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(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Course Structure and Detailed Syllabus
for

Final Year
B. Tech. Programme in Information Technology
(Academic Year 2023-24)

Rules and Regulations

1. The normal duration of the course leading to a B.Tech degree will be EIGHT semesters.
2. The normal duration of the course leading to M.Tech. degree will be FOUR semesters.
3. Each academic year shall be divided into 2 semesters, each of 20 weeks duration, including evaluation and grade finalization, etc. The Academic session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to Mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.
4. The schedule of academic activities for a Semester, including the dates of registration, mid-semester examination, end-semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.
5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra-curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

REGISTRATION:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full-Time Student of a UG/PG Programme:

A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.

2. Mandatory Pre-Registration for higher semesters:

In order to facilitate proper planning of the academic activities of a semester, it is essential for every institute to inform the Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.

3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Postgraduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

Course Prerequisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.
3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.

4. A student will be permitted to register in the next semester only if he fulfills the following conditions:

(a) Satisfied all the Academic Requirements to continue with the programme of Studies without termination;
(b) Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;
(c) Paid all required advance payments of the Institute and hostel for the current semester;
(d) Not been debarred from registering on any specific ground by the Institute.

EVALUATION SYSTEM:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 2019-20,starting from I year B.Tech.

Percentage of marks	Letter grade	Grade point
91-100	EX	10.0
86-90	AA	9.0
81-85	AB	8.5
76-80	BB	8.0
71-75	BC	7.5
66-70	CC	7.0
61-65	CD	6.5
56-60	DD	6.0
51-55	DE	5.5
40-50	EE	5.0
<40	EF	0.0

2. Class is awarded based on CGPA of all eight semesters of the B.Tech Program.

CGPA for pass is minimum 5.0	
CGPA upto< 5.50	Pass class
CGPA ≥ 5.50 & < 6.00	Second Class
CGPA ≥ 6.00 & < 7.50	First Class
CGPA ≥ 7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

3. A total of 100 Marks for each theory course are distributed as follows:

1	Mid Semester Exam (MSE) Marks	20
2	Continuous Assessment Marks	20
	End Semester Examination(ESE)Marks	60

4. A total of 100 Marks for each practical course are distributed as follows:

1	Continuous Assessment Marks	60
2	End Semester Examination (ESE)Marks	40

It is mandatory for every student of B.Tech to score a minimum of 40 marks out of 100, with a minimum of 20 marks out of 60 marks in End Semester Examination for theory courses.

This will be implemented from the first year of B.Tech starting from Academic Year 2019-20.

5. Description of Grades:

EX Grade: An 'EX' grade stands for outstanding achievement.
EE Grade: The 'EE' grade stands for minimum passing grade.
The students may appear for the remedial examination for the subjects he/she failed for the current semester of admission only and his/her performance will be awarded with EE grade only.
If any of the students remain Absent for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.
FF Grade: The 'FF' grade denotes very poor performance, i.e. failure in a course due to poor performance .The students who have been awarded 'FF' grade in a course in any semester must repeat the subject in next semester.

6. Evaluation of Performance:

1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(A) Semester Grade Point Average (SGPA): The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPA is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA - \frac{[\sum_{i=1}^{n} c_i g_i]}{[\sum_{i=1}^{n} c_i]}$$

Where
'n' is the number of subjects for the semester,
'ci' is the number of credits allotted to a particular subject, and
'gi' is the grade-points awarded to the student for the subject based on his performance
As per the above table.
-SGPA will be rounded off to the second place of decimal and recorded as such.

(B) Cumulative Grade Point Average (CGPA): An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPAis the weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (up to two decimal places).Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^{m} c_i g_i]}{[\sum_{i=1}^{m} c_i]}$$

Where
'm' is the total number of subjects from the first semester onwards up to and including the semester S,
'ci' is the number of credits allotted to a particular subject, and
'gi' is the grade-points awarded to the student for the subject based on his/her performance as per the above table.

-CGPA will be rounded off to the second place of decimal and recorded as such.

Award of Degree of Honours
Major Degree
The concept of Major and Minors at B.Tech level is introduced, to enhance learning skills of students, acquisition of additional knowledge in domains other than the discipline being pursued by the student, to make the students better employable with additional knowledge and encourage students to pursue cross-discipline research.

A. **Eligibility Criteria for Majors**

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester.
2. Students willing to opt for majors have to register at the beginning of 5th Semester.
3. The Student has to complete 5 additional advanced courses from the same discipline specified in the curriculum. These five courses should be of 4 credits each amounting to 20 credits. The students should complete these credits before the end of last semester.
4. Students may opt for the courses from NPTEL/ SWAYAM platform.(if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Students complying with these criteria will be awarded B.Tech (honours) Degrees.

B. **Eligibility Criteria for Minors**

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester.
2. Students willing to opt for minors have to register at the beginning of 5th Semester.
3. The Student has to complete 5 additional courses from other disciplines of their interest, which are specified in the respective discipline. These five courses should be of 4 credits each amounting to 20 credits.
4. Students may opt for the courses from NPTEL/ SWAYAM platform.(if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Students complying with these criteria will be awarded with B.Tech Degree in -------Engineering with Minor in ------ --Engineering.
(For e.g.: B. Tech in Civil Engineering with Minor in Computer Engineering)

For applying for Honours and Minor Degrees the student has to register themselves through the proper system.

ATTENDANCE REQUIREMENTS:

1. All students must attend every lecture, tutorial and practical classes.
2. To account for approved leave of absence (e.g. Representing the Institute in sports, games or athletics, placement activities, NCC/NSS activities, etc.) and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted.

If the student failed to maintain 75% attendance, he/she will be detained for appearing in the successive examinations.

The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be. In any case the student will not be permitted to appear for the examination if the attendance is less than 65%.

3. The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.
4. The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

TRANSFER OF CREDITS

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

a) 20 % of the total credit will be considered for respective calculations.

b) Credits transferred will be considered for overall credits requirements of the programme.

c) Credits transfer can be considered only for the course at the same level i.e. UG, PG etc.

d) A student must provide all details (original or attested authentic copies)such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.

e) A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.

f) Credits transfers availed by a student shall be properly recorded on the academic record(s) of the student.

g) In exceptional cases, the students may opt for higher credits than the prescribed.

Teaching and Evaluation Scheme for Final Year B. Tech. Programme in Information Technology

(Academic year 2023-24)

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total Marks	Credits	Total Hours
			L	T	P	MSE	CA		ESE				
							CA-I	CA- II	Internal	External			
Semester VII													
1	BTITC701	Cloud Computing and Storage Management	2	-	-	20	20		60		100	2	2
2	BTITC702	Artificial Intelligence#	3	-	-	20	20		60		100	3	3
3		**Elective VII**	3	-	-	20	20		60		100	3	3
	BTITE703A	A) Pattern Recognition											
	BTITE703B	B) Soft Computing											
	BTITE703C	C) Electronic Payment System[@]											
4		**Elective VIII** (Open)	3	-	-	20	20		60		100	3	3
	BTITOE704A	A) Financial Accounting											
	BTITOE704B	B) Machine Learning											
	BTITOE704C	C) Deep Learning											
5		**Elective IX**	3	-	-	20	20		60		100	3	3
	BTITPE705A	A) Real Time Systems											
	BTITPE705B	B) Information Security											
	BTITPE705C	C) Management Information Systems											
	BTITPE705D	D) Distributed Computing											
	BTITPE705E	E) Natural Language Processing											
6	BTITL706	Cloud Computing and Storage Management Lab	-	-	2	-	15	15	10	10	50	1	2
7		**Elective VII Lab**	-	-	2	-	15	15	10	10	50	1	2
	BTITEL707A	A) Pattern Recognition Lab											
	BTITEL707B	B) Soft Computing Lab											
	BTITEL707C	C) Electronic Payment System Lab											
8		**Elective IX Lab**	-	-	2	-	15	15	10	10	50	1	2
	BTITPEL708A	A) Real Time Systems Lab											
	BTITPEL708B	B) Information Security Lab											
	BTITPEL708C	C) Management Information Systems Lab											
	BTITPEL708D	D) Distributed Computing Lab											
	BTITPEL708E	E) Natural Language Processing Lab											
9	BTITP709	Project Phase I*	-	-	4	-	30		10	10	50	2	4
10	BTITF710	Field Training / Internship/ Industrial Training-III Evaluation	-	-	-	-	-		50		50	1	-
Summary of Semester Assessment Marks, Credit & Hours			**14**	**-**	**10**	**100**	**220**		**430**		**750**	**20**	**24**

Semester VIII													
1	BTITC801	Internet of Things#	3	-	-	20	20	60		100	3	3
2	BTITC802	Mobile Computing#	3	-	-	20	20	60		100	3	3
3	BTITP803	Project Phase II/ Project with Internship**	-	-	24	-	50	50	50	150	12	24
Summary of Semester Assessment Marks, Credit & Hours			**6**	**-**	**24**	**40**	**90**	**220**		**350**	**18**	**30**

 # These courses are to be studied on self –study mode using SWAYAM/NPTEL/Any other source.

*@ Course **designed and run** by ELECTRONIC PAYMENT AND SERVICES (P) LTD, Mumbai.*

** In case of students opting for Internship in the eighth semester, the Project must be industry-based.*

*** Six months of Internship in the industry.*

Course Title:	**Cloud Computing and Storage Management**	**Semester**	**VII**
Course Code	**BTITC701**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Core**	**Credits**	**2**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course, the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centers and Issues with Multi-tenancy, Storage virtualization, Challenges, Types of storage virtualization.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, Hadoop, HDFS and GFS.

UNIT IV

Business Continuity and Recovery: Information Availability,Life cycle, Failure analysis: Backup and Recovery-Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT V

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, ***"Cloud Computing Principles and Paradigms"***, Wiley Publishers, 2011.
2. Barrie Sosinsky, ***"Cloud Computing Bible"***, Wiley Publishers 2010.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"***, O'Reilly 2010.
4. EMC Corporation, ***"Information Storage and Management"***, 1st Edition, Wiley India 2009.

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, ***"Mastering Cloud Computing"***, McGraw Hill, 2013.
2. Michael Miller, ***"Cloud Computing : Web-based Applications that change the way you work and collaborate online"***, Pearson Education, 2008.
3. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th Edition, November 2012.

Course Title:	**Artificial Intelligence**	**Semester**	**VII**
Course Code	**BTITC702**	**Course Type**	**Compulsory**
Prerequisite	**-**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To acquaint the students with the theoretical and computational techniques in Artificial Intelligence.
2. To use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.
3. To use different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification.
4. To understand the conceptual and computational trade-offs between the expressiveness of different formal representations.

Course Outcomes:

After learning the course the students should be able:

1. To find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. To analyze, formalize and write algorithmic methods for search problems.
3. To explain important search concepts, the definitions of admissible and consistent heuristics and completeness and optimality.
4. To implement and execute by hand alpha-beta search.
5. To design good evaluation functions and strategies for game playing.
6. To carry out proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
7. To choose and implement learning algorithms such as decision trees, support vector machines, and boosting.

Course Content:

UNIT I

Introduction: Overview of Artificial intelligence- Problems of AI, AI techniques, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, Nature of environment, Structure of agents, Goal based agents, Utility based agents, Learning agents.

UNIT II

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, Production system, Problem characteristics and issues in the design of search programs. Search techniques: Solving problems by searching: problem solving agents, Searching for solutions; uniform search strategies: Breadth first search, Depth first search, Depth limited search, Bidirectional search, Comparing uniform search strategies.

UNIT III

Heuristic search strategies: Greedy best-first search, A* search, Memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, Simulated annealing search, Local beam search, Genetic algorithms; Constraint satisfaction problems, Local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, The minimax search procedure, Alpha-beta pruning, Additional refinements, Iterative deepening.

UNIT IV

Knowledge & reasoning: Knowledge representation issues, Representation & mapping, Approaches to knowledge representation, Issues in knowledge representation. Using predicate logic: Representing simple fact in logic, Representing instant & ISA relationship, Computable functions & predicates, Resolution, Natural deduction. Representing knowledge using rules: Procedural versus declarative knowledge, Logic programming, Forward versus backward reasoning, Matching, Control knowledge, Probabilistic reasoning: Representing knowledge in an uncertain domain, The semantics of Bayesian networks, Dempster-Shafer theory.

UNIT V

Natural Language processing & Expert, Fuzzy logics Systems: Planning: Overview, Components of a planning system, Goal stack planning, Hierarchical planning and other planning techniques.

Natural Language processing: Introduction, Syntactic processing, Semantic analysis, Discourse & pragmatic processing. Learning: Forms of learning, Inductive learning, Learning decision trees, explanation based learning, Learning using relevant information, Neural net learning & genetic learning. Expert Systems: Representing and using domain knowledge, Expert system shells and knowledge acquisition, Fuzzy sets & fuzzy logics.

Text Books:

1. Rich, E. and Knight K., ***"Artificial Intelligence"***, 3rd Edition, Tata McGraw- Hill, 2017.
2. Russell, S. and Norvig P., ***"Artificial Intelligence: A Modern Approach"***, 4th Edition, Pearson Education, 2010.
3. Patterson, Dan W. ,***"Introduction to Artificial Intelligence & Expert Systems"***, PHI, 2016.

Reference Book:

1. Nilsson N. J., Morgan Kaufmann, ***"Artificial Intelligence: A New Synthesis"***, Standard Edition, Tata McGraw-Hill, 1998.

Course Title:	**Pattern Recognition**	**Semester**	**VII**
Course Code	**BTITE703A**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognition research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Course Outcomes:

1. Identify and explain detailed aspects of internal structures of pattern recognitions.
2. Compare and contrast design issues for statistical pattern recognition.
3. Develop implementation skills for building pattern recognition.

Course Content:

UNIT I

Introduction: Machine Perception, Definition of Pattern Recognition (PR), Pattern Recognition System: Sensing, Segmentation & grouping, Feature extraction, Classification and Post-processing, Design Cycle: Data collection, Feature choice, Model choice, Training, Evaluation and computational complexity, Learning and adaptation: Supervised learning, Unsupervised learning, Reinforcement learning, Examples of PR Applications.

UNIT II

Statistical Pattern Recognition: Bayesian Decision Theory and Classifiers, Normal density and discriminant functions, Linear discriminant functions, **Discriminative Classifiers:** Decision Boundary, Separability, Perceptron, Support Vector Machines.

UNIT III

Parameter Estimation Methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods: Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), **Artificial neural networks:** Multilayer perceptron – feed-forward neural network, A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

UNIT IV

Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification, **Tree Classifiers:** Decision Trees: CART, C4.5, ID3, Random Forests.

UNIT V

Unsupervised Learning & Clustering, Criterion functions for clustering, Clustering Techniques: K means, Hierarchical clustering, K-medoids, DBSCAN, Cluster validation, Feature selection & extraction, **Classifier Ensembles:** (a) Bagging, (b) Boosting / AdaBoost.

Text Books:

1. Duda, R.O., Hart, P.E., Stork, D.G. ***"Pattern Classification",*** Wiley, 2nd Edition, 2001.
2. EartGose, Richard Johnsonburg and Steve Joust, ***"Pattern Recognition and Image Analysis' "***, Prentice-Hall of India- 2003.

Reference Books:

1. Bishop, C. M. ***"Pattern Recognition and Machine Learning"*** Springer, 2nd Edition, 2007.
2. Marsland, S., ***"Machine Learning: An Algorithmic Perspective"***, CRC Press. 2009.
3. Theodoridis, S. and Koutroumbas, K., ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
4. Russell, S. and Norvig, N., ***"Artificial Intelligence: A Modern Approach",*** Prentice Hall, Series in Artificial Intelligence, 2003.

Course Title:	**Soft Computing**	**Semester**	**VII**
Course Code	**BTITE703B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To gain insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems.
3. To create awareness of the application areas of soft computing technique.
4. To learn alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system.

Course Outcomes:

After learning the course the student will be able:

1. To use a new tool /tools to solve a wide variety of real world problems.
2. To find an alternate solution, more adaptable, resilient and optimum.
3. To apply knowledge of the soft computing domain to real world problems.

Course Content:

UNIT I

Artificial Neural Network: Artificial Neural Network, Biological neuron , Artificial neuron model , Concept of bias and threshold , McCulloch Pits Neuron Model , Implementation of logical AND, OR, XOR functions , Learning paradigms: Supervised, Unsupervised, Reinforcement , Linear neuron model , Gradient descent algorithm, Activation functions: Binary, Bipolar (linear, signup, log sigmoid, tan sigmoid) , Learning mechanisms: Hebbian, Delta Rule of Perceptron and its limitations.

UNIT II

Artificial Neural Network: Multilayer perceptron (MLP) and backpropagation algorithm, Application of MLP, Self-organizing Feature Maps, Clustering of Learning vector quantization, Radial Basis Function networks, Hopfield network, auto associative and hetero - associative memory, A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

UNIT III

Fuzzy Logic -I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT IV

Fuzzy Logic-II (Fuzzy Membership, Rules): Membership functions, Interference in fuzzy logic, Fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications & Defuzzification , Fuzzy Controller , Industrial applications.

UNIT V

Evolutionary computation: Genetic Algorithms, Survival of the Fittest, Fitness Computations, Crossover, Mutation, Reproduction, Rank method, Rank space method, Simulated annealing, Evolutionary computation, Ant colony optimization algorithms, Particle swarm optimization.

Text Books:

1. Laurene Fausett, ***"Fundamentals of Neural Networks: Architectures, Algorithms And Applications"***, Pearson Education, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, 3rd Edition, John Wiley & Sons, 2010.
3. J.S. Jang, C.T. Sun, E. Mizutani, ***"Neuro- Fuzzy and Soft Computing"***, PHI Learning Private Limited.
4. S. N. Sivanandam, S. N. Deepa, ***"Principles of Soft Computing"***, John Wiley & Sons, 2007.

Reference Books:

1. John Hertz, Anders Krogh, Richard Palmer, ***"Introduction to the theory of neural computation"***, Addison – Wesley Publishing Company, 1991.
2. Simon Haykin, ***"Neural Networks A comprehensive foundation"***, Prentice Hall International Inc-1999.
3. José C. Principe Neil R. Euliano , W. Curt Lefebvre, ***"Neural and Adaptive Systems: Fundamentals through Simulations"***, John-Wiley & Sons, 2000.
4. Peter E. Hart, David G. Stork Richard O. Duda, ***"Pattern Classification"***, 2nd Edition, 2000.
5. SergiosTheodoridis, Konstantinos Koutroumbas, ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
6. Hung T. Nguyen, Elbert A. Walker, ***"A First Course in Fuzzy Logic"***, 3rd Edition, Taylor & Francis Group, LLC, 2008.
7. S. N. Sivanandam, S. Sumathi, S. N. Deepa, ***"Introduction to Fuzzy Logic using MATLAB"***, Springer Verlag, 2007.

Course Title:	**Electronic Payment System**	**Semester**	**VII**
Course Code	**BTITE703C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To understand common payment methods, working of different payment systems.
2. To learn basic payments processes and systems.
3. To understand emerging payments trends.
4. To gain knowledge on the underlying technologies governing payment systems.

Course Outcomes:

After learning the course, the students should be able:

1. To learn and speak Financial Services language.
2. To familiarize with banking regulations in the payment industry.
3. Gain domain knowledge for a careerin the financial industry: Banks, Insurance & NBFC.

Course Content:

UNIT I

Evolution of payment systems in the digital world: Role of RBI in payment/clearing/settlement Indian payment systems: IMPS, NEFT/RTGS, eWallet, eKYC, AADHAR / AADHAR VAULT, RUPAY Debit/Credit cards, *99#, NACH,ABPS, BHIM, BHARAT PAY, CREDIT CARD, VISA/MASTER ROLE in CREDIT CARD PAYMENTS, CTS, UPI, BBPS, ATM.**Transformation in Social media channels & Payments:** ChatBot, WhatsApp, FB.

UNIT II

Risks in Payment Systems : Credit Risk, Liquidity Risk, Systemic Risk, Operational Risk.**Risk mitigation techniques:** Carefully chosen members, Novation, Central counterparty system, Loss sharing arrangements, Collateral, Other mitigation techniques like RECO.**Relationship structures:** Correspondent banking, Bilateral clearing, arrangements, Network managed banking.

UNIT III

Payment types: Book payments, Local payments, Domestic payments, Cross border payments.**Regional payments systems:**USA payment systems :Fedwire, CHIPS, NSS, ACH, SEPA payment systems : TARGET2, STEP 2 (SCT/SDD) PE- AC, China payment system : CDFCPS/CIPS, Hong Kong payment system : CHATSCanadian payment system : LVTS, Indian payment systems : RTGS, NEFT, IMPS, UPI.

UNIT IV

Overview of SWIFT messaging: MT and MX messages, Role of SWIFT in payment systems, SWIFTnet Fin, File act, Interact, Browse SWIFT payment message processing – MT 1XX, MT 2XX, MT 9XX, MX PAIN/PACS, SWIFT Payment Messages examples, SWIFT for corporate.

UNIT V

Use of code in payment systems:Codes – IBAN, BBAN, BIC, BEI, UID, UPIC, ABA routing codes etc., IFSC.
Foreign exchange transactions: Cash, TOM, Spot, Forwards, Interbank transactions, Merchant transactions, Exchange rate determination and rate computation.**Cash management products:** Concept of float, Cash concentration, notional pooling and sweep, Virtual account management (VAM), ACH filter/ACH block, Lockboxes. **Impact of regulation:** Basel, FATF/OFAC compliance, FATCA compliance, AML compliance, FRM compliance. Practical: Working of ATMs, Insides of an ATM, Vulnerability Points, Care to be taken while using ATM.

Text Book:

1. S. K. Nippani, B. K. Murthy, ***"Digital India Governance Transformation"***, 2018.

Online Reference for books & documentations:

https://rbidocs.rbi.org.in/rdocs/

Course Title:	**Financial Accounting**	**Semester**	**VII**
Course Code	**BTITOE704A**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To learn basic concepts of financial accounting and reporting.
2. To understand the financial reports rather than to prepare them.
3. To help the participants to become intelligent users of accounting information.
4. To develop the ability in students to use financial statements to assess a company's performance.

Course Outcomes:

After learning the course, the student will be able:

1. Understand the basic accounting and financial terminology.
2. Understand how events affect firm value.
3. Understand how financial transactions are recorded.
4. Make the participants' comfortable looking through financial statements.

CourseContent:

UNIT I

Introduction to Financial Accounting: Accounting as an Information System, Financial, Cost and Management Accounting and their Interrelationships, Finance Function and Accounting, Auditing and Internal Control, Ethical Issues in Accounting, Forms of Organisations and Their Effect on Accounting, Accounting and Corporate Governance, Accounting Concepts and Convention, Accounting Policies, Generally Accepted Accounting Principles (GAAP), International Financial Reporting Standards (IFRS), Indian Accounting Standards (Ind AS), Indian Government Accounting Standards (IGAS).

UNIT II

Presentation of Financial Statements: Balance Sheet- Conceptual Basis of a Balance Sheet, Capital and Revenue Expenditure and Receipts, Classification of Items on a Balance Sheet, Format of Balance Sheet, Balance Sheet Equation, Preparing Balance Sheet. **Preparation of Final Accounts:** The Income Statements-Introduction, Format of Profit and Loss Account, Profit and Loss Account of a Manufacturing Concern, Appropriation of Profit, Advantages of Profit and Loss Account.

UNIT III

Mechanics of Accounting: Introduction, Classification of Accounts, Double Entry System, Overview of Accounting Cycle, Preparing Journals, Subsidiary Books, Ledger, Preparation of Trial Balance, Accounting Errors and Their Rectification, Bank Reconciliation Statement (BRS), Computerised Accounting. **Fixed Assets and Depreciation Accounting:** Introduction, Cost of Fixed Assets, Depreciation, Method of Computing Depreciation, Accounting Treatments for Transactions, Impairment of Assets. **Inventory Valuation:**Introduction,Record Keeping for Inventory, Perpetual Inventory System, Inventory Valuation/Measurement, Methods of Valuation of Inventories, Analysis of Inventories.

UNIT IV

Corporate Accounts: Introduction to Companies, Types of Companies, Shares and Share Capital, Issue of Shares, Share Issue: Payments in Installment, Buyback of Shares, Debentures and Bonds, Income Statement/Profit and Loss Account, Balance Sheet, Company Annual Report. **Cash Flow Statement:** Introduction to Cash Flow Statement, Cash and Cash Equivalents, Cash Flow Activities, Operating Activities, Some Special Items, Free Cash Flow, Fund Flow Statement, Analysis of Cash Flow Statement, Preparation of Cash Flow Statement.

UNIT V

Financial Statement Analysis: Introduction, Techniques for Financial Statement Analysis, Horizontal Analysis: Comparative and Trend Statements, Vertical Analysis: Common Size, Liquidity Ratios: Current and Quick Ratio, Solvency Ratios: D/E, Interest Coverage, Profitability Ratios: GP, NP, EBIT, EBDITA, EPS, Return Ratios: ROI, ROE, Turnover Ratios, Analysis of Stock and Debtors, Working Capital Management, Stock Prices and Financial Data: P/E.

Investments: Introduction, Financial Instrument, Assets and Liabilities, Joint Ventures, Subsidiaries and Associates, Consolidated Financial Statement, Business Combinations, Accounting for Investments, Contemporary Issues in Accounting.

Text Books:

1. Bapat and Raithatha, **"*Financial Accounting – A Managerial Perspective"***, McGraw Hill, 2017.
2. C.T. Horngren, "***Accounting for Management Control: An introduction"***, Prentice Hall, 2018.

Reference Books:

1. Ramchandran and Kakani, ***"Financial Accounting for Management "***, McGraw Hill, 2018.

Course Title:	**Machine Learning**	**Semester**	**VII**
Course Code	**BTITOE704B**	**Course Type**	**Elective**
Prerequisite	**Engineering Mathematics-II**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

Course Outcomes:

After learning the course the student will be able:

1. To demonstrate knowledge of machine learning literature.
2. To describe how and why machine learning methods work.
3. To demonstrate results of parameter selection.
4. To explain relative strengths and weaknesses of different machine learning methods.
5. To select and apply appropriate machine learning methods to a selected problem.
6. To implement machine learning algorithms on real datasets.
7. To suggest ways to improve results.

Course Content:

UNIT I

Introduction: Basic definitions, types of learning, Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, hypothesis space and inductive bias, evaluation, cross-validation,

Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, A General approach for deriving confidence intervals, Difference in error of two hypothesis, Hypothesis testing, comparing learning algorithms.

UNIT II

Probability and Bayes learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, PAC learning model, Sample complexity, The VC Dimension., Linear regression, Logistic Regression,Instance based learning, Feature reduction, Collaborative filtering based recommendation, Practical Machine Learning: Bias-Variance; Training/Testing; Overfitting; Cross-Validation; Occam's razor; Regularization and Model Selection.

UNIT III

McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

UNIT IV

Principal Component Analysis and its interpretations, Singular Value Decomposition, Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer Wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization.

UNIT V

Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks, Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs.

Text Books:

1. Mitchell, Tom. M., ***"Machine Learning",*** McGraw-Hill Education, 1st Edition, May 2013.
2. Miroslav, Kubat. ***"An Introduction to Machine Learning",*** Springer Publishing.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, ***"Deep Learning",*** An MIT Press book. (http://www.deeplearningbook.org)

Reference Books:

1. Bishop, C. M., ***"Pattern Recognition and Machine Learning"***, Springer Publishing.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ***"Deep Learning",*** 2016.
3. Web Reference: https://onlinecourses.nptel.ac.in/noc23_cs24/preview

Course Title:	**Deep Learning**	**Semester**	**VII**
Course Code	**BTITOE704C**	**Course Type**	**Elective**
Prerequisite	**Engineering Mathematics-II**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of Deep learning.
2. To make use of some elementary Deep learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of DL algorithms in different fields.
4. To understand the major Deep learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common Deep learning methods.

Course Outcomes:

After learning the course the student will be able:

1. To learn about the building blocks used in these Deep Learning based solutions.
2. To learn about feedforward neural networks, convolutional neural networks, recurrent neural networks and attention mechanisms.
3. To learn various optimization algorithms such as Gradient Descent, Nesterov Accelerated Gradient Descent, Adam, AdaGrad and RMSProp.
4. To learn to train deep neural networks.
5. To get the knowledge of deep architectures used for solving various Vision and NLP tasks.

Course Content:

UNIT I

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.

UNIT II

FeedForward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition.

UNIT III

Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout.

UNIT IV

Learning Vectorial Representations Of Words Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.

UNIT V

Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images.

Text Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, ***"Deep Learning",*** An MIT Press book. http://www.deeplearningbook.org
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ***"Deep Learning",*** 2016.

Reference Books:

1. Michael Nielsen, ***"Neural Networks and Deep Learning",*** 2016.
2. Yoshua Bengio, "***Learning Deep Architectures for AI"***, 2009.

Course Title:	**Real Time Systems**	**Semester**	**VII**
Course Code	**BTITPE705A**	**Course Type**	**Elective**
Prerequisite	**Operating Systems, Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To introduce students to the fundamental problems, concepts and approaches in the design and analysis of real-time systems.
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To learn real-time scheduling and schedulability analysis.
4. To understand formal specification and verification of timing constraints and properties.
5. To design methods for real-time systems.
6. To learn new techniques of state-of-the-art real-time systems research.

Course Outcomes:

After learning the course the student will be able:

1. To characterize real-time systems and describe their functions.
2. To analyze, design and implement a real-time system.
3. To apply formal methods to the analysis and design of real-time systems.
4. To apply formal methods for scheduling real-time systems.
5. To characterize and debug a real-time system.

Course Content:

UNIT I

Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Offline vs. online Scheduling.

UNIT II

Clock-Driven Scheduling: Static, Time-Driven Scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of a-periodic Jobs, Scheduling Sporadic Jobs.

Priority Driven Scheduling of Periodic Tasks: Fixed priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

UNIT III

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queuing Servers.

UNIT IV

Resources and Resource Access control: Resource contention, Resource access control, Non Preemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

UNIT V

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Text Books:

1. Jane W. S. Liu, ***"Real-Time System"***, Pearson Education.
2. C. M. Krishna and K. G. Shin, ***"Real-Time Systems"***, McGraw Hill.

Reference Books:

1. Laplante, ***"Real Time System Design and Analysis: An Engineer Handbook"***, PHI.
2. Dr. K. V. K. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India.

Course Title:	**Information Security**	**Semester**	**VII**
Course Code	**BTITPE705B**	**Course Type**	**Elective**
Prerequisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure and Security Management**	**Credits**	**3**

Course Objectives:

1. To understand information security's importance in the increasingly computer-driven world.
2. To master the key concepts of information security and its working.
3. To develop a security mindset.
4. To learn to critically analyze situations of computer and network security usage.
5. To identify the salient issues, viewpoints and trade-offs of information security.

Course Outcomes:

After learning the course the student will be able:

1. To explain the challenges and scope of information security.
2. To explain security concepts as confidentiality, integrity and availability.
3. To explain the importance of cryptographic algorithms used in information security .
4. To identify and explain symmetric algorithms for encryption-based security of information.
5. To describe the access control mechanism used for user authentication and authorization.
6. To describe Secure Sockets Layer (SSL), Internet Protocol (IP) communications by using Internet Protocol Security (IPSec).
7. To explain the use of security tools as firewalls and intrusion prevention systems.
8. To explain malicious software issues introduced by software-based viruses and worms.
9. To describe the process of risk assessment in the context of IT security management.

Course Content:

UNIT I

Introduction to Information Systems: Security concepts, Computer security concepts, Threats, Attacks and Assets, Security functional requirements, A security architecture for Open Systems, Computer security trends, Computer security strategy.

UNIT II

Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Practical Application: Encryption of Stored Data.

UNIT III

Models, Frameworks, Standards & Legal Framework: A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799, Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity, Indian IT Act, Laws of IPR, Indian Copyright Act.

UNIT IV

Controls: Access control principles, Subjects, Objects and access rights, Discretionary access control, Role-based access control, Case study.

Virus and Malware: Introduction & types of Malicious Software (Malware), Propagation–Infected Content–Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM Email, Trojans, Payload–System Corruption, Payload–Attack, Agent–Zombie, Bots, Payload–Information Theft–Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures.

UNIT V

Security issues: Database security challenge in the modern world, Federated Databases, securing Mobile databases, Network Security, Trusted and untrusted networks, Network attacks, Network security dimensions, Network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, Outsourcing using data masking ; privacy issues in smart card applications, Ethical Hacking ;Role of Cryptography in information security, digital signatures.

Text Books:

1. Nina Godbole, ***"Information Systems Security: Security Management, Metrics, Frameworks And Best Practices"***, Wiley, 2008.
2. Mark Rhodes –Ousley, ***"Information Security: The Complete Reference"***, McGraw-Hill Education, 2nd Edition, 2013.
3. Dhiren R Patel, ***"Information Security Theory and Practices"***, PHI Learning, 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, 2nd Edition, Wiley, 2011.

Reference Books:

1. Gary R. McGraw, ***"Software Security: Building Security In"*** Addison Wesley, 2006.
2. Ankit Fadia, ***"Network Security: A Hacker's Perspective"***, 2006.

Course Title:	**Management Information Systems**	**Semester**	**VII**
Course Code	**BTITPE705C**	**Course Type**	**Elective**
Prerequisite	**Decision Support Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To create interest and awareness about the proliferation of the Information Systems in today's organizations.
2. To understand categories of MIS: Operations Support System, Management support system and Office automation system, Functional management system.
3. To learn Information systems for strategic management and strategic role of information systems.
4. To plan for information systems: Identification of Applications, Business Application Planning, Systems and Critical Success Factors, Method of Identifying Applications.
5. To understand System Development Process and Approaches, System Implementation, System maintenance, Introduction to MIS Risks, System Evaluation, IT Procurement Options. Change management in IT Projects.

Course Outcomes:

After learning the course the student will be able:

1. To understand the usage and constituents of MIS in organizations.
2. To understand the classifications, understanding and the different functionalities of these MIS.
3. To explain the functions and issues at each stage of system development.
4. To identify emerging trends in MIS technologies.
5. To identify and assess MIS in real-life organization.

Course Content:

UNIT I

Management & organizational support systems for digital firm: Definition of MIS; Systems Approach to MIS: Report writing s/w, MIS and Human factor considerations, concept of organizational information subsystem, MIS & problem solving.

UNIT II

Information systems & business strategy: Information Management, Who are the users? Manager & Systems, Evolution of Computer based information system (CBIS), Model of CBIS. Information services organization: Trend to End-User computing, Justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level and Firm level Strategy.

UNIT III

Information systems in the enterprise: Systems from Management and functional perspective and their relationship: Executive Information System, Decision support system sales and Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance and Account Information System.

UNIT IV

Information technology for competitive advantage: Firm in its environment, information resource management of information resource, Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept.

UNIT V

E-commerce and international information system: Introduction to E-Commerce, Business Intelligence. E-Commerce strategy, Electronic Data Interchange, E-commerce methodology, E-commerce technology, Business application of the Internet. Electronic Business success strategies, International Information Systems architecture, Strategy: divide, conquer and appease, Cooptation, Business organization, Problems in implementing global information systems, Computer crime, ethics and social issues.

Text Book:

1. Kelkar, S.A., ***"Management Information Systems"***, 2nd Edition, Prentice Hall of India, 2009.

Reference Books:

1. Mark G. Simkin, ***"Introduction to Computer Information System for Business"***, 1996.
2. James A. Senn, ***"Analysis & Design of Information Systems"***, McGraw-Hill.

Course Title:	**Distributed Computing**	**Semester**	**VII**
Course Code	**BTITPE705D**	**Course Type**	**Elective**
Prerequisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To understand the major tools and techniques that allow programmers to effectively program the parts of the code that require substantial communication and synchronization.
2. To study the core ideas behind modern coordination and communication paradigms and distributed data structures.
3. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs.
4. To realize basic principles and best practice engineering techniques of concurrent and distributed computing.
5. To study the safety and progress properties of concurrent and distributed algorithms.
6. To understand the performance of current multi-core and future many-core systems.

Course Outcomes:

After learning the course, the student will be able:

1. To identify the core concepts of distributed systems.
2. To learn orchestration of multiple machines to correctly solve problems in an efficient, reliable and scalable way.
3. To examine concepts of distributed systems in designing large systems.
4. To apply distributed computing concepts to develop sample systems.

Course Content:

UNIT I

Introduction: Historical background, Key characteristics, Design goals and challenges, Review of networking and internetworking, Internet protocols.

UNIT II

Processes and Inter process Communication: Processes and threads, Virtualization, Code migration, The API for the Internet protocols, External data representation, Client-server communication, Multicast communication, Message oriented communication, Network virtualization, Overlay networks, RPC and MPI.**Naming:** Name services and Domain Name System, Directory services, Case study: X.500 directory service.

UNIT III

Time, Global States and Synchronization: Physical and logical clocks, Global states, Mutual exclusion, Election algorithms, Consistency and Replication: Consistency models, Replica management, Consistency protocols.

UNIT IV

Fault Tolerance and Security: Distributed Commit, Recovery, Security Issues, Cryptography. Distributed File Systems: File service architecture, Case study: Sun Network File System, The Andrew File System.

UNIT V

Peer to peer Systems: Introduction, Napster, Peer-to-peer middleware, Routing overlays, **Case studies:** Pastry, Tapestry. **Distributed Object Based Systems:** Distributed objects, Java beans, CORBA.

Text Books:

1. Tanenbaum A.S, ***"Distributed Systems: Principles and Paradigms"***, 2nd Edition, Pearson Education, 2006.
2. Coulouris G., Dollimore J., Kindberg T. and Blair G., ***"Distributed Systems: Concepts and Design"***, 5th Edition, Addison Wesley, 2011.
3. Mahajan S., Shah S., ***"Distributed Computing"***, 1st Edition, Oxford University Press, 2010.

Reference Books:

1. Hwang K., Dongarra J., Geoffrey C. Fox, ***"Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"***, Morgan Kaufmann, 2011.
2. Comer D.E. and Droms, R.E., ***"Computer Networks and Internets"***, 4th Edition, Prentice-Hall, 2004.

Course Title:	**Natural Language Processing**	**Semester**	**VII**
Course Code	**BTITPE705E**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To learn the leading trends and systems in natural language processing.
2. To understand the concepts of morphology, syntax, semantics and pragmatics of the language.
3. To recognize the significance of pragmatics for natural language understanding.
4. To describe a simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation.
5. To describe applications based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

After learning the course the student will be able:

1. To understand the models, methods and algorithms of statistical Natural Language Processing.
2. To implement probabilistic models in code, estimate parameters for such models and run meaningful experiments to validate such models.
3. To apply core computer science concepts and algorithms, such as dynamic programming.
4. To understand linguistic phenomena and explore the linguistic features relevant to each NLP task.
5. To identify opportunities and conduct research in NLP.
6. To analyze experimental results and write reports.

Course Content:

UNIT I

Introduction to NLP: Definition, Issues, Application domain, Tools for NLP, Linguistic organization of NLP, NLP vs. PLP. Morphology: Inflectional, derivational, Parsing and parsing with FST.

UNIT II

Introduction and Basic Text Processing, Language Modeling N-grams: Simple N-grams, Counting words in Corpora, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT III

POS Tagging: Tagsets, Concept of HMM tagger, Rule based and stochastic POST, Algorithm for HMM tagging, Transformation based tagging, Models for Sequential tagging – MaxEnt, CRF.

UNIT IV

Parsing : CFG and different parsing techniques, Constituency Parsing, Dependency Parsing, Distributional Semantics, Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, Internal structure of words, Metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction based, Machine learning based and dictionary based approaches.

UNIT V

Topic Models, Entity Linking, Information Extraction, Text Summarization, Text Classification, Sentiment Analysis and Opinion Mining.

Text Books:

1. Jurafsky & J. H. Martin, ***"Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition"***, Pearson Education.
2. Allen, James, ***"Natural Language Understanding"***, 2nd Edition, Benjamin/Cummings, 1996.

Reference Books:

1. Bharathi, A.,Vineet Chaitanya and Rajeev Sangal, ***"Natural Language Processing-A Paninian Perspective",*** Prentice Hall India, 1995.
2. Eugene Cherniak, ***"Statistical Language Learning"***, MIT Press, 1993.
3. Manning, Christopher and Heinrich Schütze, ***"Foundations of Statistical Natural Language Processing",*** MIT Press, 1999.

Course Title:	**Cloud Computing and Storage Management Lab**	**Semester**	**VII**
Course Code	**BTITL706**	**Course Type**	**Compulsory**
Prerequisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credit**	**1**

Lab Experiments Objectives:

Learners will be able to...

1 Appreciate cloud architecture.
2 Create and run virtual machines on open source OS.
3 Implement Infrastructure, storage as a Service.
4 Install and appreciate security features for the cloud.

Lab Experiments List:

1. Study of Cloud Computing & Architecture.
2. Study and implementation of Infrastructure as a Service.
3. Implementation of Private cloud using Eucalyptus or Open stake.
   - Working with KVM to create a VM.
   - Installation and configuration of Private cloud.
   - Bundling and uploading images on a cloud.
   - Creating a web based UI to launch a VM.
   - Working with Volumes – Attached to the VM.

Course Title:	**Pattern Recognition Lab**	**Semester**	**VII**
Course Code	**BTITEL707A**	**Course Type**	**Elective**
Prerequisite	**NIL**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Lab Experiments List:

1. Feature Representation.
2. Mean and Covariance.
3. Linear Perceptron Learning.
4. Generation of Random Variables.
5. Bayesian Classification.
6. MLE: Learning the classifier from data.
7. Data Clustering: K-Means, MST-based.

Course Title:	**Soft Computing Lab**	**Semester**	**VII**
Course Code	**BTITEL707B**	**Course Type**	**Elective**
Prerequisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

1. To utilize Soft computing algorithms to solve engineering problems.
2. To compare results and provide an analysis of algorithm efficiency.
3. To apply a soft computing thought process for solving issues.

Lab Experiments List:

1. Implement a simple logic network using the MP neuron model.
2. Implement a simple linear regression with a single neuron model.
3. Implement and test MLP trained with back-propagation algorithms.
4. Implement and test RBF network.
5. Implement SOFM for character recognition.
6. Implement fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzification (Max-membership principle, Centroid method, Weighted average method).
8. Implement FIS with MamdaniInference mechanism.
9. A small project: may include classification or regression problems, using any soft computing technique studied earlier.

Course Title:	**Electronic Payment System Lab**	**Semester**	**VII**
Course Code	**BTITEL707C**	**Course Type**	**Elective**
Prerequisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

To design and write programs to demonstrate various real life payment system concepts.

Lab Experiments List:

Assignments and projects based on syllabus.

Course Title:	**Real Time Systems Lab**	**Semester**	**VII**
Course Code	**BTITPEL708A**	**Course Type**	**Elective**
Prerequisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To design and write programs to demonstrate various real time system concepts of scheduling processes.
2. To demonstrate how real time principles can be applied to business problems by simulating business processes.

Lab Experiments List:

1. Execute a program to demonstrate real time scheduling EDF vs. LST to show a comparative result.
2. Demonstrate clock driven scheduler system.
3. Develop a random generator to set priority and demonstrate a priority driven scheduler system.
4. Simulate a manufacturing process to demonstrate resource and resource control scheduling system in real time.
5. Simulate a logistics service provider scheduling of a product delivery system using the principles of real-time system learned in the course.

Course Title:	**Information Security Lab**	**Semester**	**VII**
Course Code	**BTITPEL708B**	**Course Type**	**Elective**
Prerequisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure and Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
   a. Caesar Cipher
   b. Playfair Cipher
   c. Hill Cipher
   d. Vigenere Cipher
   e. Rail fence – row & Column Transformation.
2. Implement the following algorithms
   a. DES
   b. RSA Algorithm
   c. Diffiee-Hellman
   d. MD5
   e. SHA-1
3. Implement the SIGNATURE SCHEME - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Set Up a honey pot and monitor the honeypot on the network (KFSensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Course Title:	**Management Information Systems Lab**	**Semester**	**VII**
Course Code	**BTITPEL708C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To prepare organizational data for MIS reports and dashboards.
2. To learn what data should be used to prepare MIS reports.
3. To write programs to produce MIS reports.
4. To depict data in a MIS report to support decision making.

Lab Experiments List:

1. Prepare a MIS report for the HR system to depict the various grades of employee in an organization by years of service.
2. Prepare a EIS report of Sales of an organization.
3. Prepare a graphical EIS dashboard of the Sales over a period of 1 year.
4. Prepare a manufacturing MIS report of all orders fulfilled, in progress and pending for management.
5. Prepare a monthly MIS profit and loss dashboard from financial data.
6. Prepare an EIS for reporting population demographics.

Course Title:	**Distributed Computing Lab**	**Semester**	**VII**
Course Code	**BTITPEL708D**	**Course Type**	**Elective**
Prerequisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objective:

1. To implement distributed systems paradigms practically to understand impact on resources and processes.

Lab Experiments List:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment.
3. Client/server using RPC/RMI.
4. Inter-process communication.
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Course Title:	**Natural Language Processing Lab**	**Semester**	**VII**
Course Code	**BTITPEL708E**	**Course Type**	**Elective**
Prerequisite	**Programming Skills**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objective:

To implement NLP concepts practically to understand how to develop NLP applications.

Lab Experiments List:

1. Morphology
2. word counting
3. word sense disambiguation
4. Part of speech tagging
5. N-gram
6. Entity linking
7. Emotion detection
8. Summarization

Course Title:	**Project Phase I**	**Semester**	**VII**
Course Code	**BTITP709**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execution skills and perform analyzing and troubleshooting of their respective problem chosen for the project. The students should be able to write technical reports, understand the importance of teamwork and group tasks. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, troubleshooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately is supposed to be utilized as a single task. A group of 03/04 students will have to work on assigned work. The topic could be product design, specific equipment, live industrial problems etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature surveys by referring to current journals belonging to Information Technology reference books and the internet. After finalization of the project, requisites like equipment, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guides, who in turn advise the group to carry out various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on a weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

Course Title:	**Internet of Things**	**Semester**	**VIII**
Course Code	**BTITC801**	**Course Type**	**Compulsory**
Prerequisite	**Microprocessor & Microcontrollers**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To equip students with the fundamental knowledge and basic technical competence in the field of Internet of Things (IoT).
2. To emphasize on core IoT functional Stack to build assembly language programs. To learn the Core IoT Functional Stack.
3. To understand the different common application protocols for IoT and apply IoT knowledge to key industries that IoT is revolutionizing.
4. To examine various IoT hardware items and software platforms used in projects for each platform that can be undertaken by a beginner, hobbyist, student, academician, or researcher to develop useful projects or products.

Course Outcomes:

After learning the course, the students should be able:

1. To understand the concepts of IoT and the Things in IoT.
2. To emphasize core IoT functional Stack and understand application protocols for IoT.
3. To examine various IoT hardware items and software platforms used in projects.
4. To apply IoT knowledge to key industries that IoT is revolutionizing.

Course Content:

UNIT I

Introduction to Internet of Things (IoT): What is IoT? - IoT and Digitization, IoT Impact – Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures, IoT Challenges, IoT and M2M, The IoT World Forum (IoTWF) Standardized Architecture, IoT Data Management and Compute Stack – Design considerations and Data related problems, Fog Computing, Edge Computing, The Hierarchy of Edge, Fog and Cloud.

UNIT II

Things in IoT: Sensors/Transducers – Definition, Principles, Classifications, Types, Characteristics and Specifications, Actuators – Definition, Principles, Classifications, Types, Characteristics and Specifications, Smart Object – Definition, Characteristics and Trends, Sensor Networks – Architecture of Wireless Sensor Network, Network Topologies, Enabling IoT Technologies - Radio Frequency Identification Technology, MicroElectro-Mechanical Systems (MEMS), NFC (Near Field Communication), Bluetooth Low Energy (BLE), LTE-A (LTE Advanced), IEEE 802.15.4– Standardization and Alliances, ZigBee.

UNIT III

The Core IoT Functional Stack: Layer 1 – Things: Sensors and Actuators Layer, Layer 2 – Communications Network Layer, Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer, Layer 3 – Applications and Analytics Layer, Analytics Vs. Control Applications, Data Vs. Network Analytics, Data Analytics Vs. Business Benefits, Smart Services.

UNIT IV

Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, Application Layer Protocol Not Present, SCADA, Generic Web-Based Protocols, IoT Application Layer Protocols – CoAP and MQTT

Create your own IoT: IoT Hardware - Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, Particle Photon, Beaglebone Black, IoT Software - Languages for Programming IoT Hardware, IoT Middleware Applications and API Development, Amazon Web Services for IoT, Making Front Ends, REST and JSON-LD.

UNIT V

Domain Specific IoTs: Home Automation – Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities – Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Environment – Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, Energy – Smart Grids, Renewable Energy Systems, Prognostics, Retail – Inventory Management, Smart Payments, Smart Vending Machines, Logistics – Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Agriculture – Smart Irrigation, Green House Control, Industry – Machine Diagnostics & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle – Health & Fitness Monitoring, Wearable Electronics.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, ***"IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things"***, 1st Edition, Pearson Education, Inc, Cisco Press, 2017.
2. Hakima Chaouchi, ***"The Internet of Things - Connecting Objects to the Web"***, 1st Edition, Wiley, 2010.
3. Perry Lea, ***"Internet of things For Architects"***, 1st Edition, Packt Publication, 2018.
4. Arshdeep Bahga, Vijay Madisetti, ***"Internet of Things – Hands-On Approach"***, 2nd Edition, Universities Press, 2016.

Reference Books:

1. Adrian McEwen & Hakim Cassimally, ***"Designing the Internet of Things",*** 1st Edition, Wiley, 2014.
2. Donald Norris, ***"Raspberry Pi – Projects for the Evil Genius"***, 2nd Edition, McGraw Hill, 2014.
3. Anand Tamboli, ***"Build Your Own IoT Platform"***, 1st Edition, Apress, 2019.

Course Title:	**Mobile Computing**	**Semester**	**VIII**
Course Code	**BTITC802**	**Course Type**	**Compulsory**
Prerequisite	**Internetworking Protocols , Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To describe the basic concepts and principles in mobile computing.
2. To understand the concept of Wireless LANs, PAN, Mobile Networks, and Sensor Networks.
3. To explain the structure and components for Mobile IP and Mobility Management.
4. To understand positioning techniques and location-based services and applications.
5. To describe the important issues and concerns on security and privacy.
6. To design and implement mobile applications to realize location-aware computing.
7. To design algorithms for location estimations based on different positioning techniques and platforms.
8. To acquire the knowledge to administrate and to maintain a Wireless LAN.

Course Outcomes:

After learning the course, the students should be able:

1. To describe wireless and mobile communications systems.
2. To choose an appropriate mobile system from a set of requirements.
3. To work around the weaknesses of mobile computing.
4. To interface a mobile computing system to hardware and networks.
5. To program applications on a mobile computing system and interact with servers and database systems.

Course Content:

UNIT I

Fundamentals of Wireless and basics of wireless network: Digital communication, Wireless communication system and limitations, Wireless media, Frequency spectrum, Technologies in digital wireless communication, Wireless communication channel specification, Wireless network, Wireless switching technology, Wireless communication.

UNIT II

Mobile Communications and Computing: An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

UNIT III

GSM and other architectures: GSM-Services and System Architectures, Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.

UNIT IV

Mobile Network and Transport Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks (MANET), Routing and Routing Algorithms in MANET, Security in ad-hoc networks.

UNIT V

Data Dissemination and Data Synchronization in Mobile Computing: Communication Asymmetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.

Text Books:

1. Raj Kamal, ***"Mobile Computing",*** Oxford University Press-New Delhi, 2nd Edition.
2. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, ***"Wireless and Mobile Networks, Concepts and Protocols"***, Wiley, India.

Reference Books:

1. Mark Ciampa, ***"Guide to Designing and Implementing wireless LANs"***, Thomson learning, Vikas Publishing House, 2001.
2. Ray Rischpater, ***"Wireless Web Development"***, Springer Publishing.
3. Sandeep Singhal, ***"The Wireless Application Protocol"***, Pearson Publication.
4. P. Stavronlakis ***"Third Generation Mobile Telecommunication Systems"***, Springer Publishers.

Course Title:	**Project Phase II/ Project with Internship**	**Semester**	**VIII**
Course Code	**BTITP803**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 24**
Stream	**Core**	**Credits**	**12**

This is continuous work to the project phase I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a powerpoint presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase II

1. Coding/Implementation.
2. Use cases.
3. Testing/Troubleshooting.
4. Data dictionary/ Documentation.
5. Finalization of project in all respects.

*(For guide, Personal copy, Departmental library.)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.