

Bharatiya Vidya Bhavan's  
**Sardar Patel Institute of Technology**  
(Autonomous Institute Affiliated to University of Mumbai)



**Bachelor of Engineering/Technology (B.E./B.Tech)**  
**in**  
**Information Technology**

**Final Year Engineering**  
**(Sem. VII and Sem. VIII)**  
**Effective from Academic Year 2017 -18**



# Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India  
(Autonomous Institute Affiliated to University of Mumbai)

## Preamble:



Concept of academic autonomy is based on the argument that Institutions can undertake the work expected of them by all stakeholders such as Students , Parents , University , Industry , Society in general, only if they have freedom of choice and action.

We at S.P.I.T. would like to believe that this freedom of choice and action as far as academics is concerned will make us more Proactive in our offerings.

An academic autonomy is as good as its Curricula and execution of it is as well as its faculty. S.P.I.T. is confident of succeeding on both the fronts.

In the first offering we have tried to pro-actively bridge the ever discussed “Industry-academic gap” by way of our SCOPE program. The issue about sensitizing students to social needs is being addressed by special activity based courses. Liberal arts courses have been introduced to enhance functionality of both sides of brain. In all this the professional core has not been overlooked. Thus the curricula are designed to achieve multi dimensional outcomes.

The evaluation mechanism is tuned for assessing the attainment of the designed outcomes and is designed as a fair mechanism.

As our learning cycle begins from July 2017, I wish to place on record that entire S.P.I.T. staff and faculty will work with singular focus and commitment towards the success of this endeavour.

**Dr. Prachi Gharpure**  
**Principal, S.P.I.T.**



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## From the Desk of Dean Academics



Greetings and congratulations to all the students, teaching and supporting staff of Sardar Patel Institute of Technology for getting autonomous status to the institute from the year 2017-18. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Indian Society and Industries.

In the proposed curriculum we have made an attempt to provide opportunity for students to develop themselves as competent engineering graduates with knowledge, skill and ethical behavior required for global career. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. The curriculum model is outcome based that focuses on learning by doing. This is achieved through activity based learning, minor projects, problem solving and innovative styles of pedagogy. Various steps are taken to transform teaching-learning process to make learning a joyful experience for students. Special laboratory based courses are introduced to give more practical exposure to the students.

To create socially responsible citizen curriculum offers courses like Constitution of India, Environmental Studies and Human Health Systems Approach. Also various activity based learning modules like 'Building Automation, Fire Safety and Electronic Security', 'Occupational Safety & Legal Studies for Engineers', 'Technical Presentation Skills', 'Technical Paper and Patent Drafting', 'Engineering Solution for Environmental Problems' and 'Financial Planning, Taxation Policies and Investment' are introduced. For overall development of the learner, various elective courses like Yoga Vidya, Music Appreciation, Dramatics, Industrial and Organizational Psychology, Law for Engineers, French Language, German Language etc. are introduced. To encourage interdisciplinary studies institute level Open Elective courses are offered.

One of the special feature of this curriculum is Skill development programme called SCOPE (Skill Certification for Outcome-Based Professional Education) planned to enhance employability, innovation and research culture in the institute. Every department is offering six domain specific tracks, each track containing six courses. Student will have an opportunity to enroll for more than 140 courses in any of the department of his choice. Some of the courses under SCOPE will be delivered in co-ordination with industries.

We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units. Faculty of S.P.I.T. deserves a special appreciation for their relentless efforts in designing curriculum and assessment instruments which will bring transformation in the quality and transparency in assessment of learners.

Looking forward for your active cooperation and constructive feedback to create vibrant and joyful learning environment at Sardar Patel Institute of Technology.

**Dr. Surendra Singh Rathod**  
**Professor and Dean Academics**



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## Message from Head of the Department



Change is the only constant thing in the Information Technology arena. In order to adapt to those changes curriculum design needs to be holistic. Curriculum comprising of Basic Science and Engineering, Professional core and electives are essential. Apart from this, knowledge of other multi-disciplinary domains give a broad outlook. Contemporary issues can have innovative solutions if the problems are seen in different perspectives. Hence open elective courses, liberal arts, legal, ethical practices are included as mandatory courses. To bridge the gap between industry and academia skill development courses are introduced.

Information Technology Curriculum follows the five pillars suggested by ACM as basic streams in our Professional core and electives with strong Information Technology foundation courses. Programming, Networking, Human Computer Interaction, Databases and Web systems are the pillars, all under the umbrella of Information assurance and security.

**Dr. Radha Shankarmani**

**Head of Information Technology Department**



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**Scheme for B.E./B.Tech. Information Technology (SEM. VII & VIII)**

| SEM. VII    |                                 |                            |   |    |               |
|-------------|---------------------------------|----------------------------|---|----|---------------|
| Course Code | Course Name                     | Teaching Scheme (Hrs/week) |   |    | Credits Total |
|             |                                 | L                          | T | P  |               |
| ITC701      | Software Project Management     | 4                          | - | -  | 4             |
| ITC702      | Cloud Computing                 | 3                          | - | -  | 3             |
| ITC703      | Intelligent System              | 4                          | - | -  | 4             |
| ITC704      | Wireless Technology             | 4                          | - | -  | 4             |
| ITC705      | Elective-I                      | 4                          | - | -  | 4             |
| ITL701      | Software Project Management lab | -                          | - | 2  | 1             |
| ITL702      | Cloud Computing lab             | -                          | - | 2  | 1             |
| ITL703      | Intelligent System lab          | -                          | - | 2  | 1             |
| ITL704      | Wireless Technology lab         | -                          | - | 2  | 1             |
| ITT705      | Elective-I                      | -                          | - | 2  | 1             |
| ITP706      | Project-I                       | -                          | - | *  | 3             |
|             | <b>Total</b>                    | 19                         | - | 10 | 27            |

\*work load of the teacher in semester VII is equivalent to 6 hours/week.

| Elective-I (Semester-VII) |                          |
|---------------------------|--------------------------|
| ITC7051                   | Image processing         |
| ITC7052                   | Software Architecture    |
| ITC7053                   | E-Commerce & E- Business |
| ITC7054                   | Multimedia Systems       |
| ITC7055                   | Usability Engineering    |
| ITC7056                   | Ubiquitous Computing     |



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| Course Code | Course Name                 | Teaching Scheme (Hrs/week) |    |                    | Credits Assigned |     |   |       |
|-------------|-----------------------------|----------------------------|----|--------------------|------------------|-----|---|-------|
|             |                             | L                          | T  | P                  | L                | T   | P | Total |
| ITC701      | Software Project Management | 4                          | -  | -                  | 4                | -   | - | 4     |
|             |                             | Examination Scheme         |    |                    |                  |     |   |       |
|             |                             | ISE                        |    | MSE                |                  | ESE |   |       |
|             |                             | 10                         | 30 | 100 (60%Weightage) |                  |     |   |       |

|   |                              |  |
|---|------------------------------|--|
| <b>Pre-requisite Course Codes</b>                                   | TEITC (Software Engineering) |  |
| After successful completion of the course, student will be able to: |                              |  |
| <b>Course Outcomes</b>  | CO1                          | Outline the business case of their project and find MOV  |
|   | CO2                          | Schematize the software project using WBS and network diagrams   |
|   | CO3                          | Measure the effectiveness of project progress by doing earned value analysis                                 |
|   | CO4                          | Demonstrate the ability to communicate and collaborate with team members in extreme project management style |
|   | CO5                          | Carry out the cost effectiveness to keep the cost under control  |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>An overview of IT Project Management:</b> Introduction, the state of IT project management, context of project management, need of project Management, project goals, project life cycle and IT development, information technology project methodology (ITPM), project feasibility, request for proposal (RFP), the business case, project selection and approval, project contracting, PMBOK | 1    | 4    |
| 2          | <b>Project Integration Management:</b> Introduction, project management process, project integration management, the project charter, project planning framework, the contents of a project plan, the planning process.   | 1    | 4    |
| 3          | <b>Project Scope Management:</b> Introduction, scope planning, project scope definition, project scope verification, scope change control, the Work Breakdown Structure (WBS), the linear responsibility chart.   | 1, 2 | 4    |



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|    |  |         |    |
|----|--|---------|----|
| 4  | <b>Project Time Management:</b> Introduction, developing the project schedule, Scheduling Charts, logic diagrams and network (AOA, AON), critical path, calendar scheduling and time based network, management schedule reserve, PDM network, PERT, CPM, Resource loading, resource leveling, allocating scarce resources to projects and several projects, Goldratt's critical chain.                         | 1,<br>2 | 10 |
| 5  | <b>Project Cost Management:</b> Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts.  | 1,<br>2 | 4  |
| 6  | <b>Project Quality Management:</b> Introduction, Quality tools and philosophies, quality systems, the IT project quality plan.   | 1       | 3  |
| 7  | <b>Project Resource Management:</b> Human Introduction, organization and project planning, the project team, multidisciplinary teams, the project environment, project leadership, ethics in projects, multicultural projects, Role of project manager, IT governance and the project office. Introduction to change, the nature of change, the change management plan, dealing with resistance and conflicts. | 1,<br>2 | 5  |
| 8  | <b>Project Communication Management:</b> Introduction, monitoring and controlling the project, the project communications plan, project metric, project control, designing the control system, the plan-monitor control cycle, data collection and reporting, reporting performance and progress, information distribution   | 1,<br>2 | 4  |
| 9  | <b>Project Risk Management:</b> Basic concepts, Identification, Assessment, Response planning, Management  | 1       | 4  |
| 10 | <b>Project Procurement Management:</b> Introduction, project procurement management, outsourcing.  | 1,<br>3 | 3  |
| 11 | <b>The Implementation Plan and Project Closure:</b> Introduction, project implementation, administrative closure, project evaluation, project audit.   | 1       | 3  |
|    |  | Total   | 48 |

## References:

1. Jack T. Marchewka, "*Information Technology Project Management*", 4th edition, Wiley India, 2009.
2. John M. Nicholas, "*Project Management for Business and Technology*", 3rd edition, Pearson Education.
3. R S. J. Mantel, J. R. Meredith and etal., "*Project Management*" 1st edition, Wiley India, 2009.
4. 4. Joel Henry, "*Software Project Management, A real-world guide to success*", Pearson Education, 2008.



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| Course Code | Course Name     | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|-----------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                 | L                          | T  | P                   | L                | T   | P | Total |
| ITC702      | Cloud Computing | 3                          | -  | -                   | 3                | -   | - | 3     |
|             |                 | Examination Scheme         |    |                     |                  |     |   |       |
|             |                 | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                 | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

|   |                              |   |
|---|------------------------------|---|
| <b>Pre-requisite Course Codes</b>                                   | TEITC502 (Operating Systems) |   |
| After successful completion of the course, student will be able to: |                              |   |
| <b>Course Outcomes</b>  | CO1                          | Differentiate between different cloud computing techniques. |
|   | CO2                          | Compare various cloud computing providers/software.         |
|   | CO3                          | Handle open source cloud implementation and administration. |
|   | CO4                          | Understand risks involved in cloud computing.               |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>Introduction to Cloud Computing</b><br>Introduction– Component of CC, Comparing CC with Virtualization, Grids, Utility Computing, client-server model, P to P Computing, Impact of CC on Business, Key Drivers for Cloud Computing, Cloud computing Service delivery model.<br>Cloud Types – Private, Public and Hybrid, when to avoid public cloud, Cloud API  | 3    | 02   |
| 2          | <b>Virtualization</b><br>Introduction & benefit of Virtualization, Implementation Levels of Virtualization, VMM Design Requirements and Providers, Virtualization at OS level, Middleware support for Virtualization, Virtualization structure/tools and mechanisms: Hypervisor and Xen Architecture, Binary Translation with full Virtualization, Para Virtualization with Compiler Support.<br>Virtualization of CPU, Memory and I/O Devices, Hardware support for Virtualization in Intel x86 processor, CPU Virtualization, Memory Virtualization and I/O Virtualization, Virtualization in Multi core processors. | 1, 3 | 04   |
| 3          | <b>Cloud computing Services</b><br>XaaS, IaaS, PaaS- Leveraging PaaS for Productivity Languages for PaaS- DBaaS(Database as a services) – SaaS (Software as a service) – Comparison of various cloud computing providers/ Softwares.   | 1,3  | 04   |





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|           |   |     |    |
|-----------|---|-----|----|
| <b>4</b>  | <b>Cloud Computing and Business Value</b><br>Key Business Drivers for CC- Cloud computing and out sourcing – Types of Scalability – Security issues in Cloud Computing- time to Market Benefits- Distribution over Internet – Three levels of Business value from Cloud computing.  | 1,3 | 04 |
| <b>5</b>  | <b>Open Source Cloud Implementation and Administration</b><br>Eucalyptus and Open Stack Architecture Features –Components – Various mode of operations – Installation and configuration process of both open source – Cloud Administration and Management Task – Creating User Interface (Web Interface ) of Private cloud.   | 1,3 | 04 |
| <b>6</b>  | <b>Cloud Deployment Techniques</b><br>Factors for Successful Cloud Deployment – Network Requirements – Potential Problem areas in a cloud Network and their Mitigation – Cloud Network Topologies – Automation and Self-service feature in a cloud –cloud performance.  | 1,3 | 04 |
| <b>7</b>  | <b>Security:</b> Security for Virtualization Platform – Host security for SaaS, 4 PaaS and IaaS – Data Security – Data Security Concerns – Data Confidentiality and Encryption – Data Availability – Data Integrity – Cloud Storage Gateways – Cloud Firewall   | 1,3 | 04 |
| <b>8</b>  | <b>Architecture for Cloud Application:</b> Cloud Application requirements- Architecture for traditional Vs Cloud Applications- Multi-ties Application Architecture SOA for Cloud applications – Resource oriented SOA – Method –oriented SOA and Event Driven SOA – Parallelization within Cloud Applications – Leveraging In memory Operations for Cloud Application                   | 1,3 | 04 |
| <b>9</b>  | <b>Cloud Programming:</b> Programming Support for Google Apps engine: GFS, Big 4 Tables, Google's NO SQL System, Chubby, Google Distributed Lock Service, Programming Support for Amazon EC2: Amazon S3, EBS and Simple DB etc.   | 1,4 | 04 |
| <b>10</b> | <b>Adoption and Use of Cloud</b><br>Adoption of Public cloud by SMBs- Public Cloud Adoption phase for SMBs- Vendor liability and Management Adoption process of Public clouds by Enterprises – Managed Private clouds Migrating Application to the cloud – Impact of Shared Resources and Multi-Tenancy on cloud Applications – Phases during Migration an Application to An IaaS Cloud | 2,3 | 04 |
| <b>11</b> | <b>Risks of Cloud Computing and Related Costs</b><br>Risk Assessment and Management – Risk of Vendor Lock-in – Risk of Loss of control over IT services- Risk of Poor Provisioning – Risk of Multi-tenant environment – Risk failure of cloud provider – SLA risk –security, malware and Internet Attacks – Risk with Application Licensing.  | 1,3 | 02 |



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|                             |   |     |    |
|-----------------------------|---|-----|----|
| <b>12</b>                   | <b>AAA Administration for Clouds</b><br>AAA model – SSO for Clouds – Authentication management and Authorization management in clouds – Accounting for Resource utilization.  | 1,3 | 02 |
| <b>13</b>                   | <b>Security as a service</b><br>What can security as service offer- Benefits for Security as a service<br>Issues with Security as a Service- Identity Management as a Service | 1,3 | 02 |
| <b>14</b>                   | <b>Mobile Cloud Computing</b><br>Introduction, Definition, Architecture, Benefits, challenges in mobile and at cloud shield   | 1   | 02 |
| Total hours of instructions |   |     | 48 |

## References:

1. Rajkumar Buya," *Cloud computing principles and Paradigms*", Wiley.
2. Kai Hwang," *Distributed and cloud computing*", MK Publications.
3. Cloud computing, black book, Dreamtech publication.
4. Using Google Apps engine O'reilly Publication



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| Course Code | Course Name        | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|--------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                    | L                          | T  | P                   | L                | T   | P | Total |
| ITC703      | Intelligent System | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |                    | Examination Scheme         |    |                     |                  |     |   |       |
|             |                    | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                    | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| Course Outcomes   | CO1 Describe the building blocks of AI as presented in terms of intelligent agents.                       |
|   | CO2 Choose an appropriate problem solving method and knowledge representation scheme for a given problem. |
|   | CO3 Analyze and formalize the problem and select the appropriate search method.                           |
|   | CO4 Develop simple intelligent system or classical toy problems using different AI techniques.            |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>Introduction</b><br>Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation.  | 1    | 04   |
| 2          | <b>Intelligent Agents</b><br>Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent.  | 1    | 03   |
| 3          | <b>Uninformed Search Techniques</b><br>DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques.                                     | 1    | 04   |
| 4          | <b>Informed Search Methods</b><br>Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A*, IDA*, SMA*, Crypto Arithmetic Problem, Backtracking for CSP, Performance Evaluation.     | 1    | 08   |
| 5          | <b>Adversarial Search</b><br>Game Playing, Min-Max Search, Alpha Beta Pruning.   | 1    | 03   |
| 6          | <b>Knowledge and Reasoning</b><br>A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining, Resolution. , Introduction to PROLOG | 1    | 08   |



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|                             |  |         |    |
|-----------------------------|--|---------|----|
| <b>7</b>                    | <b>Planning</b><br>Introduction to Planning, Planning with State Space Search, Partial Ordered planning, Hierarchical Planning, Conditional Planning, Planning with Operators.   | 1,<br>2 | 04 |
| <b>8</b>                    | <b>Uncertain Knowledge and Reasoning</b><br>Uncertainly, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bays theorem, Belief Networks, Simple Inference in Belief Networks.  | 1,<br>2 | 06 |
| <b>9</b>                    | <b>Learning</b><br>Learning from Observation, General Model of Learning Agents, Inductive Learning, Learning Decision Trees, Rote Learning, Learning by Advice, Learning in Problem Solving, Explanation based Learning. | 2,<br>3 | 05 |
| <b>10</b>                   | <b>Expert Systems</b><br>Representing and using Domain Knowledge, Expert System-shell, Explanation, and Knowledge Acquisition.   | 2,<br>3 | 03 |
| Total hours of instructions |  |         | 48 |

## References:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw Hill,.
4. George Lugar, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.
5. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
6. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
7. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication



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| Course Code | Course Name         | Teaching Scheme (Hrs/week) |    |                    | Credits Assigned |     |   |       |
|-------------|---------------------|----------------------------|----|--------------------|------------------|-----|---|-------|
|             |                     | L                          | T  | P                  | L                | T   | P | Total |
| ITC704      | Wireless Technology | 4                          | -  | -                  | 4                | -   | - | 04    |
|             |                     | Examination Scheme         |    |                    |                  |     |   |       |
|             |                     | ISE                        |    | MSE                |                  | ESE |   |       |
|             |                     | 10                         | 30 | 100 (60%Weightage) |                  |     |   |       |

|   |                   |  |
|---|-------------------|--|
| <b>Pre-requisite Course Codes</b>                                   | Computer Networks |  |
| After successful completion of the course, student will be able to: |                   |  |
| <b>Course Outcomes</b>  | CO1               | Identify the characteristics/ fundamentals of Wireless communication Channel.                |
|   | CO2               | Discuss various new trends in wireless communication and their technologies.                 |
|   | CO3               | Generalize various protocols and topologies used in new wireless communication technologies. |
|   | CO4               | Associate the need of security and economics in wireless system.                             |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>Fundamentals of wireless Communication</b> <ul style="list-style-type: none"> <li>Fundamentals of Wireless Communication Advantages, Limitations and Applications Wireless Media.</li> <li>Infrared Modulation Techniques DSSS And FHSS</li> <li>Multiple access technique: TDMA, CDMA, FDMA, CSMA, OFDMA [fundamentals] Frequency Spectrum</li> <li>Radio and Infrared Frequency Spectrum</li> </ul>  | 3,4  | 08   |
| 2          | <b>Wireless technology</b> <ul style="list-style-type: none"> <li>The cellular concepts: Frequency Reuse, Channel assignment strategies, Hand off strategies Interference and System Capacity [Design problems].</li> <li>Evolution of cellular networks 1G, 2G,3G,4G</li> <li>GSM: System Architecture, Radio Subsystem, Channel Types, GSM frame structure</li> <li>CDMA: Architecture, Frequency and channel specifications, forward and Reverse CDMA Channels.</li> </ul> | 2,3  | 10   |
| 3          | <b>Wireless in local loop(WLL)</b><br>User requirements of WLL systems, WLL system Architecture, MMDS, LMDS, WLL subscriber terminal, WLL interface to the PSTN   | 1,3  | 04   |



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|          |   |       |    |
|----------|---|-------|----|
| <b>4</b> | <b>Wireless local area networks(WLAN)</b><br>Introduction, WLAN Equipment, WLAN topologies and Technologies, IEEE802.11WLAN :Architecture, Physical Layer, Data Link Layer, MAC Layer, Security Latest developments of IEEE 802.11 standards.   | 3,4   | 08 |
| <b>5</b> | <b>Wireless personal area networks(WPAN)</b><br>Introduction, WPAN technologies and Protocols, Bluetooth(802.15.1)[ Protocol stack and network connection establishment, security aspects]<br>HR –WPAN ( UWB)( IEEE 802.15.3) LR-WPAN ( IEEE 802.15.4 )<br>Zigbee [Stack architecture, components , Network Topologies , Applications]<br>Wireless Sensor networks [Network model and protocol stack , routing algorithms, application] | 3,4   | 08 |
| <b>6</b> | <b>Wireless metropolitan area networks</b><br>IEEE 802.16 [Protocol Architecture]<br>IEEE 802.16a[Wimax ]<br>Wimax and LTE/3GPP comparison  | 1,3,4 | 04 |
| <b>7</b> | <b>Security issues in Wireless Systems</b><br>The need, attacks , security services, Wired Equivalent Privacy protocol(WEP),Mobile IP, VPN[ PPTP,L2TP,IPSec]  | 3,4   | 03 |
| <b>8</b> | <b>Economies of Wireless Network</b><br>Economic Benefits, Economics of Wireless industry Wireless data forecast, charging issues.  | 3,4   | 03 |
|          | <b>Total hours of instructions</b>  |       | 48 |

## References:

1. Nicopolitidia , M.S. Obaidat, GI Papadimitriou, ” *Wireless Networks* ”,Wiley India(student edition2010)
2. TL Singal ,”*Wireless communications*”, TataMc Graw Hill Education private Ltd.(edition2011)
3. Dr. Nupur Prasad Giri ,” *Wireless Technology*”, Dream tech Press.
4. Dr. Sunil Kumar S.Manvi &Mahabaleshwar S. Kakkasageri,” *Wireless and Mobile Networks*”,



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| Course Code | Course Name      | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                  | L                          | T  | P                   | L                | T   | P | Total |
| ITC7051     | Image Processing | 04                         | -  | -                   | 04               | -   | - | 4     |
|             |                  | Examination Scheme         |    |                     |                  |     |   |       |
|             |                  | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                  | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| Course Outcomes   | CO1   Improve subjective quality of images.                          |
|   | CO2   Extract important features from image data.                    |
|   | CO3   Represent an image to transform and describe Image.            |
|   | CO4   Identify compression algorithm to reduce the size of the Image |
|   | CO5   Apply the concept of image processing in various applications. |

| Module No. | Topics   | Ref.  | Hrs. |
|------------|--|-------|------|
| 1          | <b>Introductions to Signal Processing Only as a prerequisite for Image Processing. Hence not part of theory exam</b><br>Analog, discrete and digital signals, 1D, 2-Dsignals with examples. Discrete time signals: sequences, Discrete time systems LTI systems and their properties. Convolution and Correlation- need, methods and examples. | 3     | 04   |
| 2          | <b>Introduction to digital image processing</b><br>Introduction: Definition of digital image, generation of digital image, steps in digital image processing, 2D sampling, spatial and tonal resolutions, pixel connectivity, elements of digital image processing systems.  | 1,2,4 | 05   |
| 3          | <b>Image enhancement in the spatial domain</b><br>Point operations, histogram processing, spatial filtering: smoothing, sharpening, median, high boost.  | 1,4   | 07   |
| 4          | <b>Two Dimensional Discrete Fourier Transform</b><br>Introduction to image in frequency domain, Concept of basis images, two dimensional D.F.T. and its properties, two dimensional F.F.T. Filtering in the frequency domain: smoothening, sharpening and homomorphic filtering.   | 1,4   | 06   |



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|          |   |       |    |
|----------|---|-------|----|
| <b>5</b> | <b>Image segmentation</b><br>Detection of discontinuities, edge linking and Boundary detection, Hough transform, thresholding, region oriented segmentation.  | 1,4   | 06 |
| <b>6</b> | <b>Image representation and description</b><br>Boundary descriptors: shape number, Fourier descriptor, statistical moments; regional descriptors.   | 1,4   | 06 |
| <b>7</b> | <b>Image data compression</b><br>Image data redundancies: coding, inter-pixel, psycho visual; Fundamentals of lossless compression: Arithmetic coding, Huffman coding, LZW coding, RLE, Bit plane coding, predictive coding<br>Lossy compression : JPEG, Sub band               | 1,4   | 06 |
| <b>8</b> | <b>Image morphology</b><br>Morphological operation: Dilation erosion, Opening & Closing, Hit or Miss Transform, Basic Morphological Algorithms.   | 1,4   | 04 |
| <b>9</b> | <b>Applications of image processing</b><br>Case Study on the following applications: Digital watermarking, Biometric authentication (face, fingerprint, signature recognition) Vehicle number plate detection and recognition, Content Based Image Retrieval, Text Compression. | 1,4,5 | 04 |
|          | <b>Total hours of instructions</b>  |       | 48 |

## References:

1. Gonzalez & Woods, “*Digital Image Processing*”, Third Edition, Pearson Education.
2. W. Pratt, “*Digital Image Processing*”, Fourth Edition, 2013, Wiley Publication.
3. J. G. Proakis and D. G. Manolakis, “*Digital Signal processing Principals, Algorithms and Applications*”, Third edition, PHI publications.
4. A.K. Jain, “*Fundamentals of Image processing*”, Prentice Hall of India Publication, 1995
5. S. Jayaraman, S Esakkirajan and T Veera kumar, “*Digital Image Processing*”, Mc Graw Hill Education (India) Private Limited, New Delhi, 2009.





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| Course Code | Course Name           | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|-----------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                       | L                          | T  | P                   | L                | T   | P | Total |
| ITC7052     | Software Architecture | 04                         | -  | -                   | 04               | -   | - | 04    |
|             |                       | Examination Scheme         |    |                     |                  |     |   |       |
|             |                       | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                       | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  | TEITC601 (Software Engineering) |  |
|---|---------------------------------|--|
| After successful completion of the course, student will be able to: |                                 |  |
| Course Outcomes   | CO1                             | Recognize major software architectural styles, design patterns and frameworks.                       |
|   | CO2                             | Design software architecture for large scale software systems.                                       |
|   | CO3                             | Describe various documentation approaches and architectural description languages.                   |
|   | CO4                             | Apply architectural patterns to quickly generate architectural alternatives and choose between them. |

| Module No. | Topics   | Ref.  | Hrs. |
|------------|--|-------|------|
| 1          | <b>Basic Concepts</b><br>1.1 Concepts of Software Architecture<br>1.2 Models.<br>1.3 Processes.<br>1.4 Stakeholders.   | 1,2,3 | 03   |
| 2          | <b>Designing Architectures</b><br>2.1 The Design Process.<br>2.2 Architectural Conception.<br>2.3 Refined Experience in Action: Styles and Architectural Patterns.<br>2.4 Architectural Conception in Absence of Experience.<br>2.5 Putting it all Together: Design Processes Revisited. | 1,2,3 | 05   |
| 3          | <b>Connectors</b><br>3.1 Connectors in Action: A Motivating Example.<br>3.2 Connector Foundations.<br>3.3 Connector Roles.<br>3.4 Connector Types and Their Variation Dimensions.<br>3.5 Example Connectors.<br>3.6 Using the connect or Frame work                                      | 1,2,3 | 06   |



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|           |  |       |    |
|-----------|--|-------|----|
| <b>4</b>  | <b>Modeling</b><br>4.1 Modeling Concepts.<br>4.2 Ambiguity, Accuracy, and Precision.<br>4.3 Complex Modeling: Mixed Content and Multiple Views.<br>4.4 Evaluating Modeling Techniques.<br>4.5 Specific Modeling Techniques: Generic Techniques, Domain and Style specific ADLs, Extendable ADLs. | 1,2,3 | 04 |
| <b>5</b>  | <b>Visualization</b><br>5.1 Visualization Concepts.<br>5.2 Common issues in Visualization.<br>Visualization Techniques: Textual Visualization, UML, xADL.  | 1,2,3 | 04 |
| <b>6</b>  | <b>Analysis</b><br>6.1 Analysis Goals.<br>6.2 Scope of Analysis.<br>6.3 Architectural Concern being Analyzed.<br>6.4 Level of Formality of Architectural Models.<br>6.5 Type of Analysis.<br>6.6 Analysis Techniques.  | 1,2,3 | 06 |
| <b>7</b>  | <b>Implementation and Deployment</b><br>6.1 Concepts.<br>6.2 Existing Frameworks.<br>6.3 Software Architecture and Deployment.<br>6.4 Software Architecture and Mobility   | 1,2,3 | 04 |
| <b>8</b>  | <b>Applied Architectures and Styles</b><br>8.1 Distributed and Networked Architectures.<br>8.2 Architectures for Network-Based Applications.<br>8.3 Decentralized Architectures.<br>8.4 Service-Oriented Architectures and Web Services.   | 1,2,3 | 08 |
| <b>9</b>  | <b>Designing for Non-Functional Properties</b><br>9.1 Efficiency.<br>9.2 Complexity.<br>9.3 Scalability and Heterogeneity.<br>9.4 Adaptability.<br>9.5 Dependability.  | 1,2,3 | 04 |
| <b>10</b> | <b>Documentation</b><br>10.1 Uses of Architectural Documentation.<br>10.2 Views<br>10.3 Choosing the Relevant Views<br>10.4 Documenting a View<br>10.5 Documentation across Views  | 1,2,3 | 04 |
|           | <b>Total hours of instructions</b>   |       | 48 |



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## References:

1. Richard N. Taylor, Nenad Medvidovic, Eric M. Dashofy, "*Software Architecture: Foundations, Theory and Practice*", Wiley Publications.
2. Len Bass, Paul Clements, Rick Kazman, "*Software Architecture in Practice*", Pearson
3. M. Shaw, "*Software Architecture Perspectives on an Emerging Discipline*", Prentice Hall.



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| Course Code | Course Name               | Teaching Scheme (Hrs/week) |    |                    | Credits Assigned |     |   |       |
|-------------|---------------------------|----------------------------|----|--------------------|------------------|-----|---|-------|
|             |                           | L                          | T  | P                  | L                | T   | P | Total |
| ITC7053     | E-Commerce and E-Business | 04                         | -  | -                  | 04               | -   | - | 04    |
|             |                           | Examination Scheme         |    |                    |                  |     |   |       |
|             |                           | ISE                        |    | MSE                |                  | ESE |   |       |
|             |                           | 10                         | 30 | 100 (60%Weightage) |                  |     |   |       |

|   |                             |  |
|---|-----------------------------|--|
| <b>Pre-requisite Course Codes</b>                                   | ITL45 (Web Programming Lab) |  |
| After successful completion of the course, student will be able to: |                             |  |
| <b>Course Outcomes</b>  | CO1                         | Analyze, design and implement e-commerce system.                           |
|   | CO2                         | Understand the marketing and business strategies.                          |
|   | CO3                         | Understand the concept of payment system done in e-commerce.               |
|   | CO4                         | Identify the challenges of e-business and define the e-business structure. |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>E – commerce:-Introduction to Ecommerce</b><br>Definition of e com, different types of e com, Examples of e com E commerce trade cycle, Advantages and disadvantages of e com, Traditional commerce Vs E commerce.   | 1    | 02   |
| 2          | <b>Overview of Hardware and software technologies for E-com</b><br>Client side programming ( Dreamweaver ,Front page ), Server side programming(PHP) , Data base connectivity, session tracking, middle ware technologies from e-com perspective and security aspects wrt to ecommerce, integration of web services     | 1    | 08   |
| 3          | <b>Payment System for e-commerce</b><br>Traditional payment model, Characteristics of payment system, SET Protocol for credit card payment, E-cash, E-check, smart cards.   | 1,4  | 08   |
| 4          | <b>E – Marketing Strategies</b><br>Value chain , Working of e – market , Transactions at e – market , Strategies for marketing for selling on the web – Advertising supported , advertising subscription mixed model , fee for transaction model Sales and Promotions Strategies for Purchasing and support activities. | 2    | 08   |
| 5          | <b>E business :-Introduction to e-business</b><br>Definition of e business, Characteristics, elements of e business, e business roles, Impact of e business, challenges of e business,  | 4    | 04   |



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|          |  |     |    |
|----------|--|-----|----|
|          | difference between e-business, e commerce.   |     |    |
| <b>6</b> | <b>Developing e-business models</b><br>E-business structure, Evolution of e –business and its stages , E–business models , Characteristics of Internet based software and e-business solutions.  | 1,4 | 03 |
| <b>7</b> | <b>E-business strategies</b><br>Strategic planning process, SCM , CRM , ERP ,procurement   | 1,4 | 07 |
| <b>8</b> | <b>Design and development of an business website</b><br>a) Building an e-commerce website. :-<br>SDLC, system design ,Issues involved in designing a website , Pre requisites required for designing in–house website, steps involved in web site development ,e-business and web site development solutions, security issues involved and analyzing website traffic---<br>Case study<br>b) Analysis and design–(Work flow management, process modeling , data modeling ), UI design ,use case design , information architecture, security concerns. | 4   | 08 |
|          | <b>Total hours of instructions</b>   |     | 48 |

## References:

1. Henry Chan , “*E-Commerce Fundamentals and application*”, Wiley publication
2. Gary Schneider , “*Electronics Commerce*”, Thomson Course technology
3. Parag Kulkarni , Sunita Jahirabadkar, Pradip Chande ,”*E–Business*”, Oxford Higher Education , Oxford University Press
4. Dave Chaffey, “*E–business and E – commerce Management*”, 3<sup>rd</sup> edition, Pearson.
5. Laudon ,”*E commerce*”.
6. David Whitley , “*E-Commerce Strategies, Technology and applications*”, Tata Mc Graw Hill
7. Introduction to E-commerce Elias Awad.



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| Course Code | Course Name        | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|--------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                    | L                          | T  | P                   | L                | T   | P | Total |
| ITC7054     | Multimedia Systems | 4                          | -  | -                   | 4                | -   | - | 04    |
|             |                    | Examination Scheme         |    |                     |                  |     |   |       |
|             |                    | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                    | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

|   |  |  |  |
|---|--|--|--|
| <b>Pre-requisite Course Codes</b>                                   | TEITC501 (Computer Graphics and Virtual Reality) |  |  |
| After successful completion of the course, student will be able to: |  |  |  |
| <b>Course Outcomes</b>  | CO1  | Identify the relevance and underlying infrastructure of multimedia systems.          |  |
|   | CO2  | Apply multimedia system to indicate the current requirements of multimedia products. |  |
|   | CO3  | Apply the knowledge in developing the multimedia system as per industry standards.   |  |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>Introduction to Multimedia</b><br>What is multimedia, Hypermedia, Multimedia tools, Multimedia Authoring & its Tools, VERML, File Formats.  | 1    | 02   |
| 2          | <b>Color in Images &amp; Video</b><br>Color Models for Images & Videos, Video Signals, Digital Video, MIDI, Quantization, Transmission of Audio.   | 1,2  | 04   |
| 3          | <b>Compression Algorithms</b><br>Lossless Compression, Introduction, Basics, RLC, VLC, lossless Image Compression, Lossy Compression, introduction, Distortion, Rate Distortion Theory, Quantization | 1,2  | 04   |
| 4          | <b>Image Compression Standards</b><br>JPEG standards, JPEG 2000 standards, JPEG-L S standards, Bi-Level Image Compression Standards.   | 1,2  | 04   |
| 5          | <b>Video Compression Techniques</b><br>Introduction, Motion Compensation, Motion vectors, H.261 & H.263, MPEG-1 & MPEG-2, MPEG-4, MPEG-7, MPEG-21  | 1,2  | 05   |
| 6          | <b>Audio Compression</b><br>ADPCM, Vo coders, Psychoacoustics, MPEG audio.   | 1,2  | 03   |
| 7          | <b>Multimedia Network Applications</b><br>Quality of Multimedia Data transmission, Multimedia over IP, Multimedia over ATM, Media on Demand, Multimedia over Wireless Network.                       | 1,2  | 06   |



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|           |   |     |    |
|-----------|---|-----|----|
| <b>8</b>  | <b>Multimedia Databases</b><br>Design and Architecture of Multimedia Database, Types, Organization, Medias Abstraction, Query Language.   | 1,2 | 07 |
| <b>9</b>  | <b>Frame Work for Multimedia Standards</b><br>Introduction, Standard Activates, Standard to built a news Global Information Infrastructure, Standardization process on Multimedia Communication, ITU-I Media com 2004 Frame work, ISO/MPEG-21Framework, IETF Multimedia Internet Standards. | 1,2 | 06 |
| <b>10</b> | <b>Application layer:</b><br>Introduction, ITU applications, MPEG Application, Digital Broadcasting Applications, Universal multimedia access.  | 1,2 | 07 |
|           | <b>Total hours of instructions</b>  |     | 48 |

## References:

1. Ze-Nian Li & Mark. S. Drew,"*Fundamentals of Multimedia* “.
2. K. R. Roa , Zoran S, Bojkovic & Dragorad A. Milovanovic," *Introduction to Multimedia Communication, Application, Middleware, Networking*”



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| Course Code | Course Name           | Teaching Scheme<br>(Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|-----------------------|-------------------------------|----|---------------------|------------------|-----|---|-------|
|             |                       | L                             | T  | P                   | L                | T   | P | Total |
| ITC7055     | Usability Engineering | 04                            | -  | -                   | 04               | -   | - | 04    |
|             |                       | Examination Scheme            |    |                     |                  |     |   |       |
|             |                       | ISE                           |    | MSE                 |                  | ESE |   |       |
|             |                       | 10                            | 30 | 100 (60% Weightage) |                  |     |   |       |

|   |  |
|---|--|
| <b>Pre-requisite Course Codes</b>                                   |  |
| After successful completion of the course, student will be able to: |  |
| <b>Course Outcomes</b>  | CO1   Create useful usable and used interface. |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>Introduction</b><br>Cost Savings, Usability Now, Usability Slogans, Discount Usability Engineering, Recipe For Action, Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences  | 1,2  | 06   |
| 2          | <b>Generations of User Interfaces</b><br>Batch Systems, Line-Oriented Interfaces, Full-Screen Interfaces, Graphical User Interfaces, Next-Generation Interfaces, Long-Term Trends in Usability.  | 1,2  | 02   |
| 3          | <b>The Usability Engineering Life cycle</b><br>Know the User, Competitive Analysis, Goal Setting, Parallel Design, Participatory Design, Coordinating the Total Interface, Guidelines and Heuristic Evaluation, Prototyping, Interface Evaluation, Iterative Design, Follow-Up Studies of Installed Systems, Meta-Methods, Prioritizing, usability activities. | 1,2  | 08   |
| 4          | <b>Usability Heuristics</b><br>Simple and Natural Dialogue, Speak the Users' Language, Minimize User Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Good Error Messages, Prevent Errors, Help and documentation, heuristic evaluation.   | 1,2  | 08   |
| 5          | <b>Usability Testing</b><br>Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.   | 1,2  | 08   |





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|          |  |     |    |
|----------|--|-----|----|
| <b>6</b> | <b>Usability Assessment Methods beyond Testing</b><br>Observation, Questionnaires and Interviews, Focus Groups,<br>Logging, Actual Use, User Feedback, Choosing Usability Methods.   | 1,2 |    |
| <b>7</b> | <b>Interface Standards</b><br>National, International and Vendor Standards,<br>Producing Usable In-House Standards.<br><b>International User Interfaces</b><br>International Graphical Interfaces, International U<br>Internationalization, Resource Separation, Multilocale Interfaces. | 1,2 | 08 |
| <b>8</b> | <b>Future Developments</b><br>Theoretical Solutions, Technological Solutions, CAUSE Tools:<br>Computer-Aided Usability Engineering, Technology Transfer  | 1,2 | 04 |
|          | <b>Total hours of instructions</b>   |     | 48 |

## References:

1. Jacob Nielson, Morgan Kaufmann ,”*Usability Engineering*” , Academic Press.
2. Deborah Hix, Rex Hartson ,”*Developing User Interfaces-Ensuring Usability through Product & Process*”, Wiley



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| Course Code | Course Name          | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|----------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                      | L                          | T  | P                   | L                | T   | P | Total |
| ITC7056     | Ubiquitous Computing | 04                         | -  | -                   | 04               | -   | - | 04    |
|             |                      | Examination Scheme         |    |                     |                  |     |   |       |
|             |                      | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                      | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| <b>Course Outcomes</b>  | CO1 Explain objectives and the historical development of the field of ubiquitous computing.               |
|   | CO2 Describe fundamentals of sensor technology and sensor networks  |
|   | CO3 Apply middleware techniques to implement ubiquitous computing systems                                 |
|   | CO4 Design of new (often embedded) interactive artifacts  |
|   | CO5 Compare the usability of alternative design of interactions for specific ubiquitous computing systems |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>Introduction to Ubiquitous Computing</b><br>Definition, Advantage, Application and Scope. Properties of Ubiquitous Computing, Ubiquitous System Environment Interaction. Architectural Design for UbiCom Systems: Smart DEI Model.                       | 1,2  | 04   |
| 2          | <b>Smart Devices and Services</b><br>Introduction to Smart Devices: Users, Mobiles, Cards And Device Networks. Service Architecture Models. Service Provision Life-Cycle. Virtual Machines and Operating Systems Mobile Computers and Communicator Devices. | 1,2  | 08   |
| 3          | <b>Sensing and Controlling</b><br>Tagging the Physical World. Sensors and Sensor Networks. Micro Actuation and Sensing: Micro-Electro-Mechanical Systems (MEMS). Embedded Systems and Real-Time Systems. Control Systems for Physical World Tasks. Robots   | 1,2  | 08   |
| 4          | <b>Context-Aware Systems</b><br>Introduction to Context-Aware Computing, Context-Aware Systems, Context-Aware Applications, Designing and Implementing  | 2,3  | 08   |



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|          |   |     |    |
|----------|---|-----|----|
|          | Context-Aware Applications, Issues for building Context-Aware Applications.   |     |    |
| <b>5</b> | <b>Human-Computer Interaction</b><br>User Interfaces and Interaction for Four Widely Used Devices. Hidden UI Via Basic Smart Devices. Hidden UI Via Wearable and Implanted Devices. Human-Centered Design (HCD). User Models: Acquisition and Representation. iHCDesign   | 3,4 | 10 |
| <b>6</b> | <b>Ubiquitous Communication</b><br>Data Networks. Audio Networks. Wireless Data Networks. Universal and Transparent Audio, Video and Alphanumeric Data. Ubiquitous Networks. Network Design Issues. Human Intelligence Versus Machine Intelligence. Challenges in Ubiquitous System, Social Issues: Promise Versus Peril. | 3,4 | 10 |
|          | <b>Total hours of instructions</b>  |     | 48 |

## References:

1. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Wiley Publication.
2. John Krumm, "Ubiquitous Computing Fundamentals", CRC Press.
3. Yin-Leng Theng and Henry B.L. Duh, "Ubiquitous Computing: Design, Implementation and Usability", IGI Global.
4. Adam Greenfield, "Everyware: The Drawing Age of Ubiquitous Computing", Published in Association with AIGA.
5. "Mobile and Ubiquitous Computing", Georgia Tech, 2003.



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| Course Code | Course Name                 | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|-----------------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                             | L                          | T  | P         | L                | T  | P     | Total |
| ITL701      | Software Project Management | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                             | Examination Scheme         |    |           |                  |    |       |       |
|             |                             | ISE                        |    | ESE       |                  |    | Total |       |
|             |                             |                            |    | Practical | Oral             |    |       |       |
| 40          |                             | -                          |    | 20        |                  | 60 |       |       |

|   |  |   |
|---|--|---|
| <b>Pre-requisite Course Codes</b>                                   | TEITL601 (Software Engineering Lab)<br>ITC701 ( Software project Management) |   |
| After successful completion of the course, student will be able to: |  |   |
| <b>Course Outcomes</b>  | CO1  | Demonstrate the factors that lead to the failure of a project-case-study                |
|   | CO2  | Determine the values/benefits the project if done would bring to the organizations      |
|   | CO3  | Formulate the sequencing of task (network) to optimize the use of resources             |
|   | CO4  | Examine the deviation of planned schedule and cost with actual cost and schedule.       |
|   | CO5  | Make use of a modern tool for communication and collaboration with project team members |

| Exp. No. | Experiment Details  | Ref.  | Marks |
|----------|---|---|-------|
| 1        | Download a case study of any failed project .Analyze project failures<br>– State Reasons for failure -- Actions to be taken.<br>Find Technical feasibility of the suggested actions or in other words state how would you implement those solutions     | <a href="http://calleam.com/WTPF/?page_id=2338">http://calleam.com/WTPF/?page_id=2338</a> | 5     |
| 2        | Prepare RFP for a project containing Project Description, scope of work, Timeline & Budget, Requirements & deliverables, Technical information  | 3-PMBOK   | 5     |
| 3        | Calculate MOV for your project:<br>1. Identify the value of IT project<br>2. Develop an appropriate metric<br>3. Set the time frame for achieving the <u>MOV</u><br>4. Identify alternatives<br>5. Identify risk - choose the alternative with low risk | 1-Chapter 2   | 5     |



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|                    |   |   |           |
|--------------------|---|---|-----------|
| 4                  | Create Task set for each phase and mark critical path<br>view Gantt Chart and Network Diagram<br>Fill actual start and actual finish for completed task   | 2   | 5         |
| 5                  | calculate the Earned Value for a project that has a Project Plan and the actual task completion duration and cost   | 2   | 5         |
| 6                  | Create a team in JIRA -log issues, mention criticality. Sort issues in terms - its critically. List unresolved issues along with timestamp. Measure cycle time. Create reports  | Tutorialpoint (OR)<br><a href="http://www.guru99.com/jira-tutorial-a-complete-guide-for-beginners.html">http://www.guru99.com/jira-tutorial-a-complete-guide-for-beginners.html</a> | 5         |
| 7                  | Extend your B.E. project.<br>1. List features – Extended scope<br>2. Identify components. Write technical specification<br>3. Decide which of the components to make/outsource/buy<br>4. Justify your answer. Make suitable assumptions.<br>5. Present it in the form of the Table ( Component_id, Description, Required_Resources, Make/Outsource/Buy, Justification)<br>6. For the components you plan to buy write the criteria for evaluation. Do create a comparative statement.<br>7. Prepare sample SLA for the components you plan to outsource | <a href="https://www.pmi.org/learning/tools-templates">https://www.pmi.org/learning/tools-templates</a>   | 5         |
| 8                  | Examine the problem statement and answer the question:<br>Should the Company submit a bid, and if so, what should they bid per computer?  | 2   | 5         |
| <b>Total Marks</b> |   |   | <b>40</b> |

## References:

1. Jack Marchewka, “*Information Technology Project Management*”, 4<sup>th</sup> edition, Wiley.
2. John. M. Nicholas “*Project Management*”, 2<sup>nd</sup> edition, EEE.
3. PMI Institute “*PMBOK – Guide*”, 5<sup>th</sup> edition



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| Course Code | Course Name         | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|---------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                     | L                          | T  | P         | L                | T  | P     | Total |
| ITL702      | Cloud Computing lab | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                     | Examination Scheme         |    |           |                  |    |       |       |
|             |                     | ISE                        |    | ESE       |                  |    | Total |       |
|             |                     |                            |    | Practical | Oral             |    |       |       |
| 40          |                     | -                          |    | 20        |                  | 60 |       |       |

|   |   |   |
|---|---|---|
| <b>Pre-requisite Course Codes</b>                                   | TEITC502 (Operating Systems)<br>ITC702 ( Cloud Computing) |   |
| After successful completion of the course, student will be able to: |   |   |
| <b>Course Outcomes</b>  | CO1   | Perform virtualization configuration and administration     |
|   | CO2   | Handle open source cloud implementation and administration. |
|   | CO3   | Create and run virtual machines.                            |
|   | CO4   | Install and appreciate security features for cloud.         |

| Exp. No.           | Experiment Details   | Ref. | Marks     |
|--------------------|--|------|-----------|
| 1                  | Study and implement Desktop and Server Virtualization.   | 1,2  | 5         |
| 2                  | Study and implement OS Level Virtualization.   | 1,2  | 5         |
| 3                  | Implementation of Infrastructure As A Service - Creating an account on the Cloud and Starting a server instance. | 1,4  | 5         |
| 4                  | Implementation of Infrastructure As A Service - Allocating resources and deploying an application.               | 1,4  | 5         |
| 5                  | Implementation of Platform As A Service.   | 1,4  | 5         |
| 6                  | Implementation of Storage as a Service.  | 1,4  | 5         |
| 7                  | Implementation of Single-Sing-On.  | 1,3  | 5         |
| 8                  | Securing Servers in Cloud  | 1,3  | 5         |
| <b>Total Marks</b> |  |      | <b>40</b> |

## References:

1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde and Dr. Deven Shah, "Cloud computing Black Book", Dreamtech Publication.
2. Bernard Golden, "Virtualization for Dummies", Wiley Publication.
3. Ronald L., "Cloud security", Wiley Publication.
4. Dr. Kumar Saurabh, "Cloud computing", Wiley Publication.



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| Course Code | Course Name             | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|-------------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                         | L                          | T  | P         | L                | T  | P     | Total |
| ITL703      | Intelligent Systems Lab | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                         | Examination Scheme         |    |           |                  |    |       |       |
|             |                         | ISE                        |    | ESE       |                  |    | Total |       |
|             |                         |                            |    | Practical | Oral             |    |       |       |
| 40          |                         | -                          |    |           | 20               | 60 |       |       |

|   |   |
|---|---|
| <b>Pre-requisite Course Codes</b>                                   | ES34 (Programming and Data Structures)<br>IT31 (Advanced Data Structures)<br>ITC703 ( Intelligent Systems ) |
| After successful completion of the course, student will be able to: |   |
| <b>Course Outcomes</b>  | CO1   Design intelligent agents for solving a particular problem.   |
|   | CO2   Utilize knowledge based reasoning to solve certain problems.  |
|   | CO3   Apply different uninformed and informed search techniques to solve various problems.                  |
|   | CO4   Apply adversarial search techniques to solve various problems.  |
|   | CO5   Construct programs in declarative programming style using Prolog.                                     |

| Exp. No.           | Experiment Details   | Ref.  | Marks     |
|--------------------|--|-------|-----------|
| 1                  | To implement Vacuum Cleaner Agent  | 1     | 5         |
| 2                  | To implement Wumpus World Game using knowledge and reasoning                                 | 1     | 5         |
| 3                  | To implement Water Jug Problem using BFS and DFS (Uninformed Search)                         | 1     | 5         |
| 4                  | To solve the 8 puzzle problem with Heuristic function using Hill Climbing ( Informed Search) | 1     | 5         |
| 5                  | To Implement 8 Queen Problem with Heuristic function (Informed Search)                       | 1     | 5         |
| 6                  | To implement Tic Tac Toe using Min-Max and Alpha Beta Pruning (Adversarial Search)           | 1     | 5         |
| 7                  | To implement Family Tree in Prolog   | 2,3,4 | 5         |
| 8                  | To implement Mini Expert system using Prolog   | 2,3,4 | 5         |
| <b>Total Marks</b> |  |       | <b>40</b> |



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## References:

1. Stuart Russell and Peter Norvig, "*Artificial Intelligence: A Modern Approach*", 2<sup>nd</sup> Edition, Pearson Education.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, "*Artificial Intelligence*", 3<sup>rd</sup> edition, McGraw Hill.
3. Elaine Rich, Kevin Knight, "*Artificial Intelligence*", 2<sup>nd</sup> Edition, Tata McGraw Hill.
4. Ivan Bratko, "*Prolog Programming for Artificial Intelligence*", 4<sup>th</sup> edition, Addison-Welsey Publishers Limited,





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| Course Code | Course Name             | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|-------------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                         | L                          | T  | P         | L                | T  | P     | Total |
| ITL704      | Wireless Technology Lab | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                         | Examination Scheme         |    |           |                  |    |       |       |
|             |                         | ISE                        |    | ESE       |                  |    | Total |       |
|             |                         |                            |    | Practical | Oral             |    |       |       |
| 40          |                         | -                          |    | 20        |                  | 60 |       |       |

|   |                              |  |
|---|------------------------------|--|
| <b>Pre-requisite Course Codes</b>                                   | ITC704 (Wireless Technology) |  |
| After successful completion of the course, student will be able to: |                              |  |
| <b>Course Outcomes</b>  | CO1                          | Understand the characteristics/ fundamentals of Wireless communication Channel               |
|   | CO2                          | Understand various new trends in wireless communication and their technologies               |
|   | CO3                          | Understand various protocols and topologies used in new wireless communication technologies. |
|   | CO4                          | Understand the need of security and economics in wireless system                             |

| Exp. No.           | Experiment Details  | Ref. | Marks     |
|--------------------|---|------|-----------|
| 1                  | Installation of NS2 on ubuntu12.04.   | 1,2  | 5         |
| 2                  | To understand the cellular frequency reuse concept fulfilling the following objectives:<br>a. Finding the co-channel cells for a particular cell.<br>b. Finding the cell clusters within certain geographic area.                 | 1,2  | 5         |
| 3                  | To study logical and traffic channels of GSM.   | 1,2  | 5         |
| 4                  | To simulate a simple wireless communication between two mobile nodes and one static node using TCP connection and using services of FTP for data transfer.  | 1,2  | 5         |
| 5                  | To study and use different transmission ranges in wireless scenario in NS2.   | 1,2  | 5         |
| 6                  | Case study on security issues in wireless networks. Following are the objectives:<br>a. Need of security in wireless networks<br>b. Various attacks on wireless networks<br>c. Security measures and protocols used for security. | 4    | 5         |
| 7                  | To investigate MAC contention window for Wireless Network in NS2.   | 3,4  | 5         |
| 8                  | To study X-graph for time and congestion window for a TCP communication in NS2.   | 1,2  | 5         |
| <b>Total Marks</b> |   |      | <b>40</b> |



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## References:

1. Nicopolitidia, M S Obaidat, G I Papadimitriou, "*Wireless Networks*", Edition 2010, Wiley India Student.
2. T L Singal, "*Wireless communications*", Tata McGraw Hill Education private Ltd. 2011.
3. Dr.Nupur Prasad Giri, "*Wireless Technology*", Dreamtech Press.
4. Dr. Sunilkumar S. Manvi & Mahabaleshwar S. Kakkasageri, "*Wireless and Mobile Networks*", Wiley India.



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| Course Code | Course Name      | Teaching Scheme (Hrs/week) |    |            | Credits Assigned |    |                  |             |              |
|-------------|------------------|----------------------------|----|------------|------------------|----|------------------|-------------|--------------|
|             |                  | L                          | T  | P          | L                | T  | P                | Total       |              |
| ITT7051     | Image Processing | --                         | -- | 2          | --               | -- | 1                | 1           |              |
|             |                  | <b>Examination Scheme</b>  |    |            |                  |    |                  |             | <b>Total</b> |
|             |                  | <b>ISE</b>                 |    | <b>ESE</b> |                  |    | <b>Practical</b> | <b>Oral</b> |              |
|             |                  | <b>40</b>                  |    | <b>-</b>   |                  |    |                  |             |              |

|   |                            |   |
|---|----------------------------|---|
| <b>Pre-requisite Course Codes</b>                                   | ITC7051 (Image processing) |   |
| After successful completion of the course, student will be able to: |                            |   |
|   | CO1                        | Improve subjective quality of images.                       |
|   | CO2                        | Represent an image to transform Image.                      |
|   | CO3                        | Demonstrate and extract important features from image data. |
|   | CO4                        | implement compression to reduce the size of the Image       |

| Exp. No.           | Experiment Details   | Ref. | Marks     |
|--------------------|--|------|-----------|
| 1                  | Write a program to perform following operation on Image.<br>a. Digital Negative.<br>b. Contrast Stretching.<br>c. Grey Level Slicing.<br>d. Thres holding. | 1,2  | 5         |
| 2                  | Write a program to enhance image using histogram equalization.   | 1,2  | 5         |
| 3                  | Write a program to compute Discrete Fourier Transform.   | 1,2  | 5         |
| 4                  | Write a program to perform Morphological image processing using Erosion, Dilation, Opening and Closing.  | 1,2  | 5         |
| 5                  | Write a program to implement Image Segmentation using Gradient/Prewitt/Robert/Sobel Operators.   | 1,2  | 5         |
| 6                  | Write a program to enhance image using Smoothing and Sharpening Filters.   | 1,2  | 5         |
| 7                  | Write a program to implement Compression using RLE Compression Algorithm on an Image.  |      | 5         |
| 8                  | Write a program to implement Compression using LZW Compression Algorithm.  | 1,2  | 5         |
| <b>Total Marks</b> |  |      | <b>40</b> |

### References:

- Gonzalez & Woods, "Digital Image Processing", 3<sup>rd</sup> edition, Pearson Education.
- W. Pratt, "Digital Image Processing", 4<sup>th</sup> edition, 2013, Wiley Publication.



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| Course Code | Course Name           | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|-----------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                       | L                          | T  | P         | L                | T  | P     | Total |
| ITT7052     | Software Architecture | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                       | Examination Scheme         |    |           |                  |    |       |       |
|             |                       | ISE                        |    | ESE       |                  |    | Total |       |
|             |                       |                            |    | Practical | Oral             |    |       |       |
| 40          |                       | -                          |    | 20        |                  | 60 |       |       |

| Pre-requisite Course Codes  |     |   |
|---|-----|---|
| After successful completion of the course, student will be able to: |     |   |
| Course Outcomes   | CO1 | Design and program Modelling and Visualization                                      |
|   | CO2 | Program Integrate Software Component  |
|   | CO3 | Implement Connectors using middleware   |
|   | CO4 | Design and Program Wrapper to connect two applications with different architectures |
|   | CO5 | Design and Program for Creating web service   |
|   | CO6 | Program and Design Architecture for any specific domain                             |

| Exp. No.    | Experiment Details   | Ref. | Marks |
|-------------|--|------|-------|
| 1           | Write a Program for Modeling using xADL  | 1-6  | 5     |
| 2           | Write a Program for Visualization using xADL 2.0                                     | 1-6  | 5     |
| 3           | Write a Program to Integrate software components using a middleware                  | 1-6  | 5     |
| 4           | Write a Program Using middleware to implement connectors                             | 1-6  | 5     |
| 5           | Write a Program for Wrapper to connect two applications with different architectures | 1-6  | 5     |
| 6           | Write a Program for Creating web service   | 1-6  | 5     |
| 7           | Write a Program to Design Architecture for any specific domain                       | 1-6  | 5     |
| 8           | Perform Analysis-Case Study  | 1-6  | 5     |
| Total Marks |  |      | 40    |

## References:

1. Jack T. Marchewka, "Information Technology Project Management", 3<sup>rd</sup> edition, Wiley India, 2009.
2. S. J. Mantel, J. R. Meredith and etl.. "Project Management" 1<sup>st</sup> edition, Wiley India, 2009.
3. John M. Nicholas, "Project Management for Business and Technology", 2<sup>nd</sup> edition, Pearson Education.
4. Joel Henry, "Software Project Management, A real world guide to success", Pearson



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Education, 2008.

5. Gido and Clements, "*Successful Project Management*", 2<sup>nd</sup> edition, Thomson Learning.
6. Hughes and Cornell, "*Software Project Management*", 3<sup>rd</sup> edition, Tata McGraw Hill



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| Course Code | Course Name             | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |       |   |       |
|-------------|-------------------------|----------------------------|----|-----------|------------------|-------|---|-------|
|             |                         | L                          | T  | P         | L                | T     | P | Total |
| ITT7053     | E-Commerce & E-Business | --                         | -- | 2         | --               | --    | 1 | 1     |
|             |                         | Examination Scheme         |    |           |                  |       |   |       |
|             |                         | ISE                        |    | ESE       |                  | Total |   |       |
|             |                         |                            |    | Practical | Oral             |       |   |       |
| <b>40</b>   |                         | <b>-</b>                   |    | <b>20</b> | <b>60</b>        |       |   |       |

|   |                                    |  |
|---|------------------------------------|--|
| <b>Pre-requisite Course Codes</b>                                   | ITC7053 (E- Commerce & E-Business) |  |
| After successful completion of the course, student will be able to: |                                    |  |
| <b>Course Outcomes</b>  | CO1                                | Analyze the method to design and implement an e-commerce system.           |
|   | CO2                                | Differentiate the marketing and business strategies.                       |
|   | CO3                                | Relate the concept of finance in e-commerce                                |
|   | CO4                                | Identify the challenges of e-business and define the e-business structure. |

| Exp. No.           | Experiment Details  | Ref. | Marks     |
|--------------------|---|------|-----------|
| 1.                 | To study on different types of e-commerce website and formulating a case to design your own e-commerce website.       | 1-6  | 5         |
| 2.                 | Design home page for e-commerce website using dream weaver.   | 1-6  | 5         |
| 3.                 | To install and use Xampp for connecting front end to backend. And FORM VALIDATION USING AJAX.                         | 1-6  | 5         |
| 4.                 | To implement and manage sessions using php.   | 1-6  | 5         |
| 5.                 | To implement a search engine for custom searching products on the site.   | 1-6  | 5         |
| 6.                 | To create client and server – side web service using REST.  | 1-6  | 5         |
| 7.                 | Case study of M commerce, bit coins and Google app engine   | 1-6  | 5         |
| 8.                 | Case study of entry and expansion strategy of Amazon Inc. in India and A Case Study of Flipkart.com Versus Amazon. in | 1-6  | 5         |
| <b>Total Marks</b> |   |      | <b>40</b> |



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## References:

1. Henry Chan, "E-Commerce Fundamentals and application", Wiley publication
2. Gary Schneider , "*Electronics Commerce*", Thomson Course technology
3. Parag Kulkarni , Sunita Jahirabadkar, Pradip Chande, "*E –Business*",Oxford Higher Education, Oxford University Press
4. Dave Chaffey , "*E –business and E –commerce Management*" 3<sup>rd</sup> edition, Pearson.
5. Laudon, "*E commerce*".
6. David Whitley, "*E-Commerce Strategies, Technology and applications*", Tata McGraw Hill .



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| SEM. VIII    |  |                            |   |    |               |
|--------------|--|----------------------------|---|----|---------------|
| Course Code  | Course Name                                | Teaching Scheme (Hrs/week) |   |    | Credits Total |
|              |  | L                          | T | P  |               |
| ITC801       | Storage network management & Retrieval     | 4                          | - | -  | 4             |
| ITC802       | Big Data Analytics                         | 4                          | - | -  | 4             |
| ITC803       | Computer Simulation and Modeling           | 4                          | - | -  | 4             |
| ITC804       | Elective-II                                | 4                          | - | -  | 4             |
| ITL801       | Storage network management & Retrieval lab | -                          | - | 2  | 1             |
| ITL802       | Big Data Analytics lab                     | -                          | - | 2  | 1             |
| ITL803       | Computer Simulation and Modeling lab       | -                          | - | 2  | 1             |
| ITL804       | Elective-II                                | -                          | - | 2  | 1             |
| ITT805       | Project-II                                 | -                          | - | ** | 6             |
| <b>Total</b> |  | 16                         | - | 08 | 26            |

\*\*work load of the teacher in semester VIII is equivalent to 12 hours/week.

| Elective-I (Semester-VIII) |                                      |
|----------------------------|--------------------------------------|
| ITC8041                    | Enterprise Resource Planning         |
| ITC8042                    | Wireless Sensor Networks             |
| ITC8043                    | Geographical Information Systems     |
| ITC8044                    | Robotics                             |
| ITC8045                    | Soft Computing                       |
| ITC8046                    | Software Testing & Quality Assurance |





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| Course Code | Course Name                            | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|--|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |  | L                          | T  | P                   | L                | T   | P | Total |
| ITC801      | Storage network management & Retrieval | 4                          | -  | -                   | 4                | -   | - | 04    |
|             |  | <b>Examination Scheme</b>  |    |                     |                  |     |   |       |
|             |  | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |  | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| <b>Course Outcomes</b>  | CO1 Identify key challenges in managing information and analyze different storage networking technologies |
|   | CO2 Illustrate the different component of storage network architecture.                                   |
|   | CO3 Describe the components and the implementation of NAS and storage virtualization                      |
|   | CO4 Recognize the need of Backup to recover Information   |
|   | CO5 Use the concepts information retrieval in storage network.  |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>NEEDFORSTORAGENETWORK</b><br>INTRODUCTION:-Limitations of traditional server centric architecture, Storage centric architecture and its advantages.<br><br>BASICS OFSTORAGENETWORK:-Intelligent Storage Systems (ISS),Data protection (RAID implementation methods).RAID arrays ,Components, RAID technologies, RAID levels, RAID impact on disk, performance &RAID comparison.                                 | 1,2  | 10   |
| 2          | <b>STORAGE NETWORK ARCHITECTURE</b><br><br>SCSI,SAN:FC SAN FC Protocol Stack, IP Storage, Infini band, Virtual Interfaces.   | 1,2  | 08   |
| 3          | <b>ADVANCED STORAGE TECHNOLOGY</b><br>NETWORK ATTACHED STORAGE (NAS):-Local File systems, Network File systems and file servers, Shared Disk File systems: Case study, Comparison:NAS,FC SAN and I SC SISOAN.<br>STORAGEVIRTUALIZATION:- Virtualization in I/O path, Limitations and requirements, Definition of Storage Virtualization, Storage virtualization on Block and file level, Storage virtualization on | 1,2  | 14   |



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|          |   |   |    |
|----------|---|---|----|
|          | various levels of Storage network, Symmetric and Asymmetric Virtualization.   |   |    |
| <b>4</b> | <b>STORAGE NETWORK BACKUP AND RECOVERY</b><br>BC Terminology, BC Planning Life cycle, General Conditions for Backup, Recovery Considerations, Network Backup Services Performance Bottlenecks of Network Backup, Backup Clients, Back up file systems, Backup Databases, Next Generation Backup.            | 2 | 06 |
| <b>5</b> | <b>INFORMATION RETRIEVAL IN STORAGE NETWORK</b><br>Overview, Abstraction ,Information System, Measures from Data to Wisdom, Document and Query Form, Query structures, The matching process, Text analysis:Indexing,Matrixrepresentation,Termextraction,Termassociation, , Stemming, Multilingual retrieval | 2 | 10 |
|          | <b>Total hours of instructions</b>  |   | 48 |

## References:

1. ULFTroppen,RainerErkensandWolfgangMuller,“*StorageNetworksExplained:Basic and Applications of Fibre Channel SAN,NAS and ISCSI and Infini band*”,Wiley
2. EMC Educational Services, “*Information Storage and Management*”, Wiley India
3. R. R. Korfhage ,“*Information Storage and Retrieval*”, Wiley
4. Richard Barker and Paul Massiglia, “ *Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs*”, Wiley.
5. Robert Spalding, “ *Storage Networks: The Complete Reference*”, Tata McGraw Hill
6. W. Curtis Preston, “*Using SANs and NAS*”, O’Reilly



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| Course Code | Course Name        | Teaching Scheme<br>(Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|--------------------|-------------------------------|----|---------------------|------------------|-----|---|-------|
|             |                    | L                             | T  | P                   | L                | T   | P | Total |
| ITC802      | Big Data Analytics | 4                             | -  | -                   | 4                | -   | - | 4     |
|             |                    | Examination Scheme            |    |                     |                  |     |   |       |
|             |                    | ISE                           |    | MSE                 |                  | ESE |   |       |
|             |                    | 10                            | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| <b>Course Outcomes</b>  | CO1   Analyze the key issues in big data management and its associated applications in intelligent business and scientific computing   |
|   | CO2   Experiment with fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics |
|   | CO3   Interpret business models and scientific computing paradigms   |
|   | CO4   Apply software tools for big data analytics  |
|   | CO5   Apply big data analytics in various applications like recommender systems, social media applications etc                         |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>Introduction to Big data</b><br>Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.   | 1    | 03   |
| 2          | <b>Introduction to Hadoop</b><br>What is Hadoop? Core Hadoop Components ; Hadoop Ecosystem; PhysicalArchitecture; Hadoop limitations.   | 1,2  | 02   |
| 3          | <b>NoSQL</b><br>1. What is NoSQL? NoSQL business drivers ;NoSQL case studies;<br>2. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family(Big table)stores, Document stores, Variations of NoSQL architectural patterns;<br>Using No SQL to manage big data: What is a big data NoSQL solution? Understanding the types of big data problems; Analyzing | 3    | 04   |



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|   |   |       |    |
|---|---|-------|----|
|   | big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; Four ways that NoSQL systems handle big data problems.   |       |    |
| 4 | <p><b>Map Reduce and the New Software Stack</b></p> <p><b>Distributed File Systems :</b><br/>Physical Organization of Compute Nodes, Large-Scale File-System Organization. <b>Map Reduce:</b> The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of Map Reduce Execution, Coping With Node Failures.</p> <p><b>Algorithms Using Map Reduce:</b><br/>Matrix-Vector Multiplication by Map Reduce ,Relational-Algebra Operations, Computing Selections by Map Reduce, Computing Projections by Map Reduce, Union, Intersection, and Difference by Map Reduce, Computing Natural Join by Map Reduce, Grouping and Aggregation by Map Reduce, Matrix Multiplication, Matrix Multiplication with One Map reduce step.</p> | 1,4   | 06 |
| 5 | <p><b>Finding Similar Items</b><br/>Applications of Near-Neighbor Search, Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filter in gasa Similar-Sets Problem .</p> <p><b>Distance Measures:</b> Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance.</p>  | 1,5   | 03 |
| 6 | <p><b>Mining Data Streams</b></p> <p><b>The Stream Data Model:</b> A Data-Stream-Management System, Examples of Stream Sources, Stream Querie, Issues in Stream Processing.</p> <p><b>Sampling Data in a Stream:</b> Obtaining a Representative Sample,The General Sampling Problem, Varying the Sample Size.</p> <p><b>Filtering Streams:</b><br/>The Bloom Filter, Analysis.</p> <p><b>Counting Distinct Elements in a Stream</b><br/>The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements</p> <p><b>Counting One sin a Window:</b><br/>The Cost of Exact Counts, The Datar-Gionis-Indyk-</p>   | 5,6   |    |
| 7 | <p><b>Link Analysis</b><br/>Page Rank Definition, Structure of the web, dead ends, Using</p>  | 5,6,7 | 05 |



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|           |   |       |    |
|-----------|---|-------|----|
|           | Page rank in a search engine, Efficient computation of Page Rank: Page Rank Iteration Using Map Reduce, Use of Combiners to Consolidate the Result Vector.<br>Topic sensitive Page Rank, link Spam, Hubs and Authorities.   |       |    |
| <b>8</b>  | <b>Frequent Item sets</b><br>Handling Larger Data sets in Main Memory Algorithm of Park, Chen and Yu, The Multi stage Algorithm, The Multihash Algorithm.<br><b>The SON Algorithm and Map Reduce</b><br><b>Counting Frequent Items in a Stream</b><br>Sampling methods for streams, frequent item sets in Decaying window | 5,6,7 | 05 |
| <b>9</b>  | <b>Clustering</b><br>CURE Algorithm, Stream-Computing, A Stream-Clustering Algorithm, Initializing & Merging Buckets, Answering Queries   | 5,6,7 | 05 |
| <b>10</b> | <b>Recommendation Systems</b><br>A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering   | 6,7   | 04 |
| <b>11</b> | <b>Mining Social- Network Graphs</b><br>Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, SimRank, Counting triangles  | 6,7   | 05 |
|           | <b>Total hours of instructions</b>  |       | 48 |

## References:

1. Anand Raja Raman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press,
2. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly "Making Sense of No SQL" – A guide for managers and the rest of us, Manning Press
4. Bill Franks, "Taming The Big Data Tidal Wave: Finding Opportunities In Huge
5. *Data Streams With Advanced Analytics*", Wiley
6. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", Wiley India
7. Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses", Wiley India.
8. Paul Zikopoulos, Chris Eaton, "Understanding Big Data: Analytics for Enterprise
9. *Class Hadoop and Streaming Data*, Mc Graw Hill Education.



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| Course Code | Course Name                      | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|----------------------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                                  | L                          | T  | P                   | L                | T   | P | Total |
| ITC803      | Computer Simulation and Modeling | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |                                  | Examination Scheme         |    |                     |                  |     |   |       |
|             |                                  | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                                  | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| Course Outcomes   | CO1 Explain Modeling, Simulation and the use of Statistical models in simulation |
|   | CO2 Analyze the system and develop a Queuing model                               |
|   | CO3 Analyze the system and develop an Inventory model                            |
|   | CO4 Test the performance of Simulation   |
|   | CO5 Design a simulation system for real-life scenario using modern tools         |

| Module No. | Topics   | Ref.   | Hrs. |
|------------|--|--------|------|
| 1          | <b>Introduction to simulation</b><br>Introduction to Simulation, Simulation Examples. General Principles   | 1, 3   | 15   |
| 2          | <b>Mathematical &amp; Statistical Models in Simulation</b><br>Statistical Models in simulation. Queuing Models   | 1<br>4 | 08   |
| 3          | <b>Random Numbers</b><br>Random Number Generation. Testing random numbers(Refer to Third edition)<br>Random Variate Generation: Inverse transform technique, Direct Transformation for the Normal Distribution, Convolution Method, Acceptance-Rejection Technique(only Poisson Distribution). | 1      | 09   |
| 4          | <b>Analysis of simulation data</b><br>Input Modeling Verification, Calibration and Validation of Simulation Models, Estimation of absolute performance.  | 1      | 12   |
| 5          | <b>Application</b><br>Case study.<br>Processor and Memory simulation.<br>Manufacturing & Material handling   | 1, 2   | 04   |
|            | <b>Total hours of instructions</b>   |        | 48   |



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## References:

1. Jerry Banks, John Carson, Barry Nelson and David M. Nicol, "*Discrete Event System Simulation*", Third Edition, Prentice-Hall
2. Averill M. Law, "*System Modeling & Analysis*", 4<sup>th</sup> Edition TMH.
3. Geoffrey Gordon "*System Simulation*", EEE
4. Jerry Banks, C M, Sokolowski J A "*Principles of Modeling and Simulation*", Wiley



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| Course Code | Course Name                  | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|------------------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                              | L                          | T  | P                   | L                | T   | P | Total |
| ITC8041     | Enterprise Resource Planning | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |                              | Examination Scheme         |    |                     |                  |     |   |       |
|             |                              | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                              | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| Course Outcomes   | CO1   Relate with ERP related technologies   |
|   | CO2   Examine ERP development concepts and it's key modules                                    |
|   | CO3   Analyze the ERP implementation lifecycle and the importance of its process in E-business |
|   | CO4   Compare ERP tools and its business benefits.   |

| Module No. | Topics   | Ref.    | Hrs |
|------------|--|---------|-----|
| 1          | <b>Introduction to ERP</b><br>Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model   | 1,2,3,4 | 04  |
| 2          | <b>ERP and Related Technologies</b><br>Business Processing Reengineering(BPR),Data Warehousing, Data Mining, On-line Analytical Processing(OLAP),Supply Chain Management(SCM), Customer Relationship Management(CRM), MIS-Management Information System, DSS- Decision Support System, EIS-Executive Information System. | 1,2,3,4 | 06  |
| 3          | <b>ERP Manufacturing Perspective</b><br>MRP- Material Requirement Planning, BOM-Bill Of Material, MRP- Manufacturing Resource Planning, DRP Distributed Requirement Planning,<br>PDM – Product Data Management   | 1,2,3,4 | 06  |
| 4          | <b>ERP Modules</b><br>Finance, Plant Maintenance, Quality Management, Materials Management.  | 1,2,3,4 | 06  |
| 5          | <b>Benefits of ERP</b><br>Reduction of Lead-Time ,On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance,<br>Increased Flexibility, Reduced Quality, Costs, Improved Information Accuracy and Design- making capability.                  | 1,2,3,4 | 06  |
| 6          | <b>ERP Implementation Lifecycle</b>  | 1,2,3,4 | 06  |





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|          |   |       |    |
|----------|---|-------|----|
|          | Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode).   | 4     |    |
| <b>7</b> | <b>ERP case Studies</b><br>E-Commerce to E-business<br>E-Business structural transformation, Flexible Business Design, Customer Experience, Create the new techno enterprise, New generation e-business leaders, memo to CEO, Empower your customer, Integrate Sales                  | 4,5,6 | 06 |
| <b>8</b> | <b>E business architecture</b><br>Enterprise resource planning the E-business Backbone Enterprise architecture, planning world, ERP usage in Real world, ERP Implementation, Future of ERP applications, memo to CEO ,E-Procurement, E-Governance, Developing the E-business Design.. | 4,6   | 08 |
| <b>9</b> | <b>Introduction to ERP tools</b><br>JD Edwards-Enterprise One.<br>Microsoft Dynamics-CRM Module   | 4,5,6 | 04 |
|          | <b>Total hours of instructions</b>  |       | 48 |

## References:

1. Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill.
2. Alexis Leon, "Enterprise Resource Planning" (Diversified), TMH.
3. Ravi Shankar & S. Jaiswal, Galgotia, "Enterprise Resource Planning".
4. Annetta Clewto and Dane Franklin, "Guide to Planning ERP Application", McGraw-Hill, 1997.
5. Jose Antonio, "The SAP R/3 Handbook" McGraw-Hill.
6. Dr. Ravi Kalakota, "E-Business Network Resource planning using SAP R/3 Baan and People soft- A Practical Roadmap For Success".



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| Course Code | Course Name              | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|--------------------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                          | L                          | T  | P                   | L                | T   | P | Total |
| ITC8042     | Wireless Sensor Networks | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |                          | Examination Scheme         |    |                     |                  |     |   |       |
|             |                          | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                          | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| Course Outcomes   | CO1   Summarize the architecture of wireless sensor networks.                                     |
|   | CO2   Identify applications of wireless sensor networks.  |
|   | CO3   Discuss the challenges in designing MAC and routing protocols for wireless sensor networks. |
|   | CO4   Compare different operating systems and its performance issues.                             |
|   | CO5   Summarize WSN standards and future trends in WSN.   |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>Overview and Introduction of Wireless Sensor Network</b><br>Background of Sensor Network Technology; Types of Application; Challenges for WSNs: Characteristics requirements, Required mechanism; Basic Sensor Network Architectural Elements; Sensor Network scenarios: Types of sources and sinks, single-hop versus multi hop networks, Multiple sinks and sources, three types of mobility; Some examples of sensor nodes: Mica Mote family, EYES nodes, BT nodes. | 1,3  | 06   |
| 2          | <b>Applications of Wireless Sensor Network</b><br>Category1(C1WSNs), Category2(C2WSNs), Range of Applications, Examples of Category1 WSN (C1WSNs) Applications and Examples of Category 2WSN(C2WSNs) Applications.  | 1,3  | 04   |
| 3          | <b>MAC Protocols</b><br>Fundamentals of(wireless) MAC protocols, Requirements and design considerations for MAC Protocols in WSN, Low duty cycle protocols and wakeup concepts, STEM,S-MAC, Mediation device protocol, Wakeup radio concepts, Contention-based protocols, CSMA protocols, PAMAS, Schedule-based protocols, LEACH, SMACS, Traffic-adaptive medium access protocol(TRAMA),IEEE 802.15.4 MAC protocol, Slotted CSMA-CA protocol.                             | 2    | 09   |
| 4          | <b>Network and Transport layer Protocol</b>   | 2,4  | 07   |



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|   |   |   |    |
|---|---|---|----|
|   | Network layer :Data Dissemination and Gathering, Routing Challenges and Design Issues, Routing Strategies :Flooding and it's variants, Power- Efficient Gathering in Sensor Information Systems, Geographical routing<br>Transport layer :<br>Transport protocol Design issues, Examples of Existing Transport Control Protocols: CODA, ESRT, RMST, PSFQ, GARUDA, ATP;<br>Performance of Transport Control Protocols: Congestion, packet loss recovery. |   |    |
| 5 | <b>Operating Systems, Performance and Traffic Management Issues</b><br>Operating System Design Issues, Examples of Operating Systems: Tiny OS, Mate, Magnet OS, MANTIS,OSPM,EYES OS, SenOS, EMERALDS, Pic OS , WSN Design Issues, Performance Modeling of WSNs  | 5 | 07 |
| 6 | <b>WSN standards and Future trends in wireless sensor networks</b><br>Wireless sensor network standards-IEEE 802.15.4Low rate WPAN standard, The ZIGBEE alliance etc .Future trends in wireless sensor networks: Wireless Multimedia Sensor Networks, Sensor Network Applications in Challenging Environments   | 2 | 06 |
| 7 | <b>Security</b><br>Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4andZigBee security.   | 5 | 09 |
|   | <b>Total hours of instructions</b>  |   | 48 |

## References:

1. Feng Zhao, Leonidas Guibas ,”*Wireless Sensor Networks: An Information Processing Approach*”, Morgan Kaufmann Series in Networking2004.
2. Kazem Sohraby, Daniel Minoli, TaiebZnati., “*Wireless Sensor Networks: Technology, Protocols, and Applications*”, Wiley Student Edition.
3. Waltenegus Dargie and Christian Poellabauer.,“*Fundamentals of Wireless Sensor Networks-Theory & Practice*”,John Wiley publication, 2010.
4. J.Zheng and A. Jamalipour, “*Wireless Sensor Networks :A Networking Perspective* “John Wiley publication, 2009.
5. Edgar H. Callaway Jr, “ *Wireless Sensor Networks- Architectures and Protocols*”, AUERBACH Publications, CRC Press, 2004.



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| Course Code | Course Name                      | Teaching Scheme (Hrs/week) |    |                    | Credits Assigned |     |   |       |
|-------------|----------------------------------|----------------------------|----|--------------------|------------------|-----|---|-------|
|             |                                  | L                          | T  | P                  | L                | T   | P | Total |
| ITC8043     | Geographical Information Systems | 4                          | -  | -                  | 4                | -   | - | 4     |
|             |                                  | Examination Scheme         |    |                    |                  |     |   |       |
|             |                                  | ISE                        |    | MSE                |                  | ESE |   |       |
|             |                                  | 10                         | 30 | 100 (60%Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| Course Outcomes   | CO1   Apply the knowledge of science for real world applications in GIS.                               |
|   | CO2   Design and conduct experiments as well as analyze, interpret the geospatial data using GIS tools |
|   | CO3   Function with multidisciplinary Teams.   |
|   | CO4   Use the techniques, skills and modern engineering tools necessary for engineering practice.      |
|   | CO5   Adapt to Open source standards   |

| Module No. | Unit No. | Details of Topic  | Refer. | Hrs. |
|------------|----------|---|--------|------|
| 1.0        |          | <b>Fundamentals of GIS</b>  | 1,2    | 06   |
|            | 1.1      | Introduction, Definition of GIS, Evolution of GIS, components of GIS,   |        |      |
|            | 1.2      | Geospatial Data, Geographic Coordinate System, Map Projections, Commonly Used Map Projections, UTM grid system, Map Scale   |        |      |
|            | 1.3      | Cartographic Symbolization, Types of Maps, Typography, Map Design, Map Production   |        |      |
| 2.0        |          | <b>Data Management, Models and Quality Issues</b>   | 1,2    | 06   |
|            | 2.1      | Vector Model : Topology, Non topological Vector models, Attribute Data in GIS, Attribute Data Entry, Vector Data Query, Manipulation of Fields and Attribute Data                           |        |      |
|            | 2.2      | Raster Data Model : Elements of Raster Data Model, Types of Raster Data, Raster Data Structure, Raster Data Query, Data Compression, Data Conversion, Integration of Raster and Vector data |        |      |



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|            |     |  |     |        |
|------------|-----|--|-----|--------|
|            | 2.3 | Data input and editing, Data quality Issues: Accuracy, Consistency, Precision and Resolution, Completeness ;sources of error in GIS  |     |        |
| <b>3.0</b> |     | <b>GIS Data Exploration Analysis and Visualization</b>   | 2,4 | 2+2+4+ |
|            | 3.1 | Data exploration: Descriptive statistics, Graphs, Dynamic Graphics   |     |        |
|            | 3.2 | Vector Data Analysis: Buffering, Overlay, Distance Measurement, Pattern Analysis, Map Manipulation   |     |        |
|            | 3.3 | Raster Data Analysis :Local Operations ,Neighborhood Operations, Zonal Operations, Data Extraction, Data Generalization, Comparison of Vector and Raster Based Data  |     |        |
|            | 3.4 | Spatial Interpolation: Elements of Spatial Interpolation, Global methods, Local Methods, Kriging, Comparison of  |     |        |
| <b>4.0</b> |     | <b>Terrain mapping, Geo coding and Segmentation</b>  | 3,4 | 04     |
|            | 4.1 | Terrain Mapping and Analysis: Data for Terrain Mapping and Analysis: DIM, TIN, Terrain Mapping, Slope and Geo coding and Dynamic   |     |        |
|            | 4.2 | Geo coding, Applications of Geo coding, Dynamic Segmentation, Applications of Dynamic Segmentation.  |     |        |
| <b>5.0</b> |     | <b>Remote Sensing Fundamentals</b>   | 2,3 | 12     |
|            | 5.1 | Remote Sensing :Basic Principles, Electromagnetic Remote Sensing, Energy Sources, Energy Interactions with Surface Materials, , Energy Interactions with Earth's Atmosphere, Spectral Reflectance Curves   |     |        |
|            | 5.2 | Microwave Remote Sensing, The Radar Principle, Factors Affecting Microwave Measurements, Radar Wavebands, SLAR Systems, SAR, Interpreting SAR Images, Geometrical Characteristics, Remote Sensing, Platform and Sensors, Satellite System Parameters, Sensor Parameters, Imaging Sensor Systems, Earth Resources Satellites, Meteorological Satellites. Data |     |        |
|            | 5.3 | Visual Image Interpretation :Information Extraction By human and Computer, Remote sensing Data Products,   |     |        |
| <b>6.0</b> |     | <b>Project Management</b>  | 4,7 | 04     |
|            | 6.1 | Planning of Project , Implementation of Project, Management of Project, Case study   |     |        |



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|            |     |   |     |    |
|------------|-----|---|-----|----|
| <b>7.0</b> |     | <b>Modern trends and Applications of GIS</b>  | 6,7 | 04 |
|            | 7.1 | Multimedia GIS, Internet GIS, Mobile GIS, Applications of GIS in Urban and municipal area |     |    |

## References

1. Kang-tsung Chang, “*Introduction to Geographical Information Systems*”, Third Edition, 2003, Tata McGraw Hill.
2. M. Anji Reddi, “*Remote Sensing and Geographical Information Systems*”, Second Edition, 2001, B. S. Publications.
3. Basudeb Bhatta, “*Remote Sensing and GIS*”, 2<sup>nd</sup> edition, Oxford University Press.
4. Ian Heywood, Sarah Cornelius & etal, “*An Introduction to Geographical Information Systems*”, 2nd Edition, Pearson Education.
5. A.M. Chandra and S.K. Ghosh, “*Remote Sensing and Geographical Information Systems*”, Narosa Publishing House Pvt Ltd.
6. Peter A Burroughand Mc Donell, “*Principles of Geographical Information Systems*”, Oxford University Press, 1998.
7. M. N. DeMers, “*Fundamentals of Geographic Information Systems*”, 3rd edition, Wiley.
8. George B Korte, “*The GIS Book*”, On word press, Thomson Learning, 5th Edition, 2003
9. Tor Bernhardsen, “*Geographic Information Systems—An Introduction*”, 3rd edition, Wiley Publications
10. Grigore Burdea, Philippe Coiffet, “*Virtual Reality Technology*”, Wiley.
11. Steven Harrington, “*Computer Graphics*”, McGraw Hill.
12. Rogers, “*Procedural Elements of Computer Graphics*”, Tata McGraw Hill.
13. Vince, “*Virtual Reality Systems*”, Pearson Education.
14. F.S. Hill, Stephen M. Kelley, “*Computer Graphics using Open GL*” Prentice Hall



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| Course Code | Course Name | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|-------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |             | L                          | T  | P                   | L                | T   | P | Total |
| ITC8044     | Robotics    | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |             | Examination Scheme         |    |                     |                  |     |   |       |
|             |             | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |             | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| Course Outcomes   | CO1 Describe kinematics and dynamics of stationary and mobile robots. |
|   | CO2 Describe trajectory planning for rigid robot and mobile robots.   |
|   | CO3 Implement trajectory generation and path planning algorithms.     |
|   | CO4 Design interdisciplinary projects .                               |

| Module No. | Topics   | Ref. | Hrs. |
|------------|--|------|------|
| 1          | <b>Fundamentals</b><br>Robot Classification, Robot Components, Degrees of freedom, Joints, Coordinates, Coordinate frames, workspace, applications   | 1    | 03   |
| 2          | <b>Kinematics of Robots</b><br>Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations– position and orientation, Denavit-Haten berg representation of forward kinematics, Inverse kinematic solutions, Case studies | 1,2  | 07   |
| 3          | <b>Differential motions and velocities</b><br>Differential relationship, Jacobian, Differential motion of a frame and robot, Inverse Jacobian.   | 2,3  | 06   |
| 4          | <b>Dynamic Analysis of Forces</b><br>Lagrangian mechanics, Moments of Inertia, Dynamic equations of robots, Transformation of forces and moment between coordinate frames.   | 3    | 07   |
| 5          | <b>Trajectory Planning</b><br>Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories.  | 3    | 07   |
| 6          | <b>Mobile Robot Motion Planning</b>  | 3    | 04   |



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|          |   |     |    |
|----------|---|-----|----|
|          | Concept of motion planning, Bug Algorithms – Bug1,Bug2, Tangent Bug.  |     |    |
| <b>7</b> | <b>Potential Functions and Visibility Graphs</b><br>Attractive/Repulsive potential, Gradient descent, wave-front planner, navigation potential functions, Visibility map, Generalized Voronoi diagrams and graphs, Silhouette methods | 2,3 |    |
| <b>8</b> | <b>Coverage Planning</b><br>Cell Decomposition, Localization and Mapping  | 2,3 | 06 |
|          | <b>Total hours of instructions</b>  |     | 48 |

## References:

1. Saeed Benjamin Niku, “*Introduction to Robotics–Analysis, Control, Applications*”, .. Second Edition, 2011, Wiley India Pvt. Ltd.
2. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard,
3. Lydia E. Kavraki and Sebastian Thrun, “*Principles of Robot Motion– Theory, Algorithms and Implementations*”, Prentice-Hall of India, 2005.
4. Mark W. Spong & M. Vidyasagar, “*Robot Dynamics & Control*”, 2<sup>nd</sup> edition 2004, Wiley India Pvt.Ltd.
5. John J. Craig, “*Introduction to Robotics–Mechanics & Control*”, Third Edition, Pearson Education, India, 2009
6. Aaron Martinez & Enrique Fernandez, “*Learning ROS for Robotics Programming*”, First Edition, 2013, Shroff Publishers.





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| Course Code | Course Name    | Teaching Scheme (Hrs/week) |    |                     | Credits Assigned |     |   |       |
|-------------|----------------|----------------------------|----|---------------------|------------------|-----|---|-------|
|             |                | L                          | T  | P                   | L                | T   | P | Total |
| ITC8045     | Soft Computing | 4                          | -  | -                   | 4                | -   | - | 4     |
|             |                | Examination Scheme         |    |                     |                  |     |   |       |
|             |                | ISE                        |    | MSE                 |                  | ESE |   |       |
|             |                | 10                         | 30 | 100 (60% Weightage) |                  |     |   |       |

| Pre-requisite Course Codes  |  |
|---|--|
| After successful completion of the course, student will be able to: |  |
| Course Outcomes   | CO1 Explain the basic ideas of soft computing techniques.          |
|   | CO2 Design fuzzy inference system.                                 |
|   | CO3 Apply neural networks to solve pattern classification problems |
|   | CO4 Illustrate the concept of hybrid systems.                      |
|   | CO5 Solve optimization problems using genetic algorithms.          |

| Module No. | Topics  | Ref.    | Hrs |
|------------|---|---------|-----|
| 1          | <b>Introduction to Soft Computing</b><br><b>Neural Networks:</b> Definition, Advantages, Applications, Scope.<br><b>Fuzzy logic:</b> Definition, Applications.<br><b>Hybrid System:</b> Definition, Types of Hybrid Systems, Applications.<br><b>Genetic Algorithms:</b> Definition, Applications.  | 3,4     | 2   |
| 2          | <b>Neural Networks</b><br><b>Fundamental Concepts and Models of Artificial Neural Systems:</b> Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Neural Processing, Learning and Adaptation, Neural Network Learning Rules and Comparison.<br><b>Linearly and Non-Linearly Separable Pattern Classification.</b><br><b>Perceptron Convergence Theorem.</b><br><b>Multi-layer Feed forward Network:</b> Delta Learning Rule for Multi perceptron Layer, Generalized Delta Learning Rule, Feed forward Recall and Error Back-propagation Training, Learning Factors, Character Recognition Application. | 1,3,4,6 | 20  |
| 3          | <b>Fuzzy Set theory</b><br>Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions. Fuzzy Extension Principle, Fuzzy Relations, Projection and Cylindrical Extension of Fuzzy Relations, Fuzzy Max-Min and Max-   | 2,3,4,9 | 16  |



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|   |   |     |    |
|---|---|-----|----|
|   | Product Composition. Fuzzy Knowledge Based Systems with Applications, Defuzzification Methods, Fuzzy Composition Rules, Architecture of Mamdani Type Fuzzy Control Systems.   |     |    |
| 4 | <b>Hybrid Systems</b><br>ANFIS: Adaptive Neuro -Fuzzy Inference Systems :Introduction, ANFIS Architecture and Hybrid Learning Algorithm.  | 3,4 | 04 |
| 5 | <b>Genetic Algorithm</b><br>What are Genetic Algorithms? Why Genetic Algorithms? Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Neural Selection, Traditional Optimization and Search Techniques, Genetic Algorithm and Search space: Simple GA, General GA, Operators in GA,Encoding,Selection,Crossover,Mutation,StoppingConditionforGAflow,<br>Constraints in GA, Problem solving using GA, Classification of GA. | 3,4 | 06 |
|   | <b>Total hours of instructions</b>  |     | 48 |

## References:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3<sup>rd</sup> edition Wiley India.
3. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 2<sup>nd</sup> edition. Wiley India.
4. Jang J.S.R, Sun C. T. and Mizutani E., "Neuro-Fuzzy and Soft Computing– A Computational Approach to Learning and Machine Intelligence," PHI.
5. Laurene Fausett, "Fundamentals of Neural Networks– Architectures, Algorithms, And Applications," Pearson Education.
6. Hagan T. Martin, H.B. Demuth, and Mark Beale, "Neural Network Design," Thomson Learning.
7. Satish Kumar, "Neural Networks– A classroom Approach," 2<sup>nd</sup> ed. Tata McGraw Hill.
8. Kishan Mehrotra, Chilukuri. K. Mohan and Sanjay Ranka, "Elements of Artificial Neural Networks," 2<sup>nd</sup> ed. Penram Int. Publishing India.
9. H.J. Zimmermann, "Fuzzy Set Theory and its Applications," Allied Publishers Ltd.
10. Driakov D. Hellendoorn H. and Reinfrank M., "An Introduction to Fuzzy Control," Narosa Publishing House.



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| Course Code | Course Name                          | Teaching Scheme (Hrs/week) |   |     | Credits Assigned |                     |   |       |
|-------------|--------------------------------------|----------------------------|---|-----|------------------|---------------------|---|-------|
|             |                                      | L                          | T | P   | L                | T                   | P | Total |
| ITC8046     | Software Testing & Quality Assurance | 4                          | - | -   | 4                | -                   | - | 4     |
|             |                                      | <b>Examination Scheme</b>  |   |     |                  |                     |   |       |
|             |                                      | ISE                        |   | MSE |                  | ESE                 |   |       |
|             |                                      | 10                         |   | 30  |                  | 100 (60% Weightage) |   |       |

| Pre-requisite Course Codes  |   |
|---|---|
| After successful completion of the course, student will be able to: |   |
| <b>Course Outcomes</b>  | CO1 Identify the reasons for bugs & analyze the principles in software testing to prevent & remove bugs.            |
|   | CO2 Implement various test processes for quality improvement.   |
|   | CO3 Apply the software testing techniques in commercial environments.   |
|   | CO4 Describing the variety of ways to test software and indicate the trade-offs between various testing techniques. |
|   | CO5 Identify the open source testing tools.   |

| Module No. | Topics  | Ref. | Hrs. |
|------------|---|------|------|
| 1          | <b>Testing Methodology</b><br>Introduction, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs Exhaustive Software Testing, Software Failure Case Studies, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing methodology, Verification and Validation, Verification requirements, Verification of high level design, Verification of low level design, validation.               | 1,2  | 10   |
| 2          | <b>Testing Techniques</b><br>Dynamic Testing: Black Box testing: boundary value analysis, equivalence class testing, state table based testing, cause-effect graphing based testing, error guessing.<br><br>White box Testing Techniques: need, logic coverage criteria, basis path testing, graph matrices, loop testing, data flow testing, mutation testing. Static Testing.<br><br>Validation Activities: Unit validation, Integration, Function, System, Acceptance Testing. | 1,2  | 12   |



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|          |   |     |    |
|----------|---|-----|----|
|          | Regression Testing: Progressive vs. Regressive, regression testing produces quality software, regression testability, objectives of regression testing, regression testing types, Define problem, regression testing techniques.  |     |    |
| <b>3</b> | <b>Managing the Test Process</b><br>Test Management: test organization structure and of testing group, test planning, detailed test design and test specification.<br>Software Metrics: need, definition and classification of software matrices.<br>Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding matrices, estimation model for testing effort, architectural design, information flow matrix used for testing, function point and test point analysis.<br>Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, test suite prioritization its type, techniques and measuring effectiveness. | 1,2 | 10 |
| <b>4</b> | <b>Test Automation</b><br>Automation and Testing Tools: need, categorization, selection and cost in testing tool, guide lines for testing tools. Study of testing tools: Win Runner, QTP, Road Runner, Test Director and IBM Rational Functional Tester, Selenium etc.  | 3,5 | 08 |
| <b>5</b> | <b>Testing for Specialized Environment</b><br>Testing Object Oriented Software: OOT basics, Object-oriented testing.<br>Testing Web based Systems: Web based system, web technology evaluation, traditional software and web based software, challenges in testing for web based software, testing web based testing, Testing a data warehouse.   | 3,5 | 05 |
| <b>6</b> | <b>Quality management</b><br>Software Quality Management, McCall's quality factors and Criteria, ISO 9126 quality characteristics, ISO9000:2000, software quality management  | 3   | 03 |
|          | <b>Total hours of instructions</b>  |     | 48 |

## References:

1. Naresh Chauhan, "Software Testing Principles and Practices", Oxford Higher Education
2. William E. Perry, "Effective Methods for Software Testing", third edition, Wiley Publication
3. K shirasagar Naik, Priyadarshi Tripathy, "Software Testing and quality assurance theory and practice", Wiley Publication
4. Aditya P. Mathur, "Foundation of Software Testing", Pearson publication.
5. M.G.Limaye, "Software Testing Principles, techniques and tools", Mc Graw Hill publication.



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| Course Code | Course Name      | Teaching Scheme (Hrs/week) |    |             | Credits Assigned |              |   |           |  |
|-------------|------------------|----------------------------|----|-------------|------------------|--------------|---|-----------|--|
|             |                  | L                          | T  | P           | L                | T            | P | Total     |  |
| ITL801      | Image Processing | --                         | -- | 2           | --               | --           | 1 | 1         |  |
|             |                  | <b>Examination Scheme</b>  |    |             |                  |              |   |           |  |
|             |                  | <b>ISE</b>                 |    | <b>ESE</b>  |                  | <b>Total</b> |   |           |  |
|             |                  | <b>Practical</b>           |    | <b>Oral</b> |                  | <b>Total</b> |   |           |  |
|             |                  | <b>40</b>                  |    | <b>-</b>    |                  | <b>20</b>    |   | <b>60</b> |  |

|   |                            |   |
|---|----------------------------|---|
| <b>Pre-requisite Course Codes</b>                                   | ITC801 ( Image processing) |   |
| After successful completion of the course, student will be able to: |                            |   |
|   | CO1                        | Implement Storage Provisioning using Logical Volume Number    |
|   | CO2                        | Implement Storage Area Network using Sim SAN and Samba Server |
|   | CO3                        | Summarize the concept of Storage Network Backup and Recovery  |
|   | CO4                        | Implement Information retrieval.                              |

| Exp. No.           | Experiment Details   | Ref. | Marks     |
|--------------------|--|------|-----------|
| 1                  | Implementation of Logical Volume Number                                      | 1,2  | 5         |
| 2                  | Implementation of software RAID  | 1,2  | 5         |
| 3                  | Implementation of SAN on Samba Server  | 1,2  | 5         |
| 4                  | Installation of SimSAN tool and Launch SimSAN agent, Engine and the Console. | 1,2  | 5         |
| 5                  | Implementing SAN on SimSAN.  | 1,2  | 5         |
| 6                  | To Design data centre for an organisation                                    | 1,2  | 5         |
| 7                  | Case Study on Storage Network Backup and Recovery                            |      | 5         |
| 8                  | Information retrieval using apache solr tool.                                | 1,2  | 5         |
| <b>Total Marks</b> |  |      | <b>40</b> |

## References:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , “ *Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infiniband* “ , Wiley
2. EMC Educational Services, “*Information Storage and Management*”, wiley India



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| Course Code | Course Name        | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |       |
|-------------|--------------------|----------------------------|----|-----------|------------------|----|-------|-------|-------|
|             |                    | L                          | T  | P         | L                | T  | P     | Total |       |
| ITL802      | Big Data Analytics | --                         | -- | 2         | --               | -- | 1     | 1     |       |
|             |                    | Examination Scheme         |    |           |                  |    |       |       | Total |
|             |                    | ISE                        |    | ESE       |                  |    | Total |       |       |
|             |                    | 40                         |    | Practical | Oral             | 20 |       |       |       |
|             |                    |                            |    | -         | 20               |    | 60    |       |       |

|   |  |   |
|---|--|---|
| <b>Pre-requisite Course Codes</b>                                   | IT34 (Object Oriented Programming)<br>TEITC604 (Data Mining and Business Intelligence)<br>ITC802(Big Data Analytics) |   |
| After successful completion of the course, student will be able to: |  |   |
| <b>Course Outcomes</b>  | CO1  | Demonstrate use of Map Reduce algorithms.   |
|   | CO2  | Choose appropriate NO SQL Database in big data analytics.   |
|   | CO3  | Apply map-reduce on Big data algorithms like Frequent Item set algorithm, Clustering, Data streaming algorithm. |
|   | CO4  | Make use of software tools like Pig, Hive, Hbase etc for big data analytics.                                    |
|   | CO5  | Create an application of big data analytics like recommender systems, social media applications etc.            |

| Exp. No. | Experiment Details   | Ref. | Marks |
|----------|--|------|-------|
| 1        | Installation of Hadoop and execution of HDFS commands                                | 1,2  | 5     |
| 2        | Implementing simple algorithms in Map- Reduce on Hadoop                              | 1,2  | 5     |
| 3        | Installation of any No SQL database and solving any case study of Big data using it. | 3    | 5     |



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|                    |   |       |    |
|--------------------|---|-------|----|
| 4                  | Demonstrate Matrix multiplication, Aggregates, joins, sorting, searching etc on Hadoop.   | 1,2   | 5  |
| 5                  | Make use of different software tools like Pig, Hive, Hbase etc for big data analytics.  | 1,2   | 5  |
| 6                  | Implementing any one Clustering algorithm using Map-Reduce  | 1,2   | 5  |
| 7                  | Implementing any one data streaming algorithm using Map-Reduce  | 1,2   | 5  |
| 8                  | Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web) a) Twitter data analysis b) Fraud Detection c) Text Mining etc. | 1,2,3 | 5  |
| <b>Total Marks</b> |   |       | 40 |

## References:

1. Anand Rajaraman and Jeff Ullman, "*Mining of Massive Datasets*", Cambridge University Press
2. Alex Holmes, "*Hadoop in Practice*", Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly, "*Making Sense of No SQL*" – A guide for managers and the rest of us, Manning Press.



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| Course Code | Course Name                      | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |    |       |       |
|-------------|----------------------------------|----------------------------|----|-----------|------------------|----|----|-------|-------|
|             |                                  | L                          | T  | P         | L                | T  | P  | Total |       |
| ITL803      | Computer Simulation and Modeling | --                         | -- | 2         | --               | -- | 1  | 1     |       |
|             |                                  | Examination Scheme         |    |           |                  |    |    |       | Total |
|             |                                  | ISE                        |    | ESE       |                  |    |    |       |       |
|             |                                  |                            |    | Practical | Oral             |    |    |       |       |
|             |                                  | 40                         | 10 |           | 10               |    | 60 |       |       |

|   |  |  |
|---|--|--|
| <b>Pre-requisite Course Codes</b>                                   | ITC803 ( Computer Simulation and Modeling) |  |
| After successful completion of the course, student will be able to: |  |  |
| <b>Course Outcomes</b>  | CO1  | Explain system elements, data collection, model done from research paper |
|   | CO2  | Solve a queuing problem using Excel sheet, GPSS, Extend Sim              |
|   | CO3  | Solve a inventory problem using Excel sheet, GPSS, Extend Sim            |
|   | CO4  | Demonstrate the use of simulation on real world system as group project  |

| Exp. No.           | Experiment Details  | Ref. | Marks     |
|--------------------|---|------|-----------|
| 1                  | Identify from simulation research paper the following- Input, Decision parameter, output performance measures.<br>Reference: paper published in wintersim.org | 1    | 5         |
| 2                  | Bring out the statistics by solving a Single-server queue problem using Excel sheet   | 1    | 5         |
| 3                  | Bring out the statistics by solving a multi-server queue problem using Excel sheet  | 1    | 5         |
| 4                  | Solve to find the optimum inventory to order newspapers using Excel sheet   | 1    | 5         |
| 5                  | Bring out the statistics by solving a Single-server queue problem using GPSS  | 2    | 5         |
| 6                  | Bring out the statistics by solving an inventory problem using GPSS   | 2    | 5         |
| 7                  | Solve SSQ problem using ExtendSim   | 3    | 5         |
| 8                  | Solve Newspaper problem using Extend Sim  | 3    | 5         |
| <b>Total Marks</b> |   |      | <b>40</b> |





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## References:

1. Jerry Banks, "*Discrete Event system Simulation*", 3<sup>rd</sup> edition, PHI.
2. GPSS – World manual, Minuteman Software
3. <https://www.extendsim.com/downloads/papers/WSC1997.PDF>. manual and video are available in the ExtendSim software package installed in the laboratory.



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| Course Code | Course Name                  | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|------------------------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                              | L                          | T  | P         | L                | T  | P     | Total |
| ITL8041     | Enterprise Resource Planning | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                              | Examination Scheme         |    |           |                  |    |       |       |
|             |                              | ISE                        |    | ESE       |                  |    | Total |       |
|             |                              |                            |    | Practical | Oral             |    |       |       |
|             |                              | 40                         | -  | 20        | 60               |    |       |       |

|   |  |   |
|---|--|---|
| <b>Pre-requisite Course Codes</b>                                   | ITC8041 (Enterprise Resource Planning) |   |
| After successful completion of the course, student will be able to: |  |   |
| <b>Course Outcomes</b>  | CO1                                    | Relate with ERP related technologies  |
|   | CO2                                    | Examine ERP development concepts and it's key modules                                     |
|   | CO3                                    | Analyze the ERP implementation life cycle and the importance of its process in E-business |
|   | CO4                                    | Compare ERP tools and its business benefits.  |

| Exp. No. | Experiment Description   | Ref. | Marks     |
|----------|--|------|-----------|
| 1        | Select an ERP tool and review on it. Understand current system in use and do feasibility study to convert it in to ERP   | 1, 2 | 5         |
| 2        | To design Business Process Models for Finance, HR, Purchases, manufacturing, Sales and distribution etc. Using DFD/UML diagrams. Business process modules should be prepared.  |      | 5         |
| 3        | Suitable ERP S W should be selected based on needs of Enterprise.<br>Pre Evaluation Screening<br>Package Evaluation<br>Project Planning Phase<br>Discussion based on various implementation strategies and pros and cons of each strategy. | 1, 2 | 5         |
| 4        | Selection of Business organization for ERP Implementation. Enterprise can small, medium scale related production/retail/service/BPO or consultancy.  | 1, 2 | 5         |
| 5        | Study of ERP Implemented Business Organization interference to ERP Implementation Life cycle   | 1, 2 | 5         |
| 6        | Reporting tools for ERP  | 1,2  | 5         |
| 7        | Design and Testing of unit modules and Integration of modules with realistic data  | 1, 2 | 5         |
| 8        | Customization of an ERP tool for an organization   | 1, 2 | 5         |
|          | <b>Total marks</b>   |      | <b>40</b> |



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## References:

1. Annetta Clewto and Dane Franklin, Jose Antonio, "Guide to Planning ERP Application", McGraw-Hill, 1997.
2. Jose Antonio, "The SAPR/3 Handbook" McGraw-Hill
3. Dr. Ravi Kalakota, "E-Business Network Resource planning using SAPR/3Baan and People soft: A Practical Road map For Success".



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| Course Code | Course Name    | Teaching Scheme (Hrs/week) |    |           | Credits Assigned |    |       |       |
|-------------|----------------|----------------------------|----|-----------|------------------|----|-------|-------|
|             |                | L                          | T  | P         | L                | T  | P     | Total |
| ITL8045     | Soft Computing | --                         | -- | 2         | --               | -- | 1     | 1     |
|             |                | Examination Scheme         |    |           |                  |    |       |       |
|             |                | ISE                        |    | ESE       |                  |    | Total |       |
|             |                |                            |    | Practical | Oral             |    |       |       |
| 40          |                | -                          |    | 20        |                  | 60 |       |       |

| Pre-requisite Course Codes  | ITC8045 (Soft Computing) |   |
|---|--------------------------|---|
| After successful completion of the course, student will be able to: |                          |   |
| Course Outcomes   | CO1                      | Design fuzzy logic control systems  |
|   | CO2                      | Apply supervised learning algorithms on various input patterns                        |
|   | CO3                      | Apply unsupervised learning algorithms on various input patterns                      |
|   | CO4                      | Design simple genetic algorithms for solving optimization problems                    |
|   | CO5                      | Make use of available open source toolboxes for a particular soft computing technique |

| Exp. No.           | Experiment Details   | Ref.  | Marks     |
|--------------------|--|-------|-----------|
| 1                  | To create a fuzzy library  | 2,3,4 | 5         |
| 2                  | To implement fuzzy membership functions.   | 2,3,4 | 5         |
| 3                  | To Design and implement Fuzzy Controller.  | 2,3,4 | 5         |
| 4                  | To implement Supervised Learning algorithm.<br>(Single Discrete Perceptron Training Algorithm) | 1,3   | 5         |
| 5                  | To implement Unsupervised Learning algorithm.<br>(Winner take all Learning)                    | 1,3   | 5         |
| 6                  | To implement Error Back-Propagation Training Algorithm   | 1,3   | 5         |
| 7                  | To solve an optimization problem using genetic algorithm                                       | 3,4   | 5         |
| 8                  | To use fuzzy toolbox/ ANN toolbox in Scilab for solving a given problem                        | 1,2,3 | 5         |
| <b>Total Marks</b> |  |       | <b>40</b> |

### References:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3rd ed. Wiley India.
3. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 2nd ed. Wiley India.
4. Jang J.S.R, Sun C. T. and Mizutani E., "Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Machine Intelligence," PHI.