BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

Curriculum and Syllabus

B. Tech (Computer Science & Engineering/ Computer Science & Technology) from the Admission Batch

2018-19

Semester (6th)

Sixth Semester							
Theory							
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Evaluation**
1	PC	RCS6C001	Software Engineering	3-0-0	3	100	50
2	PC	RCS6C002	Compiler Design	3-0-0	3	100	50
3	BS		Optimization in Engineering	3-0-0	3	100	50
4	PE		Real-Time System	3-0-0	3	100	50
			Wireless Sensor Networks	3-0-0			
			Cloud Computing	3-0-0			
5	OE		Analog and Digital Communication	3-0-0	3	100	50
			Numerical Methods	3-0-0			
			Control System	3-0-0			
6	MC*	RIK6F001	Essence of Indian Knowledge Tradition - I	3-0-0	0	-	100 (Pass mark is 37)
Total Credit (Theory)					**15**		
Total Marks						**500**	**250**
Practical							
1	PC	RCS6C201	Software Engineering Lab	0-0-3	2		100
2	PC	RCS6C202	Compiler Design Lab	0-0-3	2		100
3	PSI		Future Ready Contributor Develop Model Lab	0-0-3	2		100
4	PSI		Seminar - I	0-0-3	1		100
Total Credit (Practical)					**7**		
Total Semester Credit					**22**		
Total Marks							**400**
SUMMER ENTERNSHIP TRAINING FOR 45 DAYS							

***Mandatory Non-Credit Courses (MC) result will be reflected with Pass (P) / Fail (F) grade. Thus the grade obtained will not be affecting the grade point average. However it shall appear on the grade sheet as per AICTE rule.**

5th Semester	RCS6C001	Software Engineering	L-T-P 3-0-0	3 Credits

Objectives

- To introduce concepts in software engineering
- To identify different software development models
- To apply software engineering knowledge in real-world problem solving

Module I: **(09 hours)**

Software Process Models:

Software Product, Software crisis, Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping mode, evolutionary model, spiral model, RAD model, Agile models: Extreme Programming, and Scrum.

Module II: **(09 hours)**

Software Requirements Engineering:

Requirement Gathering and Analysis, Functional and Non-functional requirements, Software Requirement Specification (SRS), IEEE 830 guidelines, Decision tables and trees. Structured Analysis & Design: Overview of design process, High-level and detailed design, Cohesion and coupling, Modularity and layering, Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure Chart, Basic concepts of Object Oriented Analysis & Design. User interface design, Command language, menu and iconic interfaces.

Module III: **(09 hours)**

Coding and Software Testing Techniques: Coding, Code Review, documentation. Testing: - Unit testing, Black-box Testing, White-box testing, Cyclomatic complexity measure, coverage analysis, mutation testing, Debugging techniques, Integration testing, System testing, Regression testing. Software Reliability and Software

Module IV: **(09 hours)**

Maintenance:

Basic concepts in software reliability, reliability measures, reliability growth modelling, Quality SEI CMM, Characteristics of software maintenance, software reverse engineering, software reengineering, software reuse. Emerging Topics: Client-Server Software Engineering, Service-oriented Architecture (SOA), and Software as a Service (SaaS)

Outcomes

- Ability to relate practical problems to software engineering concepts
- Ability to model problems using standard software development models
- Ability to apply software engineering skills in real-world problem solving

Books:

[1] Fundamentals of Software Engineering, Rajib Mall , 5th Ed, PHI, 2018.

[2] Software Engineering, A Practitioner's Approach, Roger S. Pressman , 8th Ed, TMG

Hill. 2019

[3] Software Engineering, I. Sommerville, 9th Ed., Pearson Education, 2011

Digital Learning Resources:

Course Name:	Software Engineering
Course Link:	https://nptel.ac.in/courses/106/105/106105182/
Course Instructor:	Prof. Rajib Mall, IIT Kharagpur

Course Name:	Software Engineering
Course Link:	https://nptel.ac.in/courses/106/101/106101061/
Course Instructor:	Prof. N.L. Sarda, Prof. R. K Joshi, Prof. U. Bellur IIT Bombay

6th Semester	RCS6C002	Compiler Design	L-T-P 3-0-0	3 Credits

Objectives

- To learn fundamentals of compiler
- To understand different phases of compiler design
- To know the details of each phase of compiler design

Module I: **(10 hours)**

Introduction: Overview and Phases of compilation. Lexical Analysis: Non-Deterministic and Deterministic Finite Automata (NFA & DFA), Regular grammar, Regular expressions and Regular languages, Design of a Lexical Analyzer as a DFA, Lexical Analyzer generator. Syntax Analysis: Role of a Parser, Context free grammars and Context free languages, Parse trees and derivations, Ambiguous grammar. Top Down Parsing: Recursive descent parsing, LL (1) grammars, Non-recursive Predictive Parsing, Error reporting and Recovery. Bottom Up Parsing: Handle pruning and shift reduces Parsing, SLR parsers and construction or SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, Parsing using Ambiguous grammars, Error reporting and Recovery, Parser generator

Module II: **(6 hours)**

Intermediate Code Generation: DAG for expressions, Three address codes - Quadruples and Triples, Types and declarations, Translation of Expressions, Array references, Type checking and Conversions, Translation of Boolean expressions and control flow statements, Back Patching, Intermediate Code Generation for Procedures.

Module III: **(10 hours)**

Code Generation: Factors involved, Registers allocation, Simple code generation using STACK Allocation, Basic blocks and flow graphs, Simple code generation using flow graphs. Code Optimization: Objective, Peephole Optimization, and Concepts of Elimination of local common sub-expressions, Redundant and un-reachable codes, Basics of flow of control optimization.

Module IV: **(10 hours)**

Run Time Environment: Storage Organizations, Static and Dynamic Storage Allocations, STACK Allocation, Handlings of activation records for calling sequences. Syntax Directed Translation: Syntax Directed Definitions (SDD), Inherited and Synthesized Attributes, Dependency graphs, Evaluation orders for SDD, Semantic rules, Application of Syntax Directed Translation. Symbol Table: Structure and features of symbol tables, symbol attributes and scopes.

Outcomes

- Ability to learn fundamentals of compiler
- Ability to understand different phases of compiler design
- Ability to know the details of each phase of compiler design

Books:

[1] Compilers – Principles, Techniques and Tools, A. V. Aho, M. S. Lam, R. Sethi, J. D. Ullman, 2nd Ed., Pearson. 2007

[2] Modern Compiler Design, D. Galles, 1st Ed., Pearson Education,2004

[3] Advanced Compiler Design & Implementation, S. S. Muchnick, Morgan Kaufmann, 1997

Digital Learning Resources:

Course Name:	Compiler Design
Course Link:	https://onlinecourses.nptel.ac.in/noc21_cs07/preview
Course Instructor:	Prof. Santanu Chattopadhyay,

Course Name:	Compiler Design
Course Link:	https://nptel.ac.in/courses/106/104/106104123/
Course Instructor:	Prof. S. K. Aggarwal

6th Semester		Optimization in Engineering	L-T-P 3-0-0	3 Credits

Module I: **(10 Hours)**

Idea of Engineering optimization problems, Classification of optimization algorithms, modeling of problems and principle of modeling. Linear Programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming.

Module II: **(10 Hours)**

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method. **Assignment problems:** Hungarian method for solution of Assignment problems. Integer Programming: Branch and Bound algorithm for solution of integer programming problems.

Module III: **(12 Hours)**

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming.

Module IV: **(6 Hours)**

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, multiple server, Finite sources, Queue discipline.

Books:

[1] Operations Research- Principle and Practice, A. Ravindran, D. T. Philips, J. Solberg, Second edition, Wiley India Pvt Ltd.
[2] Operation Research, Prabhakar Pai ,Oxford University Press
[3] Operations Research, Kanti Swarup, P. K . Gupta, Man Mohan, Sultan Chand & Sons, Nineteenth Edition, 2018.
[4] Operations Research, H.A. Taha, A.M.Natarajan, P. Balasubramanie, A. Tamilarasi, Pearson Education, Eighth Edition.
[5] Engineering Optimization, S S Rao, New Age International Pvt Ltd, 2003.
[6] Linear and Non-linear Optimization, **S**tephen G. Nash, A. Sofer, McGraw Hill, 2nd Edition.
[7] Engineering Optimization, A. Ravindran, K.M. Ragsdell, G.V. Reklaitis, Wiley India Pvt. Ltd, Second edition.
[8] Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition, 2005.
[9] Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.

Digital Learning Resources:

Course Name	CONSTRAINED AND UNCONSTRAINED OPTIMIZATION
Course Link	https://nptel.ac.in/courses/111/105/111105100/
Course Instructor	PROF. ADRIJIT GOSWAMI, PROF. DEBJANI CHAKRABORTY Department of Mathematics IIT Kharagpur

6th Semester	RCS6D001	Real-Time System	L-T-P 3-0-0	3 Credits

Objectives

- To understand concepts of real-time system
- To understand resource sharing and dependencies among real-time tasks
- To understand real-time OS and Database

Module-I: **(09 Hours)**

Introduction: What is real-time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations

Module-II: **(09 Hours)**

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

Module-III: **(09 Hours)**

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

Module IV **(09 Hours)**

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.

Outcomes

- Ability to understand concepts of real-time system
- Ability to analyze real-time OS
- Ability to work out real-time database

Books:

[1] Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.
[2] Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000

[3] C.M. Krishna and K.G. Shin, Real-Time Systems, TMH, 2017

Digital Learning Resources:

Course Name:	Real Time Systems
Course Link:	https://nptel.ac.in/courses/106/105/106105036/
Course Instructor:	Prof. Rajib Mal, IIT, Kharagpur

6th Semester	RCS6D002	Wireless Sensor Networks	L-T-P 3-0-0	3 Credits

Objectives

- To learn fundamentals and application of WSN
- To learn various protocols of WSN
- To understand security issues in WSN

Module-I: **(10 hours)**

Introduction: Definitions and Background, Challenges and Constraints, Applications. (Structural Health Monitoring, Habitat Monitoring, Smart Transportation, Health Care, Pipeline Monitoring, Precision Agriculture, Active Volcano, Underground Mining, Tracking Chemical Plumes).Node Architecture: The Sensing Subsystem, the Processor Subsystem, Communication Interfaces, Prototypes, Operating Systems: Functional Aspects, Non-functional Aspects, and Prototypes.

Module-II: **(10 hours)**

Basic Architectural Framework: Physical Layer: Basic Components, Source and Channel Encoding, Modulation, signal Propagation. Medium Access Control: Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols. Network Layer: Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols

Module-III: **(09 hours)**

Node and Network Management: Power Management: Local Power Management Aspects, Dynamic Power Management and Conceptual Architecture. Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in WSN, Basics of Time Synchronization, Time Synchronization Protocols. Localization: Ranging Techniques, Coarse-grained and Fine-grained node localization, Range-Based Localization, Range-Free Localization, Event-Driven Localization

Module-IV: **(09 hours)**

Security: Challenges of Security in WSN, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, Introduction to IEEE 802.15.4 and Zig Bee Security. Sensor Network Databases: Sensor Database Challenges, Querying the physical environment, Query interfaces, High-level database organization, In-network Aggregation, Data Centric Storage, Distributed and Hierarchical aggregation. Introduction to discrete event network simulators.

Outcomes

- Ability to learn fundamentals and application of WSN
- Ability to learn various protocols of WSN
- Ability to understand security issues in WSN

Books:

[1] Fundamentals of Wireless Sensor Network: Theory and Practice: Waltenegus Dargie and Christian Poellabauer, Wiley Publication, 2010

[2] Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004

Digital Learning Resources:

Course Name:	Wireless Adhoc and Sensor Networks
Course Link:	https://nptel.ac.in/courses/106/105/106105160/
Course Instructor:	Prof. Sudip Misra, IIT Kharagpur

6th Semester	RCS6D003	Cloud Computing	L-T-P 3-0-0	3 Credits

Objectives

- To understand the fundamentals of cloud computing
- To understand the architecture of various cloud
- To understand the simulation of cloud system using some state-of-the-art platforms

Module I: **(10 Hours)**

Evolution of Computing Paradigms - Overview of Existing Hosting Platforms, Grid Computing, Utility Computing, Autonomic Computing, Dynamic Data center Alliance, Hosting / Outsourcing, Introduction to Cloud Computing, Workload Patterns for the Cloud, "Big Data", IT as a Service, Technology Behind Cloud Computing

Module II: **(10 Hours)**

A Classification of Cloud Implementations- Amazon Web Services - IaaS, The Elastic Compute Cloud (EC2), The Simple Storage Service (S3), The Simple Queuing Services (SQS), VMware vCloud - IaaS, vCloud Express, Google AppEngine - PaaS, The Java Runtime Environment

Module III: **(10 Hours)**

The Python Runtime Environment- The Datastore, Development Workflow, Windows Azure Platform - PaaS, Windows Azure, SQL Azure, Windows Azure AppFabric, Salesforce.com - SaaS / PaaS, Force.com, Force Database - the persistency layer, Data Security, Microsoft Office Live - SaaS, LiveMesh.com, Google Apps - SaaS, A Comparison of Cloud Computing Platforms, Common Building Blocks.

Module IV: **(10 Hours)**

Cloud Security – Infrastructure security – Data security – Identity and access management Privacy- Audit and Compliance

Outcomes

- Ability to develop the fundamentals of cloud computing
- Ability to understand architecture of cloud
- Ability to comprehend, design, and develop cloud system using some state-of-the-art platform

Books:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012
2. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
3. R. Buyya, C. Vecchiola and S. Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.
4. P. K. Pattnaik, M. R. Kabat and S. Pal, Fundamentals of Cloud Computing, Vikas Publishing House Pvt. Ltd., 2015.

Digital Learning Resources:

Course Name: Cloud Computing
Course Link: https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Course Instructor: Prof. Soumya Kanti Ghosh, IIT Kharagpur

Course Name: Cloud Computing and Distributed Systems
Course Link: https://onlinecourses.nptel.ac.in/noc21_cs15/preview
Course Instructor: Prof. Rajiv Misra, IIT Patna

6^{th} Semester		**Analog and Digital Communication**	**L-T-P 3-0-0**	**3 Credits**

Objectives

- To understand parallel computing algorithms and models
- To analyze parallel algorithms for PRAM machines and various interconnection networks
- To understand parallel programming in MPI and POSIX

Module I: (4 hours)

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Module II: (10 hours)

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation.

Module III: (12 hours)

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Module IV: (6 hours)

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

Module V: (10 hours)

Digital Modulation trade-offs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Books:

[1] Haykin S., "Communications Systems", John Wiley and Sons, 2001.
[2] Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
[3] Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001.
[4] Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering", John Wiley, 1965.
[5] Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
[6] Proakis J.G., " Digital Communications", 4th Edition, McGraw Hill, 2000.

Digital Learning Resources:

Course Name:	Analog communication
Course Link:	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee46
Course Instructor:	Prof. Goutam Das, IIT Kharagpur
Course Name:	Modern Digital Communication Techniques
Course Link:	https://nptel.ac.in/courses/117/105/117105144/
Course Instructor:	Prof. S.S. Das, IIT Kharagpur
Course Name:	Communication Engineering
Course Link:	https://nptel.ac.in/courses/117/102/117102059/
Course Instructor:	Prof. Surendra Prasad, IIT Delhi

6^{th} Semester		**Numerical Methods**	**L-T-P 3-0-0**	**3 Credits**

Module I: **(12 Hours)**

Approximation of numbers, Significant figures, Accuracy and precision, Error definition, Round off errors, Error propagation, Total numerical error Roots of equation: Bisection ethos, False-position method, Fixed point iteration, Newton-Raphson method, Secant method, Convergence and error analysis, System of non-linear equations Linear algebraic equation: LU decomposition, The matrix inversion, Error analysis and system conditions, Gauss-Siedel method

Module II: **(12 Hours)**

Interpolation: Newton's divided difference interpolating polynomial, Lagrange interpolating polynomial, Spline interpolation. Numerical integration: The Trapezoidal rule, Simpson's rule, Newton-Cotes algorithm for equations, Romberg integration, Gauss quadrature

Module III: **(12 Hours)**

Ordinary differential equation: Euler method, Improvement of Euler's method, RungeKutta methods, System of equations, Multi step methods, General methods for boundary value problems, Eigen value problems (Algorithm and error analysis of all methods are included)

Books:

[1] S.C. Chapra, R.P.Canale," Numerical methods for Engineers", Fifth edition, THM Publication.
[2] S. Kalavathy, " Numerica methods", Thomson/ Cengage India
[3] K.E. Atkinson," Numerical analysis," Second edition, John Wiley & Sons.

Digital Learning Resources:

Course Name:	Numerical Analysis
Course Link:	https://nptel.ac.in/courses/111/107/111107062/
Course Instructor:	Dr. Sandip Banerjee, Prof. Roshan Lal, IIT Roorkee

6th Semester		**Control System**	**L-T-P 3-0-0**	**3 Credits**

Module I: **(5 hours)**

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Negative Feedback. Block diagram algebra. Signal Flow Graph and Mason's Gain formula.

Module II: **(10 hours)**

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-ordersystems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Module III: **(7 hours)**

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist stability criterion – gain and phase margins. Closed-loop frequency response: Constant M Circle, Constant N Circle, Nichols Chart.

Module IV: **(10 hours)**

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Tuning of PID controllers, Lead and Lag and Lag-Lead compensator design.

Module V: **(10 hours)**

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Books:

[1] I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
[2] K. Ogata, "Modern Control Engineering", Prentice Hall, 1991
[3] M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
[4] B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

Digital Learning Resources:

Course Name: Control System Engineering
Course Link: https://nptel.ac.in/courses/108/102/108102043/
Course Instructor: Prof. M Gopal, IIT Delhi

6th Semester	RIK6F001	Essence of Indian Knowledge Tradition-1	L-T-P 3-0-0	0 Credits

Course Objective:

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and

nature. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

Course Outcomes:

- Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Course Content:

- Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

3. Fritzof Capra, Tao of Physics

4. Fritzof Capra, The wave of Life

5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am

6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016

8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016 9. P R Sharma (English translation), Shodashang Hridayam

6th Semester	**RCS6C201**	**Software Engineering Lab**	**L-T-P 0-0-3**	**2 Credits**

Experiment1: Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)

Experiment 2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required)

Experiment 3: Develop structured design for the DFD model developed

Experiment 4: Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)

Experiment 5: Develop Sequence Diagrams.

Experiment 6: Develop Class diagrams.

Experiment 7: Develop code for the developed class model using Java.

Experiment 8: Use testing tool such as Junit.

Experiment 9: Use a configuration management tool.

Experiment 10: Use any one project management tool such as Microsoft Project, Gantt Project or ProjectLibre.

Digital Learning Resources:

Virtual Lab Link: http://vlabs.iitkgp.ernet.in/se/

6th Semester	RCS6C202	Compiler Design Lab	L-T-P 0-0-3	2 Credits

This lab is divided in to two parts namely part 1 and part 2. All programs in part 1 must be written using C/C++. Programs related to lexical analyzer and parser must use Flex(Fast Lex) and Yacc available in all modern versions of UNIX and Linux distributions. For part 2, a

simulator JFLAP is required to be installed. JFLAP works much like a black box and used to hide all implementation details and thus should only be used after students. JFLAP is available online at http://www.jflap.org/.

PART 1

1. Using JFLAP, create a DFA from a given regular expression. All types of error must be checked during the conversion.

2. Read a regular expression in standard form and check its validity by converting it to postfix form. Scan a string and check whether the string matches against the given regular expression or not.

3. (Tokenizing). A programs that reads a source code in C/C++ from an unformatted file and extract various types of tokens from it (e.g. keywords/variable names, operators, constant values).

4. Read a regular expression in its standard form and find out an Ɛ-NFA from it. Need to use adjacency list data structure of graph to store NFA. Thompson's construction needs to be used too. [2 labs]

5. Evaluate an arithmetic expression with parentheses, unary and binary operators using Flex and Yacc.[Need to write yylex() function and to be used with Lex and yacc.]

6. (Tokenizing) Use Lex and yacc to extract tokens from a given source code.

PART 2

7. Write a suitable data structure to store a Context Free Grammar. Prerequisite is to eliminate left recursion from the grammar before storing. Write functions to find FIRST and FOLLOW of all the variables.[May use unformatted file / array to store the result].

8. Using JFLAP create LL(1) parse table for a given CFG and hence Simulate LL(1) parsing.

9. Using JFLAP create SLR(1) parse table for a given grammar. Simulate parsing and output the parse tree proper format.

Digital Learning Resources:

Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/system_deligators/labs/index.php

6th Semester		**Future Ready Contributor Develop Model Lab**	**L-T-P 0-0-3**	**2 Credits**

Outcomes: The Future-ready Contributor Program aims to accomplish the following outcomes in the lives of students–

- Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
- Build their confidence with which they can go into any job and contribute meaningfully.
- Improve their ability to engage better in the workplace and to be able to handle the challenges that come up there.
- Build their career-worthiness and help them develop into future-ready contributors with ability to navigate a career in a volatile, changing world.
- Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
- Enable them recognize how they as technical professionals, can participate and make a positive contribution to their communities and to their state.

The Program content is also designed to expose students to real-world workplace scenarios and sensitize them to some of the challenges faced in society around them, especially in the local communities around them and in their own state of Odisha.

The Contributor Program syllabus has been evolved and fine-tuned over several years, to –

a) address the changing need and contemporary challenges being faced by industry and what employers of today are looking for in the people they hire;
b) working extensively with universities and students and an appreciation of their challenges and concerns;
c) guided by the higher ideas and principles of practical Vedanta in work.

Sr. No.		Content	Total Hrs
1	**Part 1 : Developing self-efficacy and basic inner strength**	**Who is a Future-ready Contributor?** *In this topic, students understand the new work environment, expectations from future workforce, and importance of being a future-ready contributor. This enables students to*	3 hrs lab sessions (discovery-based facilitator led)

		transform their expectation of themselves in work	
2		**Self-esteem & Growth Identity** *In this topic, students learn how to develop a deeper and more resilient self esteem and how to adopt a growth identity/ mindset, that is more appropriate to the demands of the future workplace.*	Same as above
3		**Become a Creator of one's destiny** *In a "victim stance", we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the "creator of destiny stance" to challenges and situations. This stance helps them take ownership & responsibility to shape destiny, build a new future & find answers to challenges; and stop being complainers.*	Same as above
4	**Part 2 : Building ability to make more effective career choices**	**Achieving Sustainable Success** *In this topic, students discover how to achieve sustainable or lasting success, by making themselves success-worthy. Where their focus shifts to building one's "engine of success" rather than being on chasing the "fruits of success". This is important, because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruits of success, fall prey to disappointment, loss in motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not. This helps them make better choices in life, that leads to steady success & long-term career fulfillment in an uncertain world.*	Same as above
5		**Career Development Pathways for a changing world** *In this topic, students explore a range of diverse "career development models" and the possibilities for contribution each opens up to them. This helps them open up hidden opportunities that such an environment offers. And free themselves from a herd mentality*	Same as above

		when making career choices.	
6		**Make an impact in every part of one's life** *In this topic, students learn how to expand the contribution possible in any role they have. This helps them take charge of own career growth & discover their power to contribute in any role or job.*	Same as above
7	**Part 3 : Building ability to become solution and value creating individuals in the world**	**Think Solutions** *The market environment in which organizations are operating, is becoming increasingly dynamic and uncertain. So, employers are increasingly seeking out people who can innovate and figure out solutions in the face of any challenge (unlike in the past when it was the people who were most efficient and productive, who were valued by organizations). At the heart of innovation lies this way of thinking of "finding solutions" rather than "seeing problems or roadblocks". Students learn how to build this way of thinking, in this topic.*	Same as above
8		**Value Thinking** *Companies are also looking for employees who do not just work hard, or work efficiently or productively - but those who will make a valuable difference to the fortunes of the company. This difference may come from innovation, but it may also come from focusing on the right things and identifying what really matters – both to the company and to the customers. In this topic, students learn how to build this capability.*	Same as above
9		**Engaging Deeply** *The environment we live in is becoming increasingly complex because more and more things are getting interconnected, new fields are emerging, technologies are rapidly changing, capabilities and knowledge one is trained in will become fast obsolete. In such a scenario, the student's ability to quickly understand and master what is going on, dive deep, get involved in any area, rapidly learn new capabilities that a job demands, is important. In this topic, students learn how to engage deeply. Learning how to dive deep, to quickly understand what is going on, get*	Same as above

		involved in any area, and rapidly learn.	
10	**Part 4 : Building ability to work collaboratively and as good citizens of organizations and the country**	**Enlightened self-interest & collaboration at work** *The changing nature of work in organizations and in the global environment, is increasingly demanding that people work more collaboratively towards shared goals and more sustainable goals. A key to working successfully when multiple stakeholders are involved, is "thinking in enlightened self-interest". In this topic, students learn how to widen their thinking from "narrow self-interest" to "enlightened self-interest" to work more effectively in teams & collaboratives.*	Same as above
11		**Human-centered thinking & Empathy** *In this topic, students learn to recognize & respond to human needs and challenges – the way of thinking at the heart of user-centric designs & customer-centricity.*	Same as above
12		**Trust Conduct** *The biggest currency in a sustainable career is "trust" i.e. being trusted by team members, bosses, customers. When we are trusted, people listen to us, they are willing to give us the chance to grow, give us the space to make mistakes, and work seamlessly with each other without always having to "prove ourselves". In this topic, students learn how to build trust with people they engage with.*	Same as above
Contribution Project Lab Sessions		*3 Contribution projects that help them apply contributor thinking. After students complete their project work (beyond the classroom), each project ends with this 3 hr lab session where they build their project output and present.*	9 hrs (3 hr lab sessions for each of 3 projects)
Project work		*The above Contribution Projects require research, and may need field work beyond the classroom that students are expected to do.*	Beyond classroom

Lab Sessions:

- Students will have to attend twelve discovery-based lab sessions to build new models of thinking & capacities (3 hrs per module)
- They will work closely with their peers to discuss and understand these new models of thinking.
- Their learning will be facilitated by trained college faculty.

Contribution Projects

- Three contribution projects that help them apply contributor thinking
- These will require research and also may need field work
- Each ends with a 3 hr lab session where they build their project output and present