Course curriculum for Computer Science & Engineering -2021 Batch

Semester-III (2021 Batch)			
S. No	**Course code**	**Course name**	**Instructor**
1	CS 201	Data structures and algorithms	Prof. Koteswar Rao Kondepu
2	CS 203	Discrete structures	Prof. Prabuchandran K J
3	EE 221	Introduction to probability (First Half Semester)	Prof. Bharath B N
4	HS 201	Economics	Prof. Mohana Rao Balaga
5	CS 211	Data structures and algorithms lab	Prof. Koteswar Rao Kondepu
6	CS 213	Software Systems Lab	Prof. Tamal Das
7	EE 227	Data Analysis (Second Half Semester)	Prof. Naveen M B

Syllabus

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

i	**Title of the course**	CS 201 Data Structures and 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**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Computer Programming (CS 102)
vii	**Course Content**	**Introduction**: data structures, abstract data types, analysis of algorithms. **Creation and manipulation of data structures**: arrays, lists, stacks, queues, trees, heaps, hash tables, balanced trees, tries, graphs. Algorithms for sorting and searching, order statistics, depth-first and breadth-first search, shortest paths and minimum spanning tree.
viii	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Press and McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.
ix	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
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**	Basic course in data structures and algorithms.

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

i	**Title of the course**	CS 203 Discrete Structures
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**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	There are four modules in the course: **1) Proofs and structures** Introduction, propositions, predicates, examples of theorems and proofs, types of proof techniques, Axioms, Mathematical Induction, Well-ordering principle, Strong Induction, Sets, Russell's paradox, infinite sets, functions, Countable and uncountable sets, Cantor's diagonalization technique, Relations, Equivalence relations, partitions of a set. **2) Counting and Combinatorics** Permutations, combinations, binomial theorem, pigeon hole principle, principles of inclusion and exclusion, double counting. Recurrence relations, solving recurrence relations. **3) Elements of graph theory** Graph models, representations, connectivity, Euler and Hamiltonian paths, planar graphs, Trees and tree traversals. **4) Introduction to abstract algebra and number theory** Semigroups, monoids, groups, homomorphisms, normal subgroups, congruence relations. Ceiling, floor functions, divisibility. Modular arithmetic, prime numbers, primality theorems.
viii	**Texts/References**	1. Discrete Mathematics and its applications with Combinatorics and graph theory, 7th edition, by Kenneth H Rosen. Special Indian Edition published by McGraw-Hill Education, 2017. 2. Introduction to Graph Theory, 2nd Edition, by Douglas B West. Eastern Economy Edition published by PHI Learning Pvt. Ltd, 2002. 3. Discrete Mathematics, 2nd Edition, by Norman L Biggs. Indian Edition published by Oxford University Press, 2003.
ix	**Name(s) of Instructor(s)**	PRB

x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
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 is a fundamental and core course which forms thefoundations for all theory courses in Computer Science.

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

i	**Title of the course**	Introduction to Probability
ii	**Credit Structure (L-T-P-C)**	(3-0-0-3)
iii	**Type of course**	Core course for EE and elective for CS
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half SemesterCourse**	Half
vi	**Pre-requisite(s), if any (For the students) – specify coursenumber(s)**	Exposure to Calculus (MA 101)
vii	**Course content**	• **Introduction:** Motivation for studying the course, revision of basic math required, connection betweenprobability and length on subsets of real line, probability-formal definition, events and sigma- algebra, independence of events, and conditional probability, sequence of events, and Borel-Cantell Lemma. • **Random Variables:** Definition of random variables, and types of random variables, CDF, PDFand its properties, examples of random variables, random vectors and independence, brief introductionto transformation of random variables, introduction to Gaussian random vectors • **Mathematical Expectation:** Importance of averages through examples, definition of expectation, moments and conditional expectation,use of MGF, PGF and characteristic functions, variance and k-th moment. • **Inequalities and Notions of convergence:** Markov,Chebychev, Chernoff and Mcdiarmid inequalities, convergence in probability, mean, and almost sure. • Random Process: Example and formal definition, stationarity, autocorrelation, and cross correlation function, ergodicity, KL expansion, introduction tospecial random process such as Markov chains, Martinagale and Brownian motion. • **Markov Chain:** Communication classes and its properties, stationary distribution and its existence, Poisson processes, Example applications of Markovdecision process. Applications of the tools discussed in the course in electrical engineering and computerscience

viii	**Texts/References**	1. Robert B. Ash, ``Basic Probability Theory," Reprint of the John Wiley & Sons, Inc., New York, 1970 edition. 2. Sheldon Ross, ``A first course in probability," PearsonEducation India, 2002. 3. Bruce Hayek, ``An Exploration of Random Processes forEngineers," Lecture notes.
ix	**Name(s) of the Instructor(s)**	Naveen M B
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science and 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**	"Randomness" is inherent to most of the systems in electrical engineering. Especially, in the field of communication, the noise at the receiver brings in several challenges in designing systems that are immune to noise. To face this challenge, it is fundamental to model and understand the "randomness." This course is aimedat covering tools necessary to achieve this goal through several example applications in electrical and computer science engineering disciplines.

Name of Academic Unit: Humanities and Social Sciences
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	HS 201 Economics
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**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	Basic economic problems. resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfectcompetition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, andinvestments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balance payments, stabilization policies : Monetary, Fiscal andExchange rate policies.
viii	**Texts/References**	1. P. A. Samuelson & W. D. nordhaus, Economics,McGraw Hill, NY, 1995. 2. A. Koutsoyiannis, Modern Microeconomics,Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. 3. R. J. Gordon, Macroeconomics 4th edition, LittleBrown and Co., Boston, 1987. 4. William F. Shughart II, The Organization of Industry,Richard D. Irwin, Illinois, 1990. 5. R.S. Pindyck and D.L. Rubinfeld. Microeconomics (7^{th} Edition), Pearson Prentice Hall, New Jersey, 2009. 6. R. Dornbusch, S. Fischer, and R. Startz. Macroeconomics (9th Edition), McGraw-Hill Inc. NewYork, 2004.
ix	**Name(s) of Instructor(s)**	--

x	**Name(s) of other Departments/ Academic Units to whom the course isrelevant**	CSE, EE & ME
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 introducingthe course**	This course is a basic course on economics and useful for all students of B.Tech.

Name of Academic Unit: Computer Science and Engineering

Level: B. Tech.

Programme: B.Tech.

	Title of the course	CS 211 Data Structures and Algorithms 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)***	Exposure to Computer Programming (CS 102)
vii	**Course Content**	Laboratory course for CS 211 is based on creating and manipulating various data structures and implementation of algorithms.
viii	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Press and McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.
x	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
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**	Basic Laboratory course in data structures and algorithms.

Name of Academic Unit: Computer Science and Engineering

Level: B.Tech.

Programme: B.Tech.

i	**Title of the course**	CS 213 Software Systems Laboratory
ii	**Credit Structure (L-T-P-C)**	(1-3-0-8)
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)***	--
vii	**Course Content**	Vim/emacs HTML, CSS 2. Report and presentation software: latex, beamer, drawingsoftware (e.g. inkscape, xfig, open-office) 3. IDE (e.g. eclipse, netbeans), code reading, debugging Basic Java Java collections, interfaces 4. Java threads Java GUI Introduction to documentation: e.g. doxygen/javadocs 5. Version management: SVN/Git 6. Unix basics: shell, file system, permissions, process hierarchy, process monitoring, ssh, rsync 7. Unix tools: e.g. awk, sed, grep, find, head, tail, tar, cut, sort 8. Bash scripting: I/O redirection, pipes 9. Python programming 10. Makefile, libraries and linking 11. Graph plotting software (e.g., gnuplot) 12. Profiling tools (e.g., gprof, prof) 13. Optional topics (may be specific to individual students302222 projects): intro to sockets, basic SQL for datastorage,JDBC/pygresql A project would be included which touches upon many of the above topics, helping students see the connect across seemingly disparate topics. The project is also expected to be a significant load: 20-30 hours of work.
viii	**Texts/References**	1. Online tutorials for HTML/CSS, Inkscape, OODrawUnix Man Pages for all unix tools, Advanced Bash Scripting Guide from the Linux Documentation Project (www.tldp.org). 2. The Python Tutorial Online Book (http://docs.python.org/3/tutorial/index.html). 3. The Java Tutorials (http://docs.oracle.com/javase/tutorial/). 4. Latex - A document preparation system, 2/e, by Leslie Lamport, Addison-Wesley, 1994.
ix	**Name(s) of Instructor(s)**	PRB, RK, SRB
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA

xi	**Is/Are there any course(s) in the same/other academic unit(s) which is/ are equivalent to this course? If so, pleasegive details.**	No
xii	**Justification/ Need for introducingthe course**	This is a fundamental and core course which trains students on different programming platforms, as well as on basic software engineering principles.

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

i	**Title of the course**	Data Analysis
ii	**Credit Structure (L-T-P-C)**	(3-0-0-3)
iii	**Type of course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	--
vii	**Course content**	The role of statistics. Graphical and numerical methods for describing and summarizing data. Probability. Population distributions. Sampling variability and sampling distributions. Estimation using a single sample. Hypothesis testing a single sample. Comparing two populations or treatments. Simple linear regression and correlation. Case studies.
viii	**Texts/References**	1. Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Elsevier, New Delhi, 3rd edition (Indian), 2014. 2. Probability, Random Variables and Stochastic Engineers and Scientists by Sheldon M. Ross, processes by Papoulis and Pillai, 4th Edition, Tata McGraw Hill, 2002. 3. An Introduction to Probability Theory and Its Applications, Vol. 1, William Feller, 3rd edition, Wiley International, 1968.
ix	**Name(s) of the Instructor(s)**	Sudhanshu Shukla
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	CSE&ME
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**	Analyzing data and interpreting results are integral part of almost every research and it finds extensive use in industry as well. From Machine learning to Finance, its applications are enormous.