Course curriculum for Computer Science & Engineering for 2021 Batch

Semester IV (2021 batch)				
Serial no.	**Course code**	**Course name**	**Credits**	**Course Instructor**
1	CS 202	Automata theory	8	Prof. Ramchandra Phawade
2	CS 209	Artificial intelligence	6	Prof. Kedar Khandeparkar
3	CS 205	Design and analysis of algorithms	6	Prof. Sandeep RB
4	EE 204	Digital systems	6	Prof. Nagaveni S
5	EE 214	Digital Circuits Lab	3	Prof. Nagaveni S
6	CS 214	Artificial intelligence lab	3	Prof. Kedar Khandeparkar
7	CE 301	Environmental studies	6	Prof. Narasamma Nipatlapalli
Total credits			**38**	

SYLLABUS

Name of Academic Unit: Computer Science and Engineering
Level: UG

i	**Title of the course**	CS 202 Automata Theory
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Discrete Structures
vii	**Course Content**	Finite state machines (DFA/NFA/epsilon NFAs), regular expressions. Properties of regular languages. My hill-Nerode Theorem. Non-regularity. Push down automata. Properties of context-free languages. Turing machines:Turing hypothesis, Turing computability, Nondeterministic, multi tape and other versions of Turing machines. Church`s thesis, recursively enumerable sets and Turing computability. Universal Turing machines. Unsolvability, The halting problem, partial solvability, Turing enumerability, acceptability and decidability, unsolvable problems about Turing Machines. Post`s correspondence problem.
Viii	**Texts/References**	1. Introduction to Automata Theory, Languages and Computation, by John. E. Hopcroft, Rajeev Motwani, J. D. Ullman, 3rd edition. Pearson. 2013. 2. Elements of the Theory of Computation, by H.R. Lewis and C. H. Papadimitrou, 2nd Edition. Prentice Hall Inc, 1998.
x	**Name(s) of Instructor(s)**	GN
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Nil
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Fundamental course on computability.

Name of Academic Unit: Computer Science and Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title** of the course	**Artificial Intelligence**
ii	Credit Structure (**L-T-P-C**)	**(3-0-0- 6)**
iii	**Type** of Course	Core
iv	Semester in which normally to be offered	Spring
v	Whether **Full or Half Semester** Course	Full
vi	**Pre-requisite(s)**, if any (For the students) – *specify course number(s)*	
vii	Course **Content***	Search: Problem representation; State Space Search; A* Algorithm and its Properties; AO* search, Minimax and alpha- beta pruning, AI in games. Logic: Formal Systems; Notion of Proof, Decidability, Soundness, Consistency and Completeness; Predicate Calculus (PC), Resolution Refutation, Herbrand Interpretation, Prolog. Knowledge Representation: PC based Knowledge Representation, Intelligent Question Answering, Semantic Net, Frames, Script, Conceptual Dependency, Ontologies, Basics of Semantic Web. Leaning: Learning from Examples, Decision Trees, Neural Nets, Hidden Markov Models, Reinforcement Learning, Learnability Theory. Uncertainty: Formal and Empirical approaches including Bayesian Theory, Fuzzy Logic, Non-monotonic Logic, Default Reasoning. Planning: Blocks World, STRIPS, Constraint Satisfaction, Basics of Probabilistic Planning. Advanced Topics: Introduction to topics like Computer Vision, Expert Systems, Natural Language Processing,

viii	Texts/References	ain Text: Stuart J. Russel, Peter Norvig, Artificial Intelligence: A Modern Approach (3rd ed.). Upper Saddle River: Prentice Hall, 2010. Other references: N.J. Nilsson, Principles of Artificial Intelligence, Morgan Kaufmann, 1985. Malik Ghallab, Dana Nau, Paolo Traverso, Automated Planning: Theory & Practice, The Morgan Kaufmann Series in Artificial Intelligence, 2004. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006. Mark Stefik, Introduction to Knowledge Systems, Morgan Kaufmann, 1995. E. Rich and K.Knight, Artificial Intelligence, Tata McGraw Hill, 1992.
ix	Name(s) of **Instructor(s)** ***	KK
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**	No
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.	No
x	Justification	AI is taught traditionally as it is driving force behind many concepts in computer science and it is also precursor to advanced courses like machine learning.

Name of Academic Unit: Computer Science and Engineering

Level: UG

Programme: B.Tech.

i	**Title of the course**	Design and Analysis of Algorithms
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Computer Programming and Utilization, Discrete Structures, Data Structures and Algorithms , Data Structures and Algorithms Laboratory
vii	**Course Content***	Syllabus is divided roughly 8 modules; each module roughly takes two weeks. Module 1: Introduction Examples and motivation. Asymptotic complexity: informal concepts, formal notation, examples Module 2: Searching in list: binary search, Sorting: insertion sort, selection sort, merge sort, quicksort, stability and other issues. Module 3: Divide and conquer: binary search, recurrence relations. nearest pair of points, merge sort, integer multiplication, matrix multiplication. Module 4: Graphs: Motivation, BFS, DFS, DFS numbering and applications, directed acyclic graphs, directed acyclic graphs, Shortest paths: unweighted and weighted, Single source shortest paths: Dijkstra, Minimum cost spanning trees: Prim's algorithm, Kruskal's Algorithm Module 5: Union-Find data structure, Priority queues, heaps. Heap sort. Dijstra/Prims revisited using heaps, Search Trees: Introduction Traversals, insertions, deletions Balancing Module 6: Greedy algorithms: Greedy: Interval scheduling, Proof strategies, Huffman coding. Module 7: Dynamic Programming: weighted interval scheduling, memoization, edit distance, longest ascending subsequence. matrix multiplication, shortest paths: Bellman Ford, shortest paths: Floyd Warshall Module 8: Intractability: NP completeness, reductions, examples, Misc topics.
viii	**Texts/References**	1. Algorithms, by Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, McGraw Hill Education, 2006. 2. Introduction to Algorithms, 3rd edition, by Cormen, Leiserson, Rivest and Stein, PHI Learning Pvt. Ltd., 2010. 3. Algorithm Design, 1st edition, by Kleniberg and Tardos, Pearson, 2014.
ix	**Name(s) of Instructor(s)**	PRB
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Nil

xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Core Course for Computer Science undergraduate students.

Name of Academic Unit: Electrical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	EE 204 Digital Systems
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) specify course number(s)**	None
vii	**Course Content**	• **Introduction to Digital Systems** • **Number systems and Logic:** Number Systems, Different Codes, Boolean logic, basic gates, truth tables • **Introduction to Logic families:** TTL, CMOS etc. • **Boolean Algebra:** Laws of Boolean Algebra, logic minimization using K maps • **Combinational Logic Circuits:** Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs • **Sequential circuits:** Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines • **Introduction to Hardware Description Languages** • **Array based logic elements:** Memory, PLA, PLD, FPGA • **Special Topics:** Asynchronous State machines, Testing and Verification of Digital Systems
viii	**Texts/References**	1. J. F. Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 2. M. Moris Mano; Digital Design, 4th Edition, Pearson,2009 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 4. H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977 5. Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998
ix	**Name(s) of Instructor(s)**	RG
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No

xii	**Justification/ Need for introducing the course**	This course introduces students to the world of Digital Systems by introducing concept of Boolean Algebra and Logic Functions. This course is a beginning of the spine related to Digital Design, Microprocessor, Embedded Systems etc,

Name of Academic Unit: Electrical Engineering
Level: B. Tech
Programme: B. Tech.

i	**Title of the course**	**EE 214: Digital Circuits Laboratory**
ii	**Credit Structure (L-T-P-C)**	(0 0 3 3)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Digital Systems Theory (EE224)
Vii	**Course Content***	This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab: Experiments with discrete ICs 1. Introduction of digital ICs 2. Realizing Boolean expressions 3. Adder/Subtractor 4. Shift registers 5. Synchronous Counters 6. Asynchronous Counters + 7-segment display 7. Finite State Machines (2 weeks) Experiments with CPLDs 1. Arithmetic and Logic Unit 2. LCD, Buzzer Interfacing 3. Pipelining
Viii	**Texts/References**	1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009 2. J.F.Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009
Ix	**Name(s) of Instructor(s) *** **	RG
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science

xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	The lab deals with fundamental digital circuits which are extensively used in electronic gadgets.

Name of Academic Unit: Computer Science and Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title** of the course	**Artificial Intelligence Lab**
ii	Credit Structure (**L- T-P-C**)	**(0-0-3- 3)**
iii	**Type** of Course	Core
iv	Semester in which normally to be offered	Spring
v	Whether **Full or Half Semester**	Full
vi	**Pre-requisite(s)**, if any (For the students) – *specify course*	
vii	Course **Content***	The lab will closely follow and aim to elucidate the lessons covered in the theory course CS344. Implementation and study of A*, Usage of Prolog Inferencing, Expert System Shells, Neural Net Platforms, Prediction and Sequence Labeling using HMMs, Simulation of Robot Navigation and such exercises are strongly recommended.
Viii	Texts/References	ain Text: Stuart J. Russel, Peter Norvig, Artificial Intelligence: A Modern Approach (3rd ed.). Upper Saddle River: Prentice Hall, 2010. Other references: N.J. Nilsson, Principles of Artificial Intelligence, Morgan Kaufmann, 1985. Malik Ghallab, Dana Nau, Paolo Traverso, Automated Planning: Theory & Practice, The Morgan Kaufmann Series in Artificial Intelligence, 2004. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006. Mark Stefik, Introduction to Knowledge Systems, Morgan Kaufmann, 1995. E. Rich and K.Knight, Artificial Intelligence, Tata McGraw Hill, 1992.
ix	Name(s) of **Instructor(s)** ***	KK
x	Name(s) of **other Departments/ Academic Units to whom** the course is	No

xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give	No
x	Justification	AI is taught traditionally as it is driving force behind many concepts in computer science and it is also precursor to advanced courses like machine learning.

Name of Academic Unit: Chemistry
Level: UG
Programme: B. Tech.

i	**Title of the course**	Environmental studies
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	core
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Nil
vii	**Course Content**	Module A: Natural Resources, Ecosystems, Biodiversity and its conservation: Natural resources and ecosystems, Forest, grassland, desert and aquatic ecosystems, biodiversity at global, national and local levels, conservation of biodiversity Module B: Air Pollution Introduction to understanding air quality management, fundamental processes of meteorology, Air Pollutants – Gaseous and particulate, Criteria for pollutants, ambient and source standards, Aerosols: Characterisation of aerosols, size distributions, measurement methods; Transport behaviour: diffusion, sedimentation, inertia; Visibility; principles of particulate control systems. Module C: Water Treatment Discussion of water quality constituents and introduction to the design and operation of water and wastewater treatment processes. Module D: Solid Waste Management and Climate Change Different aspects of solid and hazardous waste management. Climate change and greenhouse gas emissions, technologies would reduce the greenhouse gas emissions. Climate change and its possible causes. Module E: Sociology/Environmentalism Description: Environmentalism in sociological tradition, Sustainability, North-South divide, Political economy approaches in environmental studies, Debates over environmental issues Module F: Economics Energy economics and financial markets, Market dynamics, Energy derivatives, Energy Efficiency; Sustainable Development: Concept, Measurement & Strategies, Interaction between Economic Development and the Environment Module G: Philosophy Environmental ethics, Deep ecology, Practical ecology, Religion and attitude towards environmental ethics, Ecofeminism and its evolution.

		Module H: Field work and project: visit to a local area to document environmental assets, case studies of a simple ecosystem and group discussions on current environmental issues.
viii	**Texts/References**	1) Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. 2) Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, Oxford University Press, New Delhi. 3) Jackson, A.R.W. and Jackson, J.M. (1996), Environmental Sciences: The Environment and Human Impact, Longman Publishers. 4) Nathanson, J.A., (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. 5) Redclift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology. 6)Srivastava, K.P. (2002), An Introduction to Environmental Study, Kalyani Publishers, Ludhiana. 7) Review articles from literature
ix	**Name(s) of Instructor(s)**	BLT
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Common for all branches
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	Nil
xii	**Justification/ Need for introducing the course**	