Bachelor of Computer Application

Semester V							
Sl. No.	**Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	**CC12**	**BCAC501 BCAC591**	**Internet Technology**	**4**	**0**	**4**	**6**
2	CC13	BCAC502	Theory of Computation	5	1	0	6
3	DSE-I	BCAD501	A. Information Security B. Cloud Computing C. Artificial Intelligence	5/4	1/0	0/4	6
4	DSE-2	BCAD502	A. Numerical Methods B. Combinatorial Optimization C. Soft Computing	4/5	0/1	4/0	6
Sessional							
5	SEC-4	BCAS501	Industrial Training and Internship	0	0	0	**2**
						Total Credit	26

CC: Core Course
GE: General Electives(To be selected from MOOCs Basket listed below)
AEC: Ability Enhancement Course
SEC: Skill Enhancement Course

Bachelor of Computer Application
Semester-5

Name of the Course: BCA **Subject:** Internet Technology	
Course Code: BCAC501 + BCAC591	**Semester: 5th**
Duration: 48 Hours	**Maximum Marks: 100 + 100**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical: 4	Continuous Assessment: 25
Credit: 4 + 2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	To gain comprehensive knowledge of Internet and its working.
2	Ability to use services offered by internet.

3	To enhance skill to develop websites using HTML , CSS, JS.
4	
Objective:	
Sl. No.	
1	To introduce the students to the network of networks -Internet.
2	To enable the students to use various services offered by internet.
3	To gain knowledge about the protocols used in various services of internet.
4	To understand the working and applications of Intranet and Extranet.
5	
Pre-Requisite:	
Sl. No.	
1	Understanding of basic programming logic.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Networking Overview of Networking, Intranet, Extranet and Internet, Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP, Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6, Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IPtables, Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast, Electronic Mail	8	12
02	Web Programming Introduction to HTML, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, Image Maps, area, attributes of image area, Extensible Markup Language (XML), CGI Scripts, GET and POST Methods.	8	15
03	Server Side Programming and Scripting Basic PHP Programming, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling, JavaScript basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation, Definition of cookies, Create and Store cookie.	8	15
04	Security Issues Network security techniques, Password and Authentication, VPN, IP Security, security in electronic transaction, Secure Socket Layer(SSL), Secure Shell (SSH), Introduction to Firewall, Packet filtering, Stateful,	**10**	**13**

	Application layer, Proxy.		
05	Advance Internet Technology Internet Telephony (VoIP), Multimedia Applications, Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streamingmedia, Codec and Plugins, IPTV, Search Engine Optimization, Metadata.	**10**	**15**
	Sub Total:	**44**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**48**	**100**

Practical
Course Code: BCAC591
Credit: 2
Skills to be developed:
Intellectual skills:

1. Ability to understand Web Design and Development.
2. Ability to analyze problems and provide program based solutions.

List of Practical:

1. As compatible to theory syllabus.

Assignments:
Based on the curriculum as covered by subject teacher.

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
N.P. Gopalan and J. Akilandeswari	Web Technology: A Developer's Perspective		PHI
Rahul Banerjee	Internetworking Technologies, An Engineering Perspective		PHI Learning

Reference Books:

List of equipment/apparatus for laboratory experiments:

Sl. No.	

1.	Computer with moderate configuration

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 5	10	10				
B	1 to 5			5	3	5	70
C	1 to 5			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Five No of Experiments			

External Examination: Examiner-

Signed Lab Note Book(for five experiments)	**5*2=10**	
On Spot Experiment(one for each group consisting 5 students)	**10**	
Viva voce	**5**	

Name of the Course: BCA
Subject: Theory of Computation

Course Code: BCAC502	**Semester: 5th**
Duration: 60 Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1	To gain knowledge of automata theory.
2	To understand the theoretical computer science.
3	
4	

Objective:	
Sl. No.	
1	Study various types of finite automata.
2	Understand the challenge of theoretical computer science and it's application.
3	
4	
5	

Pre-Requisite:	
Sl. No.	**None**

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Languages [Alphabets, string, language, Basic Operations on language, Concatenation, KleeneStar	**11**	**10**
02	Finite Automata and Regular Languages Regular Expressions, Transition Graphs, Deterministics and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata, Pumping lemma and closure properties of regular languages.	**15**	**20**
03	Context free languages Context free grammars, parse trees, ambiguities in grammar and languages, Pushdown automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of context free languages, normal forms.	**15**	**20**

04	Turing Machines and Models of Computation RAM, Turing Machine as a model of computation, Universal Turing Machine, Language acceptability, decidability, halting problem, Recursively enumerable and recursive languages, unsolvability problems.	**15**	**20**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Daniel I.A.Cohen	Introduction to computer theory	8th Edition	John Wiley Publications
Lewis & Papadimitriou	Elements of the theory of computation		PHI
Hoperoft, Aho, Ullman	Introduction to Automata theory, Language & Computation	3 rd Edition	Pearson Education

Reference Books:

P. Linz	An Introduction to Formal Language and Automata	4th edition	Publication Jones Bartlett

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 4** **1 to 4** **1 to 4**	**10**	**10**	 **5** **5**	 **3** **3**	 **5** **15**	 **70**

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject: Information Security**	
Course Code: BCAD501A	**Semester: 5th**
Duration: 60 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1.	This introductory course is aimed at giving basic understanding about system security.
2.	This entry-level course covers a broad spectrum of security topics and is based on real-life examples to create system security interest in the students
3.	A balanced mix of technical and managerial issues makes this course appealing to attendees who need to understand the salient facets of information security basics and the basics of risk management.

Objective:	
Sl. No.	
1.	Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2.	Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
3.	Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
4.	Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges

Pre-Requisite:	
Sl. No.	
1.	Not Required

Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Information and Network Security fundamentals** Overview of Networking Concepts Basics of Communication Systems, Transmission Media, Topology and Types of Networks, TCP/IP Protocol, Wireless	**15**	**20**

	Networks, The Internet Information Security Concepts Information Security Overview: Background and Current Scenario, Types of Attacks, Goals for Security, E-commerce Security Security Threats and Vulnerabilities Overview of Security threats, Weak / Strong Passwords and Password Cracking, Insecure Network connections, Malicious Code Cybercrime and Cyber terrorism Cryptography Introduction to Cryptography, Digital Signatures, Public Key infrastructure, Applications of Cryptography, Tools and techniques of Cryptography		
02	**Security Management** Security Management Practices Overview of Security Management, Security Policy, Risk Management, Ethics and Best Practices Security Laws and Standards Security Assurance, Security Laws, International Standards, Security Audit	**15**	**10**
03	**Information and Network Security** Server Management and Firewalls User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features Security for VPN and Next Generation Technologies VPN Security, Security in Multimedia Networks, Various Computing Platforms: HPC, Cluster and Computing Grids, Virtualization and Cloud Technology and Security	**15**	**20**
04	**System and Application Security** Security Architectures and Models Designing Secure Operating Systems, Controls to enforce security services, Information Security Models System Security Desktop Security, Email security, Database Security	**11**	**20**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
B. A. Forouzan	Data Communications and Networking	3rd Ed	TMH
A. S. Tanenbaum	Computer Networks	4th Ed	Pearson Education/PHI

Reference Books:			
W. Stallings	Data and Computer Communications	5th Ed	PHI/ Pearson Education
Atul Kahate	Cryptography & Network Security		TMH

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5	10	10				
B	3, 4, 5			5	3	5	60
C	1,2,3,4,5			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: BCA
Subject: Cloud Computing

Course Code: BCAD501B	**Semester: 5th**
Duration: 60 Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation:
Aim:	Practical Sessional external examination:

1	To gain knowledge of cloud computing.
2	To gain knowledge of several application areas of cloud computing.
3	To understand cloud computing platforms.
4	
Objective:	
Sl. No.	
1	Understand the principles of cloud computing.

2	Understanding SaaS, PaaS etc.
3	To gain knowledge of applications of cloud computing.
Pre-Requisite:	
Sl. No.	None

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Definition of Cloud Computing and its Basics Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model. Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients . Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	**15**	**15**
02	Use of Platforms in Cloud Computing Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks. Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google	**15**	**15**

	Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service. Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services		
03	Cloud Infrastructure Cloud Management :An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle) Concepts of Cloud Security Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	**15**	**20**
04	Concepts of Services and Applications Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services	**11**	**20**
	Sub Total:	**44**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**48**	**100**
Assignments:			

Based on the curriculum as covered by subject teacher.

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Barrie Sosinsky	Cloud Computing Bible		Wiley India Pvt. Ltd
Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi	Mastering Cloud Computing		McGraw Hill Education (India) Private Limited

Reference Books:

Anthony T. Velte	Cloud computing: A practical approach,		Tata Mcgraw-Hill

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 4**	**10**	**10**				
B	**1 to 4**			**5**	**3**	**5**	**70**
C	**1 to 4**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject:** Information and Coding Theory	
Course Code: BCAD501C	**Semester: 6th**
Duration: 60 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**

	Practical Sessional external examination: NA		
Aim:			
Sl. No.			
1	Introduced to the basic notions of information and channel capacity.		
2	To introduce information theory, the fundamentals of error control coding techniques and their applications, and basic cryptography.		
3	To provide a complementary U/G physical layer communication		
	to convolutional and block codes, decoding techniques, and automatic repeat request (ARQ) schemes.		
Objective:			
Sl. No.			
1	Understand how error control coding techniques are applied in communication systems.		
2	Able to understand the basic concepts of cryptography.		
3	To enhance knowledge of probabilities, entropy, measures of information.		
Pre-Requisite:			
Sl. No.			
1.	Probability and Statistics		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**INFORMATION ENTROPY FUNDAMENTALS** Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.	**20**	**23**
02	**DATA AND VOICE CODING** Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC). Denial of Service Attacks, DOS-proof network architecture, Security architecture of World Wide Web, Security Architecture of Web Servers, and Web Clients, Web Application Security – Cross Site Scripting Attacks, Cross Site Request Forgery, SQL Injection Attacks, Content Security Policies (CSP) in web, Session Management and User Authentication, Session Integrity, Https, SSL/TLS, Threat Modeling, Attack Surfaces, and other comprehensive approaches to network design for	**20**	**24**

	security		
03	**ERROR CONTROL CODING** Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.	**16**	**23**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Simon Haykin	Communication Systems	4th Edition	John Wiley and Sons, 2001
Fred Halsall	Multimedia Communications, Applications Networks Protocols and Standards		Pearson Education, Asia 2002
Reference Books:			
Mark Nelson	Data Compression Book		Publication 1992
Watkinson J	Compression in Video and Audio		Focal Press, London, 1995

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1,2,3**	**10**	**10**				
B	**1,2,3**			**5**	**3**	**5**	**60**
C	**1,2,3**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject:** Numerical and statistical Methods			
Course Code: BCAD502A		**Semester: 5th**	
Duration: 60 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		**End Semester Exam: 70**	
Tutorial: 1		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 6		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
2.			
3.			
4.			
5.			
Sl. No.			
6.			
7.			
8.			
9. Pre-Requisite:			
Sl. No.			
10.	None		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
1	Roots of Equations: Graphical Method -Bisection Method - False-Position Method - Fixed-Point Iteration - Newton-Raphson Method Secant Method - Roots of Polynomials:	**8**	**14**

	Conventional Methods - Muller's Method - Bairstow's Method. Algebraic Equations: Gauss Elimination -Gauss-Jordan - LU Decomposition - Matrix Inverse -Gauss-Seidel		
2	Numerical Differentiation - Integration: Trapezoidal Rule - Simpson's Rule - Romberg Integration - Differential equations: Taylor's method - Euler's method -Runge-Kutta 2nd and 4th order methods Predictor - corrector methods.	**12**	**14**
3	Diagrammatic and Graphical representation of Numerical Data - Formation of frequency distribution - Histogram, Cumulative Frequency - Polygon and Ogives - Measures of central tendencies - Mean, Median, Mode - Measures of dispersion - Mean deviation, Standard deviation, variance, Quartile deviation and coefficient of variation - Moments (upto 4th) - Measures of Skewness and Kurtosis for grouped and ungrouped data.	**12**	**14**
4	Sample space - Events - Definition of probability - combinatorial problems - conditional probability and independence - Random variables, distributions and Mathematical expectations - Discrete distributions - Binomial - Poisson - Continuous distributions - Normal and Exponential distributions - Moments and Moment generating functions.	**12**	**14**
5	Correlation and Regression analysis: product moment correlation -coefficient - rank correlation coefficient - simple regression - method of least squares for estimation of regression coefficient. Concept of sampling and Sampling distributions - Sampling from Normal distributions - Standard error - Tests of significance - Large sample test for population mean and proportions - Test for populations means: single - two sample and paired t - test - Chi square tests for goodness of fit and test for independence of attributes in contingency table.	**12**	**14**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Snedecor G.W. and Cochran W.G. (1989)	Statistical methods	8 ed	Affiliated East West.
Trivedi K.S. (1994)	Probability and Statistics with Reliability, Queueing and computer Science		Prentice Hall of India

	applications		
Reference Books:			
S. C. Chopra and R. P.Canale	Numerical Methods for Engineers	3rd	McGraw Hill International Edition

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
• **A** • • **B** • • **C**	**1,2,3,4,5** **1,2,3,4,5** **1,2,3,4,5**	**10**	**10**	 **5** **5**	 **3** **3**	 **5** **15**	 **60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject:** Combinatorial Optimization	
Course Code: BCAD502B	**Semester: 5th**
Duration: 60 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA
Aim:	
Sl. No.	

1.	To Understand Combinatorial Optimization problems
2.	
3.	
4.	
Sl. No.	
5.	
6.	
7.	
Pre-Requisite:	
Sl. No.	
	None

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
1	Introduction to combinatorial optimization. Matrix multiplication Knapsack problem Tardos, Prof. Ranade's lecture Bipartite matching problem	**12**	**14**
2	Introduction to Linear algebra - Vectors, matrices, row view, column view, matrix multiplication, special matrices: square, symmetric, identity. Inverse of a matrix Row/Column space, rank, orthogonal vectors, null space, fundamental theorem of linear algebra	**12**	**14**
3	Introduction to Linear programming - diet problem example, the LP problem, 2-D geometric view and finding min and max Different LP problems. Feasible solution, basic feasible solution (bfs)	**12**	**14**
4	Existence of basic feasible solution Affine set, affine combination of points, Convex sets - examples, closure properties, Convex Hull of a set	**12**	**14**
5	Traversing from one bfs to another bfs Finding an initial bfs, The simplex algorithm, Proof of correctness	**8**	**14**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Vangelis Th. Paschos	Concepts of Combinatorial Optimization	2nd Edition	Wiley
Reference Books:			

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
• **A** • **B** • **C**	**1,2,3,4,5** **1,2,3,4,5** **1,2,3,4,5**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject:** Soft Computing	
Course Code:BCAD502C	**Semester: 5th**
Duration: 60	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**

Practical:0	**Continuous Assessment:25**
Credit: 6	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination:NA

Aim:

Sl. No.	
1.	Enumerate the theoretical basis of soft computing
2.	Explain the fuzzy set theory
3.	Discuss the neural networks and supervised and unsupervised learning networks
4.	Demonstrate some applications of computational intelligence
5.	Apply the most appropriate soft computing algorithm for a given situation

Objective:

Sl. No.	
1.	Enumerate the strengths and weakness of soft computing
2.	Illustrate soft computing methods with other logic driven and statistical method driven approaches
3.	Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
4.	Emphasize the role of euro-fuzzy and hybrid modeling methods
5.	Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

Pre-Requisite:

Sl. No.	
1	Mathematical knowledge

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.	**8**	**5**
02	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy InferenceSystem-Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, GeneralFuzzy Logic controllers, BasicMedical Diagnostic systems and Weather forecasting	**12**	**20**
03	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, BiologicalNeurons and Artificial neural network; model of artificial neuron. Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks. Competitive learning networks: Kohonenself organizing networks, Hebbian learning; Hopfield Networks. Neuo-Fuzzy modelling:	**12**	**20**

	Applications of Neural Networks: Pattern Recognition and classification		
04	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Imageprocessing and pattern Recognition	**12**	**15**
05	Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	**12**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Timothy J. Ross	Fuzzy logic with engineering applications		John Wiley and Sons.
S. Rajasekaran and G.A.V.Pai,	Neural Networks, Fuzzy Logic and Genetic Algorithms		PHI

Reference Books:

S N Sivanandam, S. Sumathi	Principles of Soft Computing		John Wiley & Sons
David E. Goldberg	Genetic Algorithms in search, Optimization &		Pearson/PHI

	Machine Learning		
Samir Roy &Udit Chakraborty	A beginners approach to Soft Computing		Pearson
Kumar Satish	Neural Networks: A Classroom Approach,1/e		TMH

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				**60**
B	**1 to 5**			**5**	**3**	**5**	
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Name of the Course: BCA **Subject: Industrial Training and Internship**	
Course Code: BCAS501	**Semester: 5th**
Duration: 4 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	End Semester Exam: NA
Tutorial: 0	Attendance: NA
Practical: 0	Continuous Assessment: NA
Credit: 2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	To develop industrial understanding.
2	To develop understanding of project management.
3	To cope up with industry oriented real time project environment.

Objective:	
Sl. No.	
1	To develop team work.
2	To develop understanding of project management.
3	To be able to implement real life software or hardware based projects.

Pre-Requisite:	
Sl. No.	
1.	None

Bachelor of Computer Application
Semester-6

Semester VI							
Sl. No.	**Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory							
1	CC14	BCAC601 BCAC691	Advanced Database and PL-SQL	4	0	4	6
2	DSE-3	BCAD601 BCAD691	A. Digital Image Processing B. Introduction to AI and Machine Learning C. Introduction to Data Science	4	0	4	6

Sessional							
3	SEC-3	BCAS601	Grand Viva	0	0	2	**1**
4	DSE-4	BCAD681	Major Project and Entrepreneurship	0	0	8	**4**
5	SEC-4	BCAS602	Seminar	0	0	4	**2**
			Total Credit				19

Name of the Course: BCA **Subject: Advanced DBMS with PL-SQL**	
Course Code: BCAC601 + BCAC691	**Semester: 6th**
Duration: 48 Hours	**Maximum Marks: 100 + 100**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical: 4	Continuous Assessment: 25
Credit: 4 + 2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	To gain knowledge of advanced database management ideas.
2	To gain knowledge of concurrency control and recovery management procedures.
3	To gain skill to write database programs using SQL or PL-SQL.
4	

Objective:	
Sl. No.	
1	Understand the concept of Database transactions management.
2	Understand the concept of concurrency control techniques and recovery management.
3	Gain idea about distributed DBMS.
4	To gain skill to write PL-SQL.

Pre-Requisite:	
Sl. No.	
1.	None

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Query Optimization Algorithm for Executing Query Operations: External sorting, Select operation, Join operation, PROJECT and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization, Converting Query Tree to Query Evaluation Plan, multiquery optimization and application, Efficient and extensible algorithms for multi-query optimization, execution strategies for SQL sub queries, Query Processing for SQL Updates	**6**	**5**

02	ARQQuery Execution: Introduction to Physical-Query-Plan Operators, One-Pass Algorithms for Database, Operations, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting, Two-Pass, Algorithms Based on Hashing, Index-Based Algorithms, Buffer Management, Parallel Algorithms for Relational Operations, Using Heuristics in Query Optimization, Basic Algorithms for Executing Query Operations.	**6**	**5**
03	Concurrency Control Serializability: Enforcing, Serializability by Locks, Locking Systems With Several, Lock Modes, Architecture for a Locking Scheduler Managing Hierarchies of Database Elements, Concurrency Control by Timestamps, Concurrency Control by Validation, Database recovery management	**4**	**20**
04	Transaction processing: Introduction of transaction processing, advantages and disadvantages of transaction processing system, online transaction processing system, serializability and recoverability, view serializability, resolving deadlock, distributed locking. Transaction management in multi-database system, long duration transaction, high-performance transaction system.	**8**	**20**
05	Object Oriented DBMS Overview of object: oriented paradigm, OODBMS architectural approaches, Object identity, procedures and encapsulation , Object oriented data model: relationship ,identifiers, Basic OODBMS terminology, Inheritance , Basic interface and class structure, Type hierarchies and inheritance, Type extents and persistent programming languages, OODBMS storage issues.	**4**	**10**
06	DDB: Distributed Database Introduction of DDB, DDBMS architectures, Homogeneous and Heterogeneous databases, Distributed data storage, Advantages of Data Distribution, Disadvantages of Data Distribution Distributed transactions, Commit protocols, Availability, Concurrency control & recovery in distributed databases, Directory systems, Data Replication, Data Fragmentation. Distributed database transparency features, distribution transparency.	**8**	**5**
07	Database application: Active database: starburst, oracle, DB2, chimera, Applications of active database, design principles for active rules, Temporal database, special, text and multimedia database. Video database management: storage management for video, video preprocessing for content representation and indexing, image and semantic-based query processing, real time buffer management.	**8**	**5**
	Sub Total:	**44**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**48**	**100**
Practical **Course Code: BCAC691**			

Credit: 2

List of Practical:

Implementation of practicals are adhered to the theoretical curriculum.

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Henry F. Korth and Silberschatz Abraham	Database System Concepts		Mc.Graw Hill.
Ramez Elmasri, Shamkant B.Navathe	Fundamentals of Database Systems		Addison Wesleyl
Stefano Ceri	Distributed Databases: Principles and Systems		

Reference Books:

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1	Computer with moderate configuration
2	DBMS Package

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 7**	**10**	**10**				
B	**1 to 7**			**5**	**3**	**5**	**70**
C	**1 to 7**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Five No of Experiments				
External Examination: Examiner-				
Signed Lab Note Book(for five experiments)		**5*2=10**		
On Spot Experiment(one for each group consisting 5 students)		**10**		
Viva voce		**5**		

Name of the Course: BCA **Subject:** Digital Image Processing	
Course Code: BCAD601 A+ BCAD691A	**Semester: 6th**
Duration: 36 Hours	**Maximum Marks: 100 + 100**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical: 4	Continuous Assessment: 25
Credit: 4 + 2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	To gain knowledge of about digital image .
2	To gain knowledge of image processing techniques.
3	To enhance programming skills to implement image processing algorithms.

Objective:	
Sl. No.	
1	To introduce and discuss the fundamental concepts and applications of Digital Image Processing.
2	To discuss various basic operations in Digital Image Processing.
3	To know various transform domains.
4	
5	

Pre-Requisite:	
Sl. No.	

	Knowledge of mathematics and coordinate geometry.		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	**8**	**10**
02	Digital Image Formation A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	**10**	**10**
03	Image Enhancement Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	**8**	**20**
04	Image Restoration Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	**9**	**15**
05	Image Segmentation Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection- Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding,; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	**9**	**15**
	Sub Total:	**44**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**48**	**100**

Practical
Course Code: BCAD691A
Credit: 2
Skills to be developed:

List of Practical:

1. As compatible with theory syllabus.

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Gonzalves	Digital Image Processing		Pearson
S. Sridhar	Digital Image Processing		Oxford

Reference Books:

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	A computer with moderate configuration.
2.	Matlab/ python opencv libraries

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**70**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Five No of Experiments			
External Examination: Examiner-			
Signed Lab Note Book(for five experiments)		**5*2=10**	
On Spot Experiment(one for each group consisting 5 students)		**10**	
Viva voce		**5**	

Name of the Course: BCA **Subject: Introduction to AI and Machine Learning**	
Course Code: BCAD601B	**Semester: 6th**
Duration: 48 Hrs.	**Maximum Marks: 100 +100**
Teaching Scheme	**Examination Scheme**
Theory: 4	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4	**Continuous Assessment: 25**
Credit: 4+2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Define Artificial Intelligence (AI) and understand its relationship with data
2.	Understand Machine Learning approach and its relationship with data science
3.	Identify the application
4.	Define Machine Learning (ML) and understand its relationship with Artificial Intelligence
Objective:	
Sl. No.	
1.	Gain a historical perspective of AI and its foundations
2.	Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
5.	Experiment with a machine learning model for simulation and analysis.
6.	Explore the current scope, potential, limitations, and implications of intelligent systems
Pre-Requisite:	
Sl. No.	

1.	**Basic Statistical and Computational knowledge**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Artificial intelligence fundamentals** A.I. systems integrating approaches and methods.- Advanced search- Constraint satisfaction problems - Knowledge representation and reasoning - Non-standard logics - Uncertain and probabilistic reasoning (Bayesian networks, fuzzy sets).- Foundations of semantic web: semantic networks and description logics. - Rules systems: use and efficient implementation.- Planning systems	**9**	**14**
02	**Machine learning** Computational learning tasks for predictions, learning as function approximation, generalization concept. - Linear models and Nearest-Neighbors (learning algorithms and properties, regularization). - Neural Networks (MLP and deep models, SOM). - Probabilistic graphical models. - Principles of learning processes: elements of statistical learning theory, model validation. - Support Vector Machines and kernel-based models. - Introduction to applications and advanced models. Applicative project: implementation and use of ML/NN models with emphasis to the rigorous application of validation techniques	**9**	**14**
03	**Human language technologies** Formal and statistical approaches to NLP. Statistical methods: Language Model, Hidden Markov Model, Viterbi Algorithm, Generative vs Discriminative Models Linguistic essentials (tokenization, morphology, PoS, collocations, etc.). Parsing (constituency and dependency parsing).Processing Pipelines. Lexical semantics: corpora, thesauri, gazetteers. Distributional Semantics: Word embeddings, Character embeddings. Deep Learning for natural language. **Applications:** Entity recognition, Entity linking, classification, summarization. Opinion mining, Sentiment Analysis. Question answering, Language inference, Dialogic interfaces. Statistical Machine Translation. NLP libraries: NLTK, Theano, Tensorflow	**9**	**14**
04	**Intelligent Systems for Pattern Recognition** Particular focus will be given to pattern recognition problems and models dealing with sequential and time-series data-Signal processing and time-series analysis-Image processing, filters and visual feature detectors-Bayesian learning and deep learning for machine vision and signal processing-Neural network models for pattern recognition on non-vectorial data (physiological data, sensor streams, etc)-Kernel and adaptive methods for relational data-Pattern recognition applications: machine vision, bio	**9**	**14**

	informatics, robotics, medical imaging, etc.-ML and deep learning libraries overview: e.g. scikit-learn, Keras, Theano		
05	**Smart applications and Robotics** Common designs for smart applications examples: fuzzy logic in control systems or cloud analysis of field sensors data streams Make or buy: selecting appropriate procurement strategies example: writing your own RRN architecture vs. using cloud services Development platforms for smart objects examples: Brillo (IoT devices) or Android TV (Smart TVs) Development platforms for smart architectures examples: TensorFlow (server-side RNNs), or the Face Recognition API (mobile) Cloud services for smart applications examples: Google Cloud Machine Learning API, Google Cloud Vision API, Google Cloud Speech API, or Deploying Deep Neural Networks on Microsoft Azure GPU VMs Deployment and operations examples: cloud hosting vs. device hosting, or harnessing user feedback to drive improvement Measuring success: methods and metrics examples: defining user engagement and satisfaction metrics, or assessing the naturalness of smart interactions **Introduction to robotics:** main definitions, illustration of application domains-Mechanics and kinematics of the robot-Sensors for robotics-Robot Control-Architectures for controlling behaviour in robots-Robotic Navigation-Tactile Perception in humans and robots-Vision in humans and robots-Analysis of case studies of robotic systems-Project laboratory: student work in the lab with robotic systems	**8**	**14**
	Sub Total:	**44**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**48**	**100**

Practical

Course Code: BCAD691B

Credit: 2

Skills to be developed:

List of Practical:

As compatible with theory syllabus.

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:			
Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Stuart Russell and Peter Norvig	Artificial Intelligence: A Modern Approach		
Nils J Nilsson	Artificial Intelligence: A New Sythesis		
Reference Books:			
Negnevitsky	Artificial Intelligence		
Akerkar Rajendr	Intro. to artificial intelligence		
AnandHareendran S and Vinod Chandra S S	Artificial Intelligence and Machine Learning		

End Semester Examination Scheme.		**Maximum Marks-70.**		**Time allotted-3hrs.**			
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5	10	10				
B	3, 4, 5			5	3	5	60
C	1,2,3,4,5			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:				
Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: BCA **Subject: Introduction to Data Science**	
Course Code: BCAD601C	**Semester: 6th**
Duration:48 Hrs	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**

Theory:4	**End Semester Exam:70**
Tutorial: 0	**Attendance: 5**
Practical:4	**Continuous Assessment:25**
Credit: 4 + 2	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination:NA

Aim:

Sl. No.	
1.	To gain basic knowledge of data and information.
2.	To gain basic knowledge of data science.
3.	To understand the history, potential application area and future of data science.
4.	To gain basic knowledge of machine learning.

Objective:

Sl. No.	
1.	To gain knowledge of data, information and data science.
2.	To be able to identify problems related to data science.
3.	To be able to enhance logical thinking .
4.	To be able to understand basic machine learning principles and apply the knowledge in appropriate domains.

Pre-Requisite:

Sl. No.	
1.	Knowledge of basic mathematics.
2.	Analytical and Logical skills

Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed.	**4**	**5**
02	**Introduction to Statistics** Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R.	**4**	**5**
03	**Data Analysis**	**6**	**10**

	Exploratory Data Analysis and Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm).		
04	**Machine Learning** Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means.	**4**	**10**
05	**Application of Machine Learning** One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web.	**6**	**10**
06	**Introduction to Feature** Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.	**6**	**10**
07	**Recommendation Systems** Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system.	**6**	**5**
08	**Social-Network Graphs** Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs.	**4**	**5**
09	**Data Visualization** Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset.	**4**	**5**
10	**Data Science and Ethical Issues**	**4**	**5**

	Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists.		
	Sub Total:	**48**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**52**	**100**

Assignments:

Based on the curriculum as covered by the subject teacher.

List of Books

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Jure Leskovek, AnandRajaraman and Jeffrey Ullman	Mining of Massive Datasets. v2.1		Free Online
Kevin P. Murphy	Machine Learning: A Probabilistic Perspective	ISBN 0262018020	
Foster Provost and Tom Fawcett	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking	ISBN 1449361323. 2013	
Trevor Hastie, Robert Tibshirani and Jerome Friedman	Elements of Statistical Learning	Second Edition. ISBN 0387952845. 2009. (free online)	
Cathy O'Neil and Rachel Schutt	Doing Data Science, Straight Talk From The Frontline		O'Reilly

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 10	10	10				

B	1 to 10			5	3	5	70
C	1 to 10			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: BCA **Subject:** Major Project with Viva-Voce	
Course Code: BCAD681	**Semester: 6th**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: NA**
Tutorial: 0	**Attendance : NA**
Practical: 0	**Continuous Assessment: NA**
Credit: 8	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	Analyze and apply the role of client side and server side scripting languages.
2	Building team work.
3	
4	

Objective:	
Sl. No.	
1	Analyze and apply the role of client side and server side scripting languages.

2	Building team work.
3	