Chemical and Biochemical Engineering

Semester VI						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CL301T	Introduction to Transport Phenomena	3	0	0	6
2	CL301C	Numerical Methods in Chemical Engineering	3	0	0	6
3	--	Program Elective-I	3	0	0	6
4	CL302L	Chemical Engineering Lab III	0	0	3	3
4	CS204L	Artificial Intelligence	3	0	0	6
5	CS201L	Artificial Intelligence Lab	0	0	3	3
		Total Credits				**30**

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1	**Title of the course** (L-T-P-C)	**Introduction to Transport Phenomena** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Introduction: Vectors/Tensors, Viscosity, Shell balance: Falling film, Circular tube; Equations of Change for isothermal systems: Continuity, Motion, Energy, Substantial derivatives; Unidirectional flows: Pipe flow, Variable viscosity falling film, Couette viscometer, Rotating Sphere; Unsteady flows: Startup Plate flow, Parallel plates, Oscillating plate; Thermal conductivity and mechanism of energy transport; Shell energy balances and temperature distributions in solids and laminar flow; The equations of change for nonisothermal systems; Diffusivity and the mechanisms of mass transport; Concentration distributions in solids and laminar flow; Equations of change for multicomponent systems; Introduction to the concept of heat and mass transfer coefficients.
4	**Texts/References**	1. R.B.Bird, W.E. Stewart and E.N. Lightfoot, Transport Phenomena, 2nd ed., Wiley, 2006

1	**Title of the course** (L-T-P-C)	**Numerical Methods in Chemical Engineering** **2-0-2-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Solution of simultaneous linear and non-linear equations; Eigenvalues and eigenvectors of matrixes; Statistical analysis of data; Curve fitting; Approximation of functions; Interpolation; Numerical integration and differentiation, solutions of cubic equations of state, P-x-y diagram using gamma-phi approach Solution of ordinary differential equations - initial and boundary value problems, Batch and stirred tank reactors, Chemical reaction and diffusion in pore problems, Tubular reactor with first and second order reactions, Chemical reaction and diffusion in a spherical catalyst pellet problem Solution of partial differential equations; Analysis of error and stability in numerical computing. One dimensional transient heat conduction, transient conduction rectangle/sphere/cylinder Implementation of numerical methods on computer through programming in FORTRAN/C++ and commercial software such as MATLAB.
4	**Texts/References**	**1.** S. C. Chapra and R. P. Canale, Numerical methods for engineers (8th ed), Tata McGraw- Hill, 2021. **2.** S. K. Gupta, Numerical methods for engineers (3rd ed), New Age International, 2015 **3.** F. Gerald, and P. O. Wheatley, Applied numerical methods (7th ed), Pearson Education, 2022. **4.** R. M. Somasundaram and R. M. Chandrasekaran, Numerical methods with C++ programming, Prentice-Hall of India, 2005. **5.** Numerical Methods for Chemical Engineering, Applications in MATLAB, Kenneth J. Beers, Cambridge University Press, 2007

1	**Title of the course** (L-T-P-C)	**Chemical Engineering Lab III (mass transfer and reaction engineering) (0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	*Mass transfer*: Experiments on hydrodynamics of a packed column, Differential distillation, drying, Cooling tower, gas liquid absorption *Reaction engineering*: Experiments on esterification kinetics, Batch reactive distillation, mi-cellar catalysis, homogeneous reaction, metal recovery from dilute solutions, reaction in CSTR, reaction in PFR
4	**Texts/References**	

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)	**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**	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.