Semester IV						
SL. No	**Course code**	**Course name**	**L**	**T**	**P**	**C**
1	MA402T	Statistics	3	0	0	6
2	MA302T	Real Analysis	2	1	0	6
3	CS204T	Artificial Intelligence	3	0	0	6
4	CS201L	Artificial Intelligence Lab	0	0	3	3
5	CS301L	Computer Architecture Laboratory	0	0	3	3
6	CS302T	Computer Architecture	3	0	0	6
7		Elective				6
Total credits						**36**

1	**Title of the course (L-T-P-C)**	**Artificial Intelligence (3-0-0-6)**
2	**Pre-requisite courses(s)**	
3	**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 ain.
4	**Texts/References**	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.

1	**Title of the course (L-T-P-C)**	**Computer Architecture (3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The language of bits, assembly language, logic gates, registers, and memories, processor design, principles of pipelining, the memory system, multiprocessor systems, i/o and storage devices. each concept will be first taught on the basis of the fundamental driving principles. following this, real world examples (e.g., arm processors) will be used to emphasize the content.
4	**Texts/References**	• Computer Organization and Architecture, by Smruti Ranjan Sarangi, McGraw Higher Ed, 2017. • Computer Architecture a Quantitative Approach, Sixth edition, by David Patterson and John L. Hennesy, Morgan Kaufmann, 2017.

1	**Title of the course (L-T-P-C)**	**Artificial Intelligence Lab (0-0-3-3)**
2	**Pre-requisite courses(s)**	
3	**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.
4	**Texts/References**	**1.** Stuart J. Russel, Peter Norvig, **2.** Artificial Intelligence: A Modern Approach (3rd ed.). **3.** Upper Saddle River: Prentice Hall, 2010. **4.** Other references: N.J. Nilsson, Principles of Artificial Intelligence, Morgan Kaufmann, 1985. Malik Ghallab, Dana Nau, Paolo Traverso, **5.** 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.

1	**Title of the course (L-T-P-C)**	**Computer Architecture Laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The lab will closely follow the theory course. The idea is to have the students develop a software model of a simple processor, capturing both functionality and timing aspects. They will implement modules as the concepts are taught in class.
4	**Texts/References**	Nill

1	**Title of the course (L-T-P-C)**	**Real Analysis (2-1-0-6)**
2	**Pre-requisite courses(s)**	**Calculus and Linear Algebra or Instructor's consent**
3	**Course content**	Review of basic concepts of real numbers: Archimedean property, Completeness. Metric spaces, compactness, connectedness, (with emphasis on Rn). Continuity and uniform continuity. Monotonic functions, Functions of bounded variation; Continuous functions. Derivatives of functions and Taylor's theorem. Riemann integral and properties, characterization of Riemann integrable functions. Improper integrals, Gamma functions. Sequences and series of functions, uniform convergence and its relation to continuity, differentiation, and integration. Fourier series, pointwise convergenc, Fejer's theorem, Weierstrass approximation theorem.
4	**Texts/References**	**1.** W. Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill, 1983 **2.** T. Apostol, Mathematical Analysis, 2nd Edition, Narosa, 2002. **3.** S. Abbott, Understanding Analysis, 2nd Edintion, Springer Verlag New York, 2015 **4.** S. R. Ghorpade and B. V. Limaye, A course in Calculus and Real Analysis, 2nd Edition, Springer international publishing, 2018

1	**Title of the course (L-T-P-C)**	**Statistics (2-1-0-6)**
2	**Pre-requisite courses(s)**	**Probability or Instructor's Consent**
3	**Course content**	Introduction to Statistics with examples of its use; Descriptive statistics; Graphical representation of data: Histogram, Stem-leaf diagram, Box-plot; Exploratory statistical analysis with a statistical package; Basic distributions, properties; Model fitting and model checking: Basics of estimation, method of moments, Basics of testing, interval estimation; Distribution theory for transformations of random vectors; Sampling distributions based on normal populations: t, χ 2 and Fx distributions. Bivariate data, covariance, correlation, and least squares
4	**Texts/References**	**1.** Lambert H. Koopmans: An introduction to contemporary statistics. David S Moore, George P McCabe, and Bruce Craig: Introduction to the Practice of Statistics **2.** Larry Wasserman: All of Statistics. A Concise Course in Statistical Inference. **3.** John A. Rice: Mathematical Statistics and Data Analysis **4.** Robert V. Hogg, J.W. McKean, and Allen T. Craig: Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, Asia. **5.** Edward J Dudewicz and Satya N. Mishra: Modern Mathematical Statistics, Wiley.