	Digital Marketing	3	0	0	3	40	60	100
3	CC-X	MCA323	Java Programming	3	0	0	3	40	60	100
4	SEC-IV	MCA328	Cloud Computing	3	0	0	3	40	60	100
5	CC-XI	MCA329	Artificial Intelligence	4	0	0	4	40	60	100
6	SEC-V	MCA330	Data Science	4	0	0	4	40	60	100
7	AECC-V	MCA331	Managerial Communication	2	0	0	2	40	60	100
8	LC-V	MCA359	Design & Analysis of Algorithms Lab	0	0	4	2	50	50	100
9	LC-VI	MCA360	Java Programming Lab	0	0	4	2	50	50	100
Total				22	00	08	26	380	520	900

Semester - III (Value Added Courses)

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC – I	TMUPA301#	Analytical Reasoning	2	1	0	0	40	60	100
2	VAC – II	TMUPS301#	Managing Self	2	1	0	0	50	50	100

VAC is an audit course which will be compulsory to pass with 45% marks. However it will not be added towards overall result.

Syllabus as per CBCS (2019-20)

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Semester – IV

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-XII	MCA402	Theory of Computation	4	0	0	4	40	60	100
2	CC-XIII	MCA427	Dot Net Framework with C#	4	0	0	4	40	60	100
3	SEC-VI	MCA428	Software Testing and Quality Assurance	3	0	0	3	40	60	100
4	CC-XIV	MCA437	Data Mining	4	0	0	4	40	60	100
5	LC-VII	MCA461	Dot Net Framework with C# Lab	0	0	4	2	50	50	100
6	SEC-VII	MCA460	Software Testing and Quality Assurance Lab	0	0	2	1	50	50	100
7	SEC-VIII	MCA462	Research Tools I (Lab)	0	0	2	1	50	50	100
8	SEC-IX	MCA458	Seminar	0	0	0	2	50	50	100
9	DSEC-I		Discipline Specific Elective Course – I	4	0	0	4	40	60	100
10	DSEC-II		Discipline Specific Elective Course – II	4	0	0	4	40	60	100
			Total	23	00	08	29	440	560	1000

Semester - IV (Discipline Specific Elective Courses)

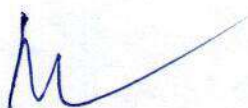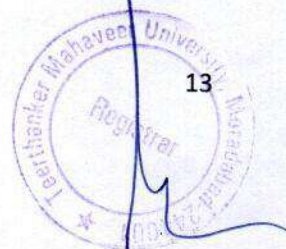| DSEC	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
Discipline Specific Elective Course – I*	MCA425	Ethical Hacking	4	0	0	4	40	60	100
	MCA433	Social Networks	4	0	0	4	40	60	100
	MCA434	Artificial Neural Network	4	0	0	4	40	60	100
	MCA436	Digital Image Processing	4	0	0	4	40	60	100
Discipline Specific Elective Course – II*	MCA429	E-Commerce Technologies	4	0	0	4	40	60	100
	MCA430	Enterprise Resource Planning	4	0	0	4	40	60	100
	MCA431	Computer Based Accounting	4	0	0	4	40	60	100
	MCA432	Human Values and Professional Ethics	4	0	0	4	40	60	100

*Select any one course from each Discipline Specific Elective Course

Semester - IV (Value Added Courses)

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC –III	TMUPA401#	Modern Algebra and Data Management	2	1	0	0	40	60	100
2	VAC –IV	TMUPS401#	Managing Work and Others	2	1	0	0	50	50	100

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Syllabus as per CBCS (2019-20)

Syllabus of MCA -College of Computing Sciences & IT, TMU Moradabad

Semester – V

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-XV	MCA528	Python Programming	4	0	0	4	40	60	100
2	CC-XVI	MCA529	Big Data Analytics	4	0	0	4	40	60	100
3	CC-XVII	MCA530	Machine Learning	4	0	0	4	40	60	100
4	LC-VIII	MCA559	Python Programming and IoT Lab	0	0	4	2	50	50	100
5	LC-IX	MCA560	Machine Learning Lab	0	0	2	1	50	50	100
6	SEC-X	MCA561	Research Tools II (Lab)	0	0	2	1	50	50	100
7	PROJ-I	MCA554	Minor Project	0	1	4	3	50	50	100
8	DSEC-III		Discipline Specific Elective Course - III	4	0	0	4	40	60	100
9	DSEC-IV		Discipline Specific Elective Course– IV	4	0	0	4	40	60	100
	Total			20	01	12	27	400	500	900

Semester - V (Discipline Specific Elective Courses)

DSEC	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
Discipline Specific Elective Course–III*	MCA529	Distributed Computing	4	0	0	4	40	60	100
	MCA530	Game Programming	4	0	0	4	40	60	100
	MCA532	Natural Language Processing	4	0	0	4	40	60	100
	MCA535	Simulation and Modeling	4	0	0	4	40	60	100
Discipline Specific Elective Course– IV*	MCA533	Cryptography and Network Security	4	0	0	4	40	60	100
	MCA534	Fog Computing	4	0	0	4	40	60	100
	MCA536	Operations Research	4	0	0	4	40	60	100
	MCA537	Software Project Management	4	0	0	4	40	60	100

*Select any one course from each Discipline Specific Elective Course

Semester - V (Value Added Courses)

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC - V	TMUPA501#	Modern Algebra and Geometry	2	1	0	0	40	60	100

VAC is an audit course which will be compulsory to pass with 45% marks. However it will not be added towards overall result.

Syllabus as per CBCS (2019-20)

Semester – VI

S. No.	Course Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	PROJ-II	MCA602	Internship Program	0	0	0	12	50	50	100
Total				0	0	0	12	50	50	100

Syllabus as per CBCS (2019-20)
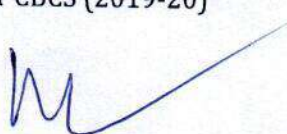
Course Code: MCA 112	MCA- Semester-I (Core Course - II) Digital Electronics & Computer Organization	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the concept of number system, codes and binary arithmetic.	
CO2.	Understanding the concept of combinational and sequential circuit	
CO3.	Understanding the concept of register transfer and micro operation.	
CO4.	Understanding the concept of processor organization.	
CO5.	Analyzing various combinational & sequential circuit and Input/output mechanisms.	
Course Content:		
Unit-1:	**Number System:** Binary, Octal, Hexadecimal and Decimal, Codes: BCD Code, Excess -3 Codes, Gray code, Alphanumeric Codes, Parity Bits, Floating Point Numbers. Binary Arithmetic: Basic Rules of Binary Addition, Subtraction, multiplication and division. Addition and subtraction using 1's and 2's Complement Method.	8 Hours
Unit-2:	**Combinational and Sequential Circuit:** Logic Gates, Karnaugh Map, SOPs & POSs Boolean Expressions, Demorgan's theorem Combinational Circuits: Implementing Combinational Logic, Arithmetic Circuits: Basic Building Blocks, half adder, full adder, half subtractor, full subtractor, De-multiplexers and Decoders, Encoders, R-S Flip Flop, Level Triggered and Edge Triggered Flip Flops, J-K Flip Flop, Master-slave Flip Flops, T-flip Flop, D-flip Flop.	8 Hours
Unit-3:	**Register Transfer and Micro operations:** Register Transfer Language, Bus and Memory Transfer, Three State Bus Buffers, Memory Transfer, Arithmetic Micro operation (Binary Adder, Binary Adder-Subtractor, Binary Increment, Arithmetic Circuit), Logic Micro operations(List of logic operation), Shift Micro operations, Arithmetic Logic Shift Unit.	8 Hours
Unit-4:	**Processor Organization:** General register organization, Stack organization, Addressing mode, Instruction format, Instruction Cycle, Data transfer & manipulations, Program Control, Introduction to RISC and CISC.	8 Hours
Unit-5:	**Input-Output Organization:** I/O Interface, I/O bus and interface modules, Asynchronous data transfer: Strobe control, Hand Shaking, Modes of transfer: Programmed I/O, Interrupt initiated I/O, DMA, Interrupts & Interrupt handling, Direct Memory access: DMA Controller and DMA Transfer.	8 Hours
Text Books:	1. Mano Morris, *Digital Logic*, Prentice Hall of India.	
Reference Books:	1. Vravice, Zaky & Hamacher, *Computer Organization*, Tata Mc Graw Hill 2. Tannenbaum, *Structured Computer Organization*, Prentice Hall	

Syllabus as per CBCS (2019-20)

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	of India. 3. Hayes John P., *Computer Organization*, McGraw Hill. *** Latest editions of all the suggested books are recommended.**
Additional Electronic Reference:	1.https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials 2. https://examupdates.in/digital-logic-design-books/

New course
Added.

Course Code: MCA 113	MCA- Semester-I (Ability-Enhancement Compulsory Course - I) Environmental Studies	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the basic concept of human value and ethics.	
CO2.	Understanding the basics of relationship and physical facilities.	
CO3.	Understanding the importance of human value and ethics.	
CO4.	Understanding the needs of Self ('I') and 'Body'.	
CO5.	Understanding harmony in the Family.	
Course Content:		
Unit-1:	Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, Concept of sustainability & sustainable development. **Ecology and Environment**: Concept of an Ecosystem-its structure and functions, Energy Flow in an Eco-system, Food Chain, Food Web, Ecological Pyramid& Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.	8 Hours
Unit-2:	**Natural Resources:** Renewable & Non-Renewable resources; Land resources and land use change; Land degradation, Soil erosion & desertification. **Deforestation**: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. **Energy Resources**: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies. **Biodiversity:** Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Bio geographical Classification of India	8 Hours
Unit-3:	**Environmental Pollutions:** Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies	8 Hours
Unit-4:	**Environmental policies & practices: Climate change & Global Warming** (Greenhouse Effect),Ozone Layer -Its Depletion and Control Measures, Photochemical Smog, Acid Rain Environmental laws: Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context	8 Hours
Unit-5:	**Human Communities & Environment:** Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case studies.	8 Hours
Text Books:	1. "Environmental Chemistry", De, A. K., New Age Publishers Pvt. Ltd.	

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Reference Books:	1. "Biodiversity and Conservation" ,Bryant, P. J., Hypertext Book 2. "Textbook of Environment Studies", Tewari, Khulbe & Tewari ,I .K. Publication. 3. "Introduction to Environmental Engineering and Science", Masters, G. M., Prentice Hall India Pvt. Ltd. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference:	1. https://www.tutorialspoint.com/environmental_studies/index.htm 2. http://www.schoolchalao.com/basic-education/environmental-education	

New course Added

Course Code: MCA 114	MCA- Semester-I (Core Course - III) Discrete Mathematics	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the basic concepts of set theory, arithmetic, logic, proof techniques, binary relations.	
CO2.	Understanding the concepts of graphs and trees.	
CO3.	Understanding the various principals of counting.	
CO4.	Applying the knowledge and skills obtained to investigate and solve a variety of discrete mathematical problems.	
CO5.	Analyzing basic mathematical proofs and discriminates between valid and unreliable arguments.	
Course Content:		
Unit-1:	**Propositional Calculus:** Propositions, Truth tables, Logical Equivalence, Logical implications, Algebra of propositions, Conditional propositions, Bi-conditional statements, Negation of Compound statements, Tautologies and Contradiction, Normal Form, Arguments, Fallacies.	8 Hours
Unit-2:	**Principle of Counting:** The Principle of Inclusion-Exclusion, Mathematical Induction, Addition and Multiplication Rules, Pigeon-Hole Principle, Permutations and Combination.	8 Hours
Unit-3:	**Graphs:** Introduction to Graphs, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, and Null graph, Hand Shaking Lemma, Regular graph, Complete Graph, Bipartite Graph, Isomorphic and Homeomorphisms of Graphs, Subgraph, Connected and Disconnected graphs, Operations on Graphs, Euler graph, Fleury's Algorithm to find Eulerian Circuit, Hamiltonian graph, Chinese Postman Problem and Travelling-Salesman problem.	8 Hours
Unit-4:	**Planar Graph and Coloring of Graphs:** Introduction, Planar Graphs, Kuratowski's Graphs, Detection of Planarity, Coloring of Graphs, Chromatic Partitioning, Chromatic Polynomial, Edge Coloring, Vertex Coloring, Four Color Theorem, Five Color Theorem. **Trees:** Definition, Properties of trees, Spanning tree, Minimal Spanning tree, Kruskal's and Prim's Algorithms to find Minimal Spanning tree.	8 Hours
Unit-5:	**Combinatorics:** Generating function, Recurrence Relations- Homogeneous solution, particular solution, Solving Recurrence Relations using the Characteristic Polynomial and Generating function	8 Hours
Text Books:	1. J. P. Tremblay and R Manohar, "Discrete Mathematics",TMH	
Reference	1. Liu C.L., "Elements of Discrete Mathematics"	

Books:	2. Neville Dean, "Essence of Discrete Mathematics Prentice Hall"	
	3. Swapan Kumar Sarkar "Discrete Mathematics", -S Chand	
	* Latest editions of all the suggested books are recommended.	
Additional Electronic Reference:	1. https://www.tutorialspoint.com/discrete_mathematics/index.htm 2. https://www.javatpoint.com/discrete-mathematics-tutorial	

Syllabus as per CBCS (2019-20)

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Nav course Added

Course Code: MCA 115	MCA- Semester-I (Core Course - IV) Operating System	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding about various operating systems and the functions and services provided by the operating system.	
CO2.	Understanding the process management, process concepts and how process synchronized.	
CO3.	Understanding the detailed operation deadlock and deadlock characterization.	
CO4.	Understand different memory management techniques like paging segmentation etc.	
CO5.	Analyzing the working and functions various operating systems.	
Course Content:		
Unit-1:	Introduction to the Operating System, Types of Operating System: Batch System, Time Sharing System, Real Time System. Multi Programming, Distributed System, Functions of Operating System and its services.	8 Hours
Unit-2:	**Process Management:** Process Concept, Process State, Process Control Block, Process Scheduling, CPU Scheduling - CPU Scheduling, Scheduling Criteria, Scheduling Algorithms, Preemptive & Non Preemptive Scheduling.	8 Hours
Unit-3:	**Process Synchronization:** Critical Section Problem, Race Condition, Synchronization Hardware, Semaphores, Classical Problems of Synchronization. Dead Locks: Characterization, Methods for Handling Deadlock, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.	8 Hours
Unit-4:	**Memory Management:** Contiguous Allocation, External and Internal Fragmentation, Paging & Segmentation. Virtual Memory: Concept of Virtual Memory, Concept of Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.	8 Hours
Unit-5:	**Directory Structure, Allocation Methods:** Contiguous Allocation, Linked Allocation, Indexed Allocation Free Space Management. Disk Structure, Disk Scheduling Algorithms, Disk Management.	8 Hours
Text Books:	1. Silbershatz and Galvin," Operating System Concept", Addition Weseley Eigth Edition	
Reference Books:	1. Flynn, Mchoes, "Understanding Operating System", Thomson Press, Sixth Edition 2. Tannenbaum,"Modern Operating System Concept", PHI Learning,Third Edition, 3. Joshi, R. C. and Tapaswi, S., "Operating Systems", Wiley Dreamtech. * Latest editions of all the suggested books are recommended.	
Additional Electronic Reference:	1.https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf 2. https://www.studytonight.com/operating-system/	
Course Code:	MCA- Semester-I	L-4

Handwritten: New course Added

Course Code: MCA 154	MCA- Semester-I (Laboratory Course - II) Digital Electronics & Computer Organization Lab	L-0 T-0 P-4 C-2
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the working of digital electronics and computer organization simulator.	
CO2.	Developing various logic gates like AND, OR etc. on simulator.	
CO3.	Developing various combinational circuits and sequential circuit on simulator.	
CO4.	Developing various registers used in computer system on simulator	
CO5.	Developing the different convert like binary to octal etc. on simulator	
Course Content:		
	1. The student will be required to perform the following experiments: 2. Verify the truth tables of Logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR). 3. To study NAND, NOR, XOR, XNOR using basic gates 4. To study logic gates using NAND gate 5. To study logic gates using NOR gate. 6. Implement Arithmetic expressions using basic gates 7. Implement Arithmetic expressions using NAND gates. 8. To Implement Arithmetic expressions using NOR gates. 9. Verify the truth tables of flip-flops 10. To implement Master-Slave Flip-flop 11. To implement 4*1 multiplexer 12. To implement 8*1 multiplexer 13. To implement 8*1 multiplexer using two 4*1 multiplexer 14. To implement 1*4 de-multiplexer 15. To implement 1*8 de-multiplexer 16. To implement 1*8 de-multiplexer using two 1*4 de-multiplexer 17. To implement 2 to 4 Decoder 18. To implement 3 to 8 Decoder 19. To implement 2 to 4 Decoder with NAND Gates. 20. To implement 3 to 8 Decoder using Two 2 to 4 Decoder. 21. To implement Register with parallel Load. 22. To implement Shift Register 23. To implement 4-bit synchronous binary counter 24. To implement 4-bit binary Adder 25. Design 3 bit Gray Code to binary converters 26. Design BCD to Excess-3 code converter 27. Design a Gray-to Excess-3 Code converter using NAND gates 28. To study Binary adder subtractor 29. To study Binary incrementer. 30. To study arithmetic circuit	40 Hours

Course Code:	MCA- Semester-II	L-4

New course
Added

Course Code: MCA322	MCA- Semester-III (Skill-Enhancement Course - III) Digital Marketing	L-3 T-0 P-0 C-3
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding basic concepts of digital marketing.	
CO2.	Understanding how segmentation and targeting can be done.	
CO3.	Understanding concept and importance of Search Engine Optimization (SEO) for business websites	
CO4.	Understanding basics and importance of web marketing email marketing and mobile marketing.	
CO5.	Applying digital marketing concepts for business	
Course Content:		
Unit-1:	Introduction to Digital Marketing, Benefits & Opportunity of Digital Marketing, Inbound and Outbound Marketing, Content Marketing, Understanding Traffic, Understanding Leads, Digital Marketing use in 'Business to Business' (B2B), 'Business to Consumer' (B2C) and 'Not-for-Profit' marketing	6 Hours
Unit-2:	Search Marketing (SEO): Introduction to Search Engine , Search Engine Optimization (SEO), Importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, On-page & Off-page optimization, Back link, Internal & External links, Steps for B2B SEO and B2C SEO.	6 Hours
Unit-3:	Email Marketing: Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing & it's use in email marketing. Digital Display Advertising: Concepts, Benefits and Challenges.	6 Hours
Unit-4:	Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Impact of Social Media on SEO, Basic concepts – CPC, PPC, CPM, CTR. Importance of Landing Page. Test and Create landing pages.	6 Hours
Unit-5:	Introduction to Mobile Marketing, Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging. Web Analytics: Introduction to web analytics, Web Analytics Process, Analytics Reporting, Traffic and Behavior Report.	6 Hours
Text Books:	1. Stanton William J., Fundamentals of Marketing, McGraw Hill, N. Delhi 10th Ed.	
Reference Books:	1. Neelamegham S., Indian Cases in Marketing, Vikas Publication, New Delhi 2. Kotler Philip & Armstrong Graw, Principles of Marketing,	

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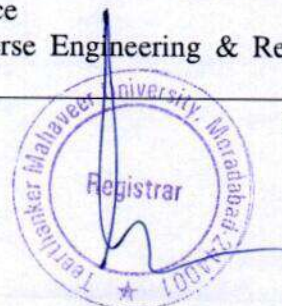
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	Pearson Education, New Delhi 2004. 3. Vandana Ahuja, Digital Marketing, Oxford Higher Education. * Latest editions of all the suggested books are recommended.	
Additional Electronic Reference:	1. https://www.guru99.com/free-digital-marketing-tutorial.html 2. https://www.edureka.co/blog/digital-marketing-tutorial/	

New course
Added

Course Code: MCA 330	MCA- Semester-III (Skill-Enhancement Course - V) Data Science	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the flow process for data science problems.	
CO2.	Understanding reading and writing data using R programming language.	
CO3.	Analyzing data science problems into standard typology.	
CO4.	Developing R codes for data science solutions.	
CO5.	Developing use cases to validate approach and identify modifications required.	
Course Content:		
Unit-1:	Overview of R, R data types and objects, , Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools.	8 Hours
Unit-2:	Reading and writing data using R, Create and customize visualizations using ggplot2, Data Visualization using R.	8 Hours
Unit-3:	Linear algebra for data science - algebraic view: vectors, matrices, product of matrix vector, rank, null space, solution of over-determined set of equations and pseudo-inverse.	8 Hours
Unit-4:	Linear algebra for data science- geometric view: vectors, distance, projections, eigen value decomposition.	8 Hours
Unit-5:	Univariate and multivariate linear regression, Model assessment (including cross validation, verifying assumption used in linear regression), Assessing importance of different variables, subset selection.	8 Hours
Text Books:	1. Acharya. S, "Data Analytics using R", McGrawHill Education.	
Reference Books:	1. Ozdemir. S, "Principles of Data Science ", Packt. * Latest editions of all the suggested books are recommended.	
Additional Electronic Reference:	1. https://intellipaat.com/blog/tutorial/data-science-tutorial/ 2. https://elitedatascience.com/data-science-resources	

New course Added

Course Code: MCA219	MCA- Semester-II (Core Course - VII) Software Engineering	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of software development life cycle and various process models of software development.	
CO2.	Understanding the concepts of agile software development and the basics of requirements engineering using case study.	
CO3.	Understanding the concepts of software design and to apply software design techniques with the help of flow charts, ERD and DFD.	
CO4.	Understanding the concepts of coding approach, software testing, and software maintenance & software reliability.	
CO5.	Analyzing various tools and techniques of coding approach, software testing, and software maintenance & software reliability.	
Course Content:		
Unit-1:	**Introduction:** Introduction to Software Engineering, Software Development Life Cycle (SDLC) & its phases. **Software Process Models:** Water Fall, Evolutionary Process Model - Prototype & Spiral Model, Incremental Process Model – Iterative Approach, RAD. Overview of ETVX Concept (Entry, Task, Verification & Validation, Exit)	8 Hours
Unit-2:	**Agile Methodology:** Agile Manifesto- Values & Principles. Agile Methods: Extreme Programming, Scrum. Challenges in Adopting Agile Methods. **Requirement Engineering:** Functional and Non Functional Requirements, User Requirements, System Requirements, Interface Specifications, Context Diagram, Software Requirement Specifications (SRS) **Case Study :** SRS following IEEE Standards.	8 Hours
Unit-3:	**Software-Design:** Design principles, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies-Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Data Flow Diagrams (DFD), Data Dictionary, Entity Relationship Diagrams (ERD), Concept of User Interface	8 Hours
Unit-4:	**Coding:** Top-down and bottom-up approach, Coding Standards, Code Review, Code Walkthrough, Code Inspections. **Software Testing:** Overview of Testing, Verification & Validation. **Software Reliability:** Overview of Software Reliability, Reliability Metrics	8 Hours
Unit-5:	**Software Maintenance :** Need for Software Maintenance, Categories of Maintenance: Preventive, Corrective, Adaptive and Perfective Maintenance, Cost of Maintenance **Trends in Software Engineering :** Reverse Engineering & Re-engineering, CASE Tools	8 Hours

Text Books:	1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach", McGraw Hill	
Reference Books:	1. Pankaj Jalote, Software Engineering, Wiley 2. Ian Sommerville, Software Engineering, Addison Wesley *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference:	1. https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf 2. https://www.tutorialspoint.com/software_engineering/software_engineering_pdf_version.htm	

New course added

Course Code: MCA427	MCA- Semester IV (Core Course - XIII) Dot Net Framework with C#	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the basics of Dot Net Framework with C#.	
CO2.	Understanding the meaning and basic components of a Dot Net Framework with C#.	
CO3.	Understanding the hands-on use of Dot Net Framework with C# applications in Web, Window and Console Application.	
CO4.	Understanding the categories of programs, Web, Window and Console Application.	
CO5.	Understanding the use of the Dot Net Framework with C# programs to create professional, academic, and business software projects.	
Course Content:		
Unit-1:	**Architecture of the .Net Framework Development Platform:** Compiling Source Code into Managed Code, Metadata, Intermediate Language (IL), Common Language Runtime Services, Common Type System, Common Language Specification The .Net Framework Class Library, Just-In-Time Compilation, Unified Classes. **C# Basics:** Data Types, Literals and Variables, Operator, Program Control Statements, Class and Object, Arrays and Strings, **A Closer Look at Methods and Classes:** C# Access Modifiers, Use ref and out parameter, Variable number of Arguments, Concept of Return Object and Array. Method Overloading, Overloading Constructors, Optional Arguments, Named Arguments, Recursion, Understanding Static.	8 Hours
Unit-2:	Operator Overloading, Indexers and Properties, **Inheritance :** Member Access using Protected Access, Calling Base Class Constructor, Name Hiding, Virtual Methods and Overriding, Abstract Classes, Using sealed to Prevent Inheritance, Boxing and Unboxing. Interfaces, Exception Handling. Using I/O.	8 Hours
Unit-3:	Delegates and Events, Namespaces and Assemblies, Reflection, Unsafe Code, Networking and Socket. **Multithreading :** Thread Class, Determining when a Thread Ends, Thread Priorities, Synchronization, Thread Communication using Wait(), Pulse() and PulseAll(), Using the Mutex and a Semaphore. Collections. Windows Forms (IDE Environment)	8 Hours
Unit-4:	**Advanced Features Using C#:** Windows Services, Web Services. **Introduction to ADO.Net:** Connected v/s. Disconnected Data Access. ADO.Net Architecture, Connection Object, SQL Command Object, Data Adapter, Data Reader, DataSet. **Asp.net Web Form Controls.** State Management, Grid View Control, Validation Controls. Concepts of Paging, Database connectivity with authentication and authorization.	8 Hours

Unit-5:	**Advanced Features Using C#:** Distributed Application in C#, Graphical Device interface with C#, Enumeration. **AJAX:** Introduction to AJAX, Using Asp.Net Ajax Controls, Implement Web forms by using Asp.Net Ajax, ASP.NET application using Ajax control toolkit. **LINQ :** LINQ Fundamental, LINQ to Object, LINQ to XML, LINQ to SQL	**8 Hours**
Text Books:	1. Wiley," Beginning Visual C# 2008", Wrox	
Reference Books:	1. C#.Net Developers Guide- Greg Hack, Jason Werry, SaurabhNandu. (SyngRess) 2. Wrox Press Professional C# 4th Edition – Simon Robinson, Jay Glynn 3. ".Net professional framework 4.0", Wrox * **Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference:	1. https://dotnet.microsoft.com/learn/csharp 2. https://dotnettutorials.net/course/csharp-dot-net-tutorials/	

New Course Added

Course Code: MCA461	MCA- Semester IV (Laboratory Course - VII) Dot Net Framework with C# Lab	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the dot net framework with C# applications in web, window and console application.	
CO2.	Applying the dot net framework features to create personal, academic and business documents.	
CO3.	Developing the C# programs by using C# programming concept.	
CO4.	Developing the various business applications using dot net framework with C#	
CO5.	Developing the real life applications using dot net framework features.	
Course Content:		
	Students are required to perform programs related to: 1. The use of sequence, conditional and iteration construct. 2. Various operators like logical, arithmetical, relational, etc. 3. Overloading of various operators. 4. Use of Static Member functions, optional arguments. 5. Use of destructor and various types of constructor. 6. Various forms of Inheritance. 7. Use of Interface in multiple inheritance, virtual and override concept, delegates. 8. File operation. 9. Create windows based application with connected and disconnected architecture. 10. Simple web application using ASP Net. 11. Use of Active X controls. 12. Create web application using ASP.Net with Ajax and Ajax Control Toolkits provided by Microsoft. 13. Create Window application using ASP.Net with Ajax and Ajax Control Toolkits provided by Microsoft. **Note:** Students are advised to develop a small project illustrating the handling of database and screens in order to fully understand the C#.	**40 Hours**

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New course Added

Course Code: MCA528	MCA- Semester V (Core Course - XV) Python Programming	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the baisc concept of python programming language.	
CO2.	Understanding the object oriented programming concepts using Python	
CO3.	Understanding the important aspects related with string, lists and dictionary in python	
CO4.	Understanding various modules used in python	
CO5.	Applying the technical skill for designing user defined functions in python	
Course Content:		
Unit-1:	Introduction History, Features, Setting up path, Working with Python, Basic Syntax ,Variable and Data Types , Operator Conditional Statements If ,If-else ,Nested if-else Looping For, While ,Nested loops Control Statements Break, Continue ,Pass	8 Hours
Unit-2:	String Manipulation Accessing Strings ,Basic Operations ,String slices ,Function and Methods Lists Introduction ,Accessing list ,Operations ,Working with lists ,Function and Methods Tuple Introduction ,Accessing tuples ,Operations ,Working ,Functions and Methods	8 Hours
Unit-3:	Dictionaries Introduction, Accessing values in dictionaries ,Working with dictionaries ,Properties ,Functions Functions Defining a function , Calling a function, Types of functions ,Function Arguments ,Anonymous functions ,Global and local variables	8 Hours
Unit-4:	Modules Importing module ,Math module ,Random module ,Packages ,Composition Input-Output Printing on screen ,Reading data from keyboard ,Opening and closing file ,Reading and writing files ,Functions	8 Hours
Unit-5:	Exception Handling Exception ,Exception Handling ,Except clause , Try ? finally clause , User Defined Exceptions OOPs concept Class and object , Attributes , Inheritance , Overloading , Overriding , Data hiding	8 Hours
Text Books:	1. Learning Python by Mark Lutz, David Ascher Shop O'Reilly - O'Reilly Media	
Reference Books:	1. Learn Python the Hard Way, Zed A. Shaw , Goodreads 2. Python Essential Reference, David M. Beazley, Addison Wesley 3. Python Programming for the Absolute Beginner third edition Ross Dawson Goodreads * **Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference:	1. https://www.python.org/about/gettingstarted/ 2. https://www.tutorialspoint.com/python/index.htm	

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New Course Added

Course Code: MCA529	MCA- Semester V (Core Course - XVI) Big Data Analytics	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the requirement of Big data with respect to 5 V's.	
CO2.	Understanding the basic storage structure used in Big data with respect to clusters.	
CO3.	Understanding the Hadoop Ecosystem and its components.	
CO4.	Analyzing the data processing in Big data with HIVE , PIG and HBASE.	
CO5.	Analyzing the functionality and working of Zookeeper for monitoring Servers in Cluster.	
Course Content:		
Unit-1:	**INTRODUCTION TO BIG DATA:** Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.	8 Hours
Unit-2:	**INTRODUCTION HADOOP:** Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.	8 Hours
Unit-3:	**HADOOP ARCHITECTURE:** Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.	8 Hours
Unit-4:	**HIVE AND HIVEQL, HBASE:**Hive Architecture and Installation, Comparison with Traditional Database, HiveQL – Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase conceptsAdvanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.	8 Hours
Unit-5:	**Big Data Analytics:** Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.	8 Hours
Text Books:	1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.	
Reference Books:	1. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012. 2. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013. 3. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014 * Latest editions of all the suggested books are recommended.	
Additional Electronic Reference:	1. https://examupdates.in/big-data-analytics/ 2. https://www.tutorialspoint.com/big_data_analytics/index.htm	

New Course Added.

Course Code: MCA530	MCA- Semester V (Core Course - XVII) Machine Learning	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding different types of learning approaches that could be used for implementing machine learning problems.	
CO2.	Understanding the key elements of machine learning and the importance of model selection and generalization	
CO3.	Understanding the various components of bayesian decision theory and dimensionality reduction for solving machine learning problems .	
CO4.	Applying the various approaches of Clustering and Classification for improving the learning capability of machine.	
CO5.	Analyzing multiple supervised learning algorithms and select the best suitable for a specific problem	
Course Content:		
Unit-1:	Introduction: Machine learning problems, Types of learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised Learning: Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization.	8 Hours
Unit-2:	**Bayesian Decision Theory**: Classification, Losses and Risks, Association Rules, **Dimensionality Reduction:** Subset Selection, Principal Components Analysis, Multidimensional Scaling, Linear Discriminant Analysis.	8 Hours
Unit-3:	**Clustering:** Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Supervised Learning after Clustering, Hierarchical Clustering **Classification:** Decision Trees, Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data.	8 Hours
Unit-4:	**Local Models:** Introduction, Competitive Learning, Radial Basis Functions, Incorporating Rule-Based Knowledge, Normalized Basis Functions, Competitive Basis Functions, Learning Vector Quantization, Hierarchical Mixture of Experts.	8 Hours
Unit-5:	**Artificial Neural Networks:** Introduction, neural network representation, perceptrons, multilayer networks and back propagation algorithm. Introduction to deep learning, application areas, major components	8 Hours
Text Books:	1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2010.	
Reference Books:	1. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT 2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education,2013. ***Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference:	1. https://www.tutorialspoint.com/machine_learning/machine_learning_tutorial.pdf 2. https://machinelearningmastery.com/self-study-guide-to-machine-learning/	

dictionary by value
11. Write a Python script to add a key to a dictionary
12. Write a Python program to create a tuple
13. Write a Python program to create a tuple with different data types.
14. Write a Python program to create a tuple with numbers and print one item.
15. Write a Python program to unpack a tuple in several variables.
16. Write a Python program to add an item in a tuple

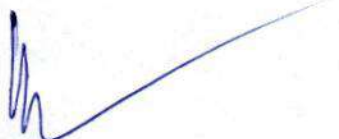ARDUINO EXPERIMENTS BASED ON THE FOLLOWINGS SENSORS SHOULD BE PERFORMED

Course Code: MCA560	MCA- Semester V (Laboratory Course - IX) Machine Learning Lab	L-0 T-0 P-2 C-1
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the importance of selecting right programming language for developing solutions for machine learning problems	
CO2.	Understanding the importance of data set and classifying it for training and testing of the Machine Learning Model	
CO3.	Applying their knowledge of EM and k-Means algorithm for reading and clustering the data.	
CO4.	Applying Bayesian Network for developing a model predicting disease in human beings.	
CO5.	Applying various parameters or functions to make the model for reliable and accurate	
Course Content:		
	1. Apply EM algorithm to cluster a set of data stored in a .CSV file. 2. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. 3. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. 4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. 5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.	**20 Hours**

Course Code: MCA559	MCA- Semester V (Laboratory Course - VIII) Python Programming and IoT Lab	L-0 T-0 P-4 C-2
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the building blocks of Internet of Things and characteristics.	
CO2.	Applying the different collections such as list, tupple, dictionaries used in python to create python program.	
CO3.	Applying various functions used in python to create python program.	
CO4.	Developing the python programs by using the concept of class, inheritance and operator overloading	
CO5.	Developing the applications by using python programming concepts.	
Course Content:		
	1. Write a Python program to calculate the length of a string. 2. Write a Python program to count the number of characters (character frequency) in a string. 3. Write a Python program to get a string made of the first 2 and the last 2 chars from a given a string. If the string length is less than 2, return instead of the empty string. 4. Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself. 5. Write a Python program to get a single string from two given strings, separated by a space and swap the first two characters of each string. 6. Write a Python program to sum all the items in a list. 7. Write a Python program to multiplies all the items in a list. 8. Write a Python program to get the largest number from a list. 9. Write a Python program to get the smallest number from a list. 10. Write a Python script to sort (ascending and descending) a	40 Hours

	17. Experiment to ON LED light on pin 13 18. Experiment to ON/OFF LED light on pin 13 19. Experiment to Blink LED light on pin 13 20. Experiment to perform the alternate task on bell ringer and LED 21. Experiment to Blink alternate LEDs light(Hint use 4 LEDs) 22. Experiment to measure distance of an object using IR OBSTACLE SENSOR 23. Experiment to detect Leakage of as using GAS SENSOR 24. Experiment to detect fire of as using FIRE SENSOR	