

## Manipal School of Information Sciences

## Manipal Academy of Higher Education, Manipal

Outcome Based Education (OBE) Framework

## Two Year full time Postgraduate Program

## **Master of Engineering - ME (Big Data Analytics)**



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#### NATURE AND EXTENT OF THE PROGRAM

An engineering graduate skillset requirement is changing with invent of the new technologies. In particular the impact of Big data and its transformative technologies like Data Analytics provide a high employability in the industry. Big Data Analytics are playing an important role in business, government, healthcare and education. Big Data technologies provide efficient solutions for acquiring and processing large scale data. Data Analytics combines principles and techniques from mathematics, computer science and machine learning for offering predictive and prescriptive solutions

M.E in Big Data Analytics Program is a comprehensive two-year postgraduate program, which aims to provide hands-on experience to prepare industry- Big Data Analytics professionals. The program ME (BDA) helps engineering graduates to learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications.

M.E. in Big Data Analytics postgraduate degree would welcome graduates from any discipline with 50% mark in qualifying exam. Students after successfully completing the program will get career opportunities as an Big Data Architect, Data Analyst, Database Administrator, Data Scientists, Big Data Engineer and Business Analyst.



## **PROGRAM EDUCATION OBJECTICE (PEO)**

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for

#### M E (Big Data Analytics) program are as follows.

PEO No	Education Objective
DEO 1	Develop in depth understanding of the key technologies in data engineering, data
ILUI	science and business analytics.
PEO 2	Practice problem analysis and decision-making using machine learning techniques.
DEO 3	Gain practical, hands-on experience with statistics, programming languages and big
I EO S	data tools through coursework and applied research experiences.



## **GRADUATE ATTRIBUTES**

S No.	Attribute	Description				
		Acquire in-depth knowledge of specific discipline or				
	Scholarship of	professional area, including wider and global perspective, with				
1	Knowledge	an ability to discriminate, evaluate, analyse and synthesise				
		existing and new knowledge, and integration of the same for				
		enhancement of knowledge.				
		Analyse complex engineering problems critically, apply				
2	Critical Thinking	independent judgement for synthesising information to make				
-		intellectual and/or creative advances for conducting research				
		in a wider theoretical, practical and policy context.				
		Think laterally and originally, conceptualise and solve				
3		engineering problems, evaluate a wide range of potential				
	Problem Solving	solutions for those problems and arrive at feasible, optimal				
		solutions after considering public health and safety, cultural,				
		societal and environmental factors in the core areas of				
		expertise.				
		Extract information pertinent to unfamiliar problems through				
		literature survey and experiments, apply appropriate research				
		methodologies, techniques and tools, design, conduct				
4	Dessenah Shill	experiments, analyse and interpret data, demonstrate higher				
4	Kesearch Skin	order skill and view things in a broader perspective, contribute				
		individually/in group(s) to the development of				
		scientific/technological knowledge in one or more domains of				
		engineering.				
		Create, select, learn and apply appropriate techniques,				
_	Usage of modern	resources, and modern engineering and IT tools, including				
3	tools	prediction and modelling, to complex engineering activities				
		with an understanding of the limitations.				



		Possess knowledge and understanding of group dynamics,					
		recognise opportunities and contribute positively to					
	Collaborative and	collaborative-multidisciplinary scientific research,					
6	Multidisciplinary	demonstrate a capacity for self-management and teamwork,					
	work	decision-making based on open-mindedness, objectivity and					
		rational analysis in order to achieve common goals and further					
		the learning of themselves as well as others.					
		Demonstrate knowledge and understanding of engineering and					
	Project Monogoment	management principles and apply the same to one's own work,					
7	Project Management	as a member and leader in a team, manage projects efficiently					
	and Finance	in respective disciplines and multidisciplinary environments					
		after consideration of economical and financial factors.					
		Communicate with the engineering community, and with					
		society at large, regarding complex engineering activities					
	Communication	confidently and effectively, such as, being able to comprehend					
0	Communication	and write effective reports and design documentation by					
		adhering to appropriate standards, make effective					
		presentations, and give and receive clear instructions.					
		Recognise the need for, and have the preparation and ability to					
0	Life long Learning	engage in life-long learning independently, with a high level of					
,	Life-long Learning	enthusiasm and commitment to improve knowledge and					
		competence continuously.					
		Acquire professional and intellectual integrity, professional					
		code of conduct, ethics of research and scholarship,					
10	Ethical Practices and	consideration of the impact of research outcomes on					
10	Social Responsibility	professional practices and an understanding of responsibility					
		to contribute to the community for sustainable development of					
		society.					
	Independent and	Observe and examine critically the outcomes of one's actions					
11	Reflective Learning	and make corrective measures subsequently, and learn from					
	Kenterive Learning	mistakes without depending on external feedback.					



#### **QUALIFICATIONS DESCRIPTORS**

#### 1. Demonstrate

(i) A systematic, extensive and coherent knowledge and understanding of an academic field of study as a whole and its applications, and links to related disciplinary areas/subjects of study; including a critical understanding of the established theories, principles and concepts, and of a number of advanced and emerging issues in the field of Big Data;

(ii) Procedural knowledge that creates different types of professionals related to the Big Data, including research and development, teaching and government and public service;

(iii) Professional and communication skills in the domain of machine learning, distributed computing, real time streaming, natural language and text processing, including a critical understanding of the latest developments, tools in the domain of big data and data analytics.

- 2. Demonstrate comprehensive knowledge about materials, including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to the bigdata and analytics, and techniques and skills required for identifying problems and issues related.
- 3. Demonstrate skills in identifying information needs, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, analysis and interpretation of data.
- 4. Methodologies as appropriate to the subject(s) for formulating evidence based solutions and arguments.
- 5. Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems and issues relating to the chosen field of study.



- 6. Communicate the results of studies undertaken in an academic field accurately in a range of different contexts using the main concepts, constructs and techniques of the bigdata and data analytics studies.
- 7. Address one's own learning needs relating to current and emerging areas of study, making use of research, development and professional materials as appropriate, including those related to new frontiers of knowledge.
- 8. Apply one's disciplinary knowledge and transferable skills to new/unfamiliar contexts and to identify and analyse problems and issues and seek solutions to real-life problems.



## **PROGRAM OUTCOMES**

### After successful completion of M E (Big Data Analytics), Students will be able to:

PO No	Attribute	Competency				
		Acquire in-depth knowledge of BDA domain, with an ability to				
PO 1	Scholarship of	discriminate, evaluate, analyze, synthesize the existing and new				
101	Knowledge	knowledge, and integration of the same for enhancement of				
		knowledge.				
		Analyze complex Big Data and Data Analytics Eco System				
		critically, apply independent judgement for synthesizing				
<b>PO 2</b>	Critical Thinking	information to make intellectual and/or creative advances for				
		conducting research in a wider theoretical, practical and policy				
		context.				
PO 3		Think laterally and originally, conceptualize and solve Big Data				
		problems, evaluate a wide range of potential solutions for those				
	<b>Problem Solving</b>	problems and arrive at feasible, optimal solutions after				
		considering public health and safety, cultural, societal and				
		environmental factors in the core areas of expertise.				
		Extract information pertinent to unfamiliar problems through				
		literature survey and experiments, apply appropriate research				
		methodologies, techniques and tools, design, conduct				
PO 4	Research Skill	experiments, analyze and interpret data, demonstrate higher				
104	Keşear en Skin	order skill and view things in a broader perspective, contribute				
		individually/in group(s) to the development of				
		scientific/technological knowledge in one or more domains of				
		engineering.				
		Create, select, learn and apply appropriate techniques,				
PO 5	Usage of modern	resources, and modern engineering and IT tools, including				
105	tools	prediction and modelling, to complex engineering activities				
		with an understanding of the limitations.				



		Possess knowledge and understanding of group dynamics,
	Collaborative	recognize opportunities and contribute positively to
	and	collaborative-multidisciplinary scientific research, demonstrate
PO 6	anu Multidissinlinary	a capacity for self-management and teamwork, decision-
	work	making based on open-mindedness, objectivity and rational
	WOFK	analysis in order to achieve common goals and further the
		learning of themselves as well as others.
		Demonstrate knowledge and understanding of engineering and
	Project	management principles and apply the same to one's own work,
PO 7	Management and	as a member and leader in a team, manage projects efficiently
	Finance	in respective disciplines and multidisciplinary environments
		after consideration of economical and financial factors
		Communicate with the engineering community, and with
PO 8	Communication	society at large, regarding complex engineering activities
		confidently and effectively, such as, being able to comprehend
		and write effective reports and design documentation by
		adhering to appropriate standards, make effective presentations,
		and give and receive clear instructions.
		Recognize the need for and have the preparation and ability to
	Life-long	engage in life-long learning independently, with a high level of
PO 9	Learning	enthusiasm and commitment to improve knowledge and
		competence continuously.
		Acquire professional and intellectual integrity, professional
		code of conduct, ethics of research and scholarship,
DO 10	Ethical Practices	consideration of the impact of research outcomes on
PO 10	and Social	professional practices and an understanding of responsibility to
	Responsibility	contribute to the community for sustainable development of
		society.
	Independent and	Observe and examine critically the outcomes of one's actions
PO 11	Reflective	and make corrective measures subsequently and learn from
	Learning	mistakes without depending on external feedback.



# COURSE STRUCTURE, COURSEWISE LEARNING OBJECTIVE, AND COURSE OUTCOMES (COS)

#### FIRST YEAR:

#### Semester: 1

Semester: 2

Subject Code	Subject Title	L	Т	Р	C	Subject Code	Subject Code Subject Title		Т	Р	С
BDA 601	Fundamentals of Machine Learning	3	-	-	3	BDA 605	Machine Learning for Big Data	3	-	-	3
BDA 602	Algorithms and Data Structures for Big Data	3	-	-	3	BDA 616	Modern Databases for Big Data	3	-	-	3
BDA 623	Architecture of Big Data Systems	3	-	-	3	MCL 602 Advanced Applications of Probability and Statistics		3	-	-	3
MCL 601	Applied Probability and Statistics	3	-	-	3	BDA 618 Multimedia Analytics		3	-	-	3
	Elective - 1	3	-	-	3		Elective - 2	3	-	-	3
BDA 601L	Fundamentals of Machine Learning Lab	-	-	3	1	BDA 605L	Machine Learning for Big Data Lab	-	-	3	1
BDA 602L	Algorithms and Data Structures for Big Data Lab	-	-	3	1	BDA 616L	Modern Databases for Big Data Lab	-	-	3	1
BDA 623L	Architecture of Big Data Systems Lab	-	-	3	1	MCL 602L	MCL 602L Advanced Applications of Probability and Statistics		-	3	1
MCL 601L	Applied Probability and Statistics Lab	-	-	3	1	BDA 618L Multimedia Analytics Lab		-	-	3	1
	Elective - 1 Lab	-	-	3	1		Elective - 2 Lab	-	-	3	1
BDA 695	Mini Project - 1	-	-	4	-	BDA 696 Mini Project - 2		-	-	-	4
BDA 697	Seminar - 1	-	-	1	-	BDA 698	Seminar - 2	-	-	-	1
1	Total	- 1	15	25	1	Fotal	15	- 1	15	25	

#### **SECOND YEAR (FINAL YEAR):**

III and IV Semester							
BDA 799	Project Work	25					
Total Number of Cre	75						



#### List of Electives(Theory)

	Elective - 1	Elective - 2		
Code	Subject	Code	Subject	
CSE-625	Mobile Web Application Development	CDC-607	DevOps for Cloud	
BDA-622	Principles of Data Visualization	BDA-621	Natural Language and Text Processing	
		ENP-601	Entrepreneurship	

### List of Electives(Lab)

	Elective - 1	Elective - 2			
Code	Subject	Code	Subject		
CSE-625L	Mobile Web Application Development	CDC-607L	DevOps for Cloud Lab		
	Lab				
BDA-	Principles of Data Visualization Lab	BDA-621L	Natural Language and Text Processing		
622L			Lab		
		ENP-601L	Entrepreneurship Lab		



Name o	Name of the Institution / Department: Manipal School of Information Sciences												
Name of the Program:						ME in BDA							
Course Title:						Fundamentals of Machine Learning							
Course	Code:	BDA-6	01		Cour	Course Instructor:							
Academic Year: 2020 - 2021						ster: I	First Yea	ar, Semest	er 1				
No of Credits: 3						equisites	: Basi	c Program	ming – pi	eferably I	Python		
Synop	sis:	This C	ourse p	rovides	s insigh	t on							
		1. Thi	is cou	rse pro	ovide t	vide the concept of machine learning, applications,							
		tec	hniques	s, desig	n issue	s and ap	proach	es to mac	hine lear	ning.			
		2. Thi	is cours	se prov	ide the	fundan	nental l	knowledg	e about	concept l	earning,		
		hyp	oothesis	s and bi	ias.								
		3. To	implen	nent ma	chine l	earning	algorith	nms such	as Decis	ion Tree l	earning,		
		Pro	obably	Appro	ximatel	y Corr	ect (PA	AC) lear	ning, Ba	ayesian l	earning,		
		Ins	tance-b	ased 1	earning	g, Prin	cipal C	Compone	nt Anal	ysis (PC	A) and		
		Ens	semble	metho	ds in re	al time	data set	for vario	ous analy	sis.			
Course	e												
Outcon	nes	On suc	cessful	compl	etion of	f this co	urse, st	udents w	ill be abl	e to			
(COs):													
CO 1.		Identif	y the g	oals, aj	pplicati	ons, typ	bes and	design is	ssues of	machine	learning		
		technic	ques.										
CO 2:		Relate	concep	t learni	ng and	hypoth	esis spa	ice.					
CO 3:		Apply	PCA le	arning	approa	ch to re	duce th	e dimensi	ion.				
CO 4:		Analys	e diffe	rent ma	chine l	earning	algoritl	nms.					
CO 5:		Design	ensem	ble me	thods.								
Mappi	ng of (	COs to 1	POs										
COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11		
CO 1	*												
CO 2		*											
CO 3			*										
CO 4				*									
CO 5				*									

Course content and outcomes:



Content	Competencies
Unit 1: Introduction	
Definition of Machine Learning, Goals	1. Define Machine Learning (C1)
and applications of machine learning,	2. Describe about any three applications for
Basic design issues and approaches to	which machine learning approaches seem
machine learning, Types of machine	appropriate. (C2)
learning techniques	3. Illustrate different types of machine
	learning techniques (C3)
Unit 2: Inductive Classification	
The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Inductive bias.	<ol> <li>Relate concept learning and hypothesis space (C4).</li> <li>Apply different algorithms to obtain most general and most specific hypotheses from the training examples. (C3)</li> </ol>
Unit 3: Decision Tree learning	
Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute, Entropy and information gain, Searching for simple trees and computational complexity.	<ol> <li>Apply decision tree algorithm to find the hypothesis space (C3)</li> <li>Construct decision tree machine learning algorithm (C5)</li> <li>Explain the method of choosing training examples and target function in the design of a machine learning system (C2)</li> <li>Explain different validation technique to find the accuracy in training and testing of data set (C5)</li> </ol>
Unit 4: Computational learning the	orv
Models of learnability: learning in the limit, Probably Approximately Correct (PAC) learning, Sample Complexity: quantifying the number of examples	1. Define various terms related to computational learning approach (C1).



needed to PAC learn, Computational	2. Describe different models learning in the
complexity of training. Sample	limit (C2)
complexity for finite hypothesis spaces,	3. Calculate the number of training examples
Noise Learning Multiple Classes, Bias-	required in different types of learning
variance trade-off, under-fitting and	approaches (C4).
over-fitting concepts	
Unit 5: Bayesian learning	
Probability theory and Bayes rule,	1. Write the applications of Bayes theorem
Naive Bayes learning algorithm -	(C3)
Parameter smoothing, Generative vs.	2. Describe the use of Logistic Regression in
discriminative training, Logistic	Machine Learning (C2)
regression, Bayes nets and Markov nets	3. Predict the target value for the new instance
for representing dependencies	using Naïve Bayes classifier. (C3)
Unit 6: Instance-based learning	
Constructing explicit generalizations	1. Construct explicit generalizations (C5)
versus comparing to past specific	2. Discriminate Instances Based and Case-
examples, K-Nearest Neighbour	based learning (C4)
learning algorithm, Case-based	3 Explain K nearest neighbour learning (C5)
reasoning (CBR) learning	5. Explain K-heatest heighbour learning (C5)
Unit 7: Continuous Latent Variable	es
Principal Component Analysis (PCA),	1. Describe use of Principal Component
Applications of PCA	Analysis for the complex data set (C2).
	2. Apply PCA to choose principal
	components for the given data set (C3)
Unit 8: Ensemble methods (baggin	g and boosting)
Using committees of multiple	1. Choose a suitable method of ensemble
hypotheses, Bagging, Boosting,	learning approach (C3).
DECORATE, Active learning with	2. Explain various ensemble techniques (C5)
ensembles	
Learning strategies, contact hours and	student learning time



(Deemed to be University under Section 3 of the UGC Act, 1956)

Learning strategy			Contact h	ours		Stu	Student learning time		
						(H)	rs)		
Lecture		30			60	60			
Quiz			02			04	04		
Small Group Discussi	ion (SGD)		02			02			
Self-directed learning	(SDL)		-			04			
Problem Based Learn	ing (PBL)		02			04			
Case Based Learning	(CBL)		-			-			
Revision			02			-			
Assessment			06			-			
TOTAL			44			74			
Assessment Methods	5:								
Formative:					Sun	nmative	:		
Internal practical Test	t			Session			al examination		
Theory Assignments					semeste	er examination			
Lab Assignment & Viva				Viva					
Mapping of assessme	ent with Co	S							
Nature of assessment		CO 1	CO 2	C	0	CO 4	CO 5		
				3					
Sessional Examinatio	n 1	*	*						
Sessional Examinatio	n 2			*	:	*			
Assignment/Presentat	tion	*	*	*	:	*			
End Semester Examin	nation	*	*	*	:	*	*		
Feedback Process	• Mi	d-Semes	ster feedback						
	• End	d-Semes	ter Feedbacl	- -					
		1 11 // /					100-		
Reference Material	1. T. Mitc	hell, "M	lachine Lear	nıng", I	McGi	raw-Hill	, 1997.		
	2. E. Alpa	ydin, "N	Aachine Lea	rning",	MIT	Press, 2	2010.		
	3. C. Bish	op," Pat	tern Recogni	ition an	d Ma	ichine L	earning", Springer,		
	2006.								



4. E. Hart, R. Duda and D. Stork, "Pattern Classification", Wiley-
Interscience, 2000.
5. T. Hastie, R. Tibshirani and J. Friedman, "The Elements of
Statistical Learning: Data Mining,
Inference and Prediction", Springer, 2nd Edition, 2009.
6. Jason Bell, "Machine Learning for Big Data", Wiley Big Data
Series, 2016.
7. Rama Murthy G," Multidimensional Neural Networks Unified
Theory", New Age International, 2008.



Name	of the P	rogram	:		ME i	ME in BDA						
Course Title:					Fund	Fundamentals of Machine Learning Lab						
Course	Code:	BDA-60	)1L		Cour	Course Instructor:						
Acader	nic Yea	r: 2020	- 2021		Seme	ester: 1	First Yea	ar, Semest	er 1			
No of (	Credits:	redits: 1 Prerequisites: Basics of Programming										
Synop	sis:	This Course provides insight on										
		1. This course provide the concept of machine learning, applications									ications,	
		techniques, design issues and approaches to machine learning.										
		2. Th	is cours	se prov	ide the	fundar	nental k	knowledg	ge about	concept	earning,	
		hyp	othesis	s and bi	ias.							
		3. To	implen	nent ma	achine l	earning	algorith	nms such	as Decis	ion Tree	learning,	
		Pro	obably	Appro	ximate	ly Corr	rect (PA	AC) lear	ming, B	ayesian	earning,	
		Ins	tance-b	ased	earning	g, Prin	cipal C	Compone	nt Anal	ysis (PC	(A) and	
		En	semble	metho	ds in re	al time	data set	for vario	ous analy	sis.		
Cours	e											
Outco	mes	On suc	cessful	compl	etion of	f this co	ourse, st	udents w	ill be abl	e to		
(COs)												
CO 1:		Identif	y the so	oftware	and to	ols for c	lesignin	g machir	ne learnii	ng applica	tions.	
CO 2:		Apply	concep	t learni	ng and	hypoth	esis spa	ce.				
CO 3:		Apply	machin	e learn	ing app	broach t	o reduce	e the dim	ension.			
CO 4:		Analys	se differ	rent ma	chine l	earning	algorith	nms.				
CO 5:		Design	ensem	ble me	thods.							
Mappi	ing of (	COs to ]	POs									
COs	PO 1	PO 2	<i>PO</i> 3	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11	
CO 1	*											
CO 2		*										
CO 3			*									
CO 4				*								
CO 5				*								
Cours	e conte	ent and	outcon	nes:								



Content	Competencies
Unit 1: Introduction	
Definition of Machine Learning Goals and applications of machine learning Basic design issues and approaches to machine learning Types of machine learning techniques	<ol> <li>Identify programming environments available for the machine learning (C1)</li> <li>Classify the pros and cons of various environments for ML coding (C2)</li> </ol>
Unit 2: Inductive Classification	
The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Inductive bias.	<ol> <li>Design a machine learning model to get a Maximally Specific Hypothesis for the given training examples (C5).</li> <li>Construct a machine learning model to obtain most general and most specific hypotheses for the given training examples (C5)</li> </ol>
Unit 3: Decision Tree learning	
Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute Entropy and information gain. Searching for simple trees and computational complexity.	<ol> <li>Develop a machine learning classifier using decision tree and random forest (C5)</li> <li>Examine different applications of decision tree and random forest (C4)</li> </ol>
Unit 4: Computational learning theo	ry



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Models of learnability: learning in the limit. Probably Approximately Correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. Noise. Learning Multiple Classes. Bias-variance trade-off, under- fitting and over-fitting concepts.	<ol> <li>Design a learning method to determine the sample complexity of training examples (C5)</li> <li>Analyse bias-variance trade-off, under- fitting and over-fitting concepts (C4)</li> </ol>
Unit 5: Bayesian learning	
Probability theory and Bayes rule. Naive Bayes learning algorithm - Parameter smoothing. Generative vs. discriminative training Logistic regression. Bayes nets and Markov nets for representing dependencies	<ol> <li>Design a machine learning model using Bayes learning (C5).</li> <li>Develop a machine learning classifier models using different approach (C5)</li> <li>Design Bayes nets and Markov nets for representing dependencies (C5)</li> </ol>
Unit 6: Instance-based learning	
Constructing explicit generalizations versus comparing to past specific examples. K-Nearest Neighbour learning algorithm. Case-based reasoning (CBR) learning.	<ol> <li>Design machine learning models to classify the instances using K-NN and CBR approaches (C5).</li> </ol>



Unit 7: Continuous Latent Variables										
Principal Component Analysis (PCA), Applications of PCA	1. Apply PC application	CA for different complex s (C3)								
Unit 8: Ensemble methods (bagging and boosting)										
Using committees of multiple hypotheses. Bagging Boosting DECORATE Active learning with ensembles.	<ol> <li>Design a B</li> <li>Develop m Ensemble r</li> </ol>	ayesian Networks (C5) achine learning models using nodels. (C5)								
Learning strategies, contact hours and	student learning ti	me								
Learning strategy	Contact hours	Student learning time (Hrs)								
Lecture	12	-								
Seminar	-	-								
Quiz	-	-								
Small Group Discussion (SGD)	-	-								
Self-directed learning (SDL)	-	-								
Problem Based Learning (PBL)	-	-								
Case Based Learning (CBL)	03	-								
Clinic	-	-								
Practical	24	-								
Revision	03	-								
Assessment	06	-								
TOTAL	48	-								
Assessment Methods:										
Formative:		Summative:								



Internal practical Test						Sessional examination		
Theory Assignments						End semester examination		
Lab Assignment & Viva						Viva		
Mapping of assessment with Cos								
Nature of assessment		CO 1	CO 2	C	03	CO 4	CO 5	
Sessional Examinatio	n 1	*	*					
Sessional Examinatio	n 2			*		*		
Assignment/Presentat	ion	*	*	*		*	*	
Laboratory Examination	on	*	*	*		*	*	
Feedback Process	• Mi	d-Semester	feedback					
	• En	d-Semester	Feedback					
Reference Material	1 Machin	e Learning	T Mitche	-11 M	Graw-	Hill 1997		
	2. Machin	e Learning	. E. Alpavo	din. N	IIT Pres	s. 2010		
	3. Pattern	Recognitio	on and Ma	chine	Learni	ng. C. Bisł	op. Springer.	
	2006	6				6,	<b>I</b> , <b>I B</b> ,	
	4. Pattern	n Classifica	ation, R. E	Duda,	E. Har	t, and D. S	Stork, Wiley-	
	Interscience	ce, 2000						
	5. T. Hasti	e, R. Tibsh	irani and J.	Fried	man, T	he Element	s of Statistical	
	Learning:	Data Minin	g,					
	Inference a	and Predict	ion. Spring	ger, 2r	d Editi	on, 2009		
	6. Machin	e Learning	for Big Da	ata, Ja	son Bel	ll, Wiley Bi	ig Data Series	
	7. Multidi	mensional	Neural Net	twork	s Unifie	ed Theory, I	Rama Murthy	
	G							
	8. Current	literature						



Name of the Program:			ME in	ME in BDA								
Course Title:					Algor	Algorithms and Data Structures for Big Data						
Course Code: BDA 602						Course Instructor:						
Academic Year: 2020-2021					Seme	ster: I	First Yea	r, Semeste	r 1			
No of C	Credits:	3			Prere	equisites	: Program	mming in l	Python, <b>(</b>	C		
Synop	sis:	This C	ourse p	rovides	s insigh	t on						
		1. Thi	is cours	se intro	duces st	tudents	to eleme	entary data	a structu	ires and d	esign of	
		alg	orithms	5.								
		2. Stu	dents l	earn ho	w to d	esign op	otimal a	lgorithms	with re	spect to t	ime and	
		spa	ice									
		3. Stu	dents 1	earn h	ow to i	mpleme	ent link	list, stacl	c, queue	es, search	ing and	
		sor	ting tec	hnique	s, sets,	trees an	d graph	S.	-		-	
		4. Stu	dents l	earn to	implen	nent stri	ng and t	text proce	ssing tee	chniques.		
		5 Stu	dents l	earn to	implen	pent Da	ta stream	n algorith	me			
		<b>J</b> . Stu			mpien							
Course	e											
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, stı	udents wil	l be able	e to		
(COs):	:											
CO 1:		Analys	e recur	sive pr	ograms	, solve a	a genera	l class of	recurrer	ice relation	ons (C4)	
~ ~ ~		Design	progra	ams fo	r imple	ementati	ion of l	inked list	ts, stack	, queues	, binary	
CO 2:		search	tree, so	orting a	nd sear	ching (C	24)					
		Design	progr	ams fo	or dict	ionary.	hash t	ables, gr	aphs ar	nd shorte	est path	
CO 3:		4 1	· · · · · · · · · · · · · · · · · · ·	14)							period	
		technic	lues. (C	.4)								
CO 4:		Design	string	and tex	t proce	ssing pi	ograms	. (C4)				
Mappi	ng of (	COs to 1	POs									
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11	
CO 1	*	*	*						*			



CO 2	*	*	*							*			
CO 3	*	*	*							*			
CO 4	*	*	*	*									
Course	e conte	nt and	outcon	nes:	I						1		
Conter	ıt					Competencies							
Unit 1: Algorithm specification and analysis techniques													
Analys	is of re	cursive	progra	ms.		1.	Defi	ne recur	sive prog	rams (C	22)		
Solving	g recur	rence eq	juation	8.		2.	Desi	gn simp	le recursi	ve prog	rams (C4	)	
Genera	ıl solut	tion for	· a larg	ge clas	s of	3.	Solv	e recurr	ence relat	tions (C4	4)		
recurre	ences.												
Unit 2	: Elen	nentary	v data s	tructu	res								
Implen	nentatio	on of lis	ts, stac	ks, que	ues.	1.	Desi	gn singl	y linked l	ist (C3)			
						2. Design doubly linked list(C3)							
						3. Explain the concepts of array-based stacks (C2)							
						4. Explain the concepts of pointer-based stacks							
						(C2)							
						5. Design and implement Queues. (C4)							
Unit 3	: Sor	ting an	d Sear	ching T	echni	que	es						
Quick	sort, he	ap sort,	merge	sort.		Design applications with suitable sorting and							
Linear	search	and bin	ary sea	rch.		searching techniques. (C4)							
Unit 4	: Has	hing ar	nd Dict	ionarie	es								
Hashin	g and I	Dictiona	ries			De	sign	various	hash fu	inctions	and im	plement	
						suitable hash tables (C4)							
Unit 5	: Bina	ary sear	ch tree	es									
Constr	uction.					Un	dersta	ind and	impleme	ent BST	and its	various	
Inorder	r, pro	eorder	and	posto	rder	tra	versal	technic	ues (C2)				
travers	als.												
Unit 6	: Gra	phs											
Repres	entatio	n of gr	aphs. 1	Depth 1	First	1.	Defi	ne grapł	ns (C2)				
Searching. Breadth First Searching.							2. Design data structure for graphs (C6)						



Minimum cost spanning tree.	3. Formulate an algorithm to	solve minimum cost			
Single source shortest paths and all-	spanning tree(C6)				
pairs shortest path.	4. Formulate an algorithm to solve Single source				
	shortest path (C6)				
	5. Formulate an algorithm	to solve All- pair			
	shortest path(C6)				
Unit 7: String and text processing tech	niques				
Pattern-Matching Algorithms.	1. Design applications	with suitable pattern			
Text Compression.	matching algorithms	(C4).			
Tries.					
Unit 8: Data stream algorithms					
Sampling, Random Projections, Basic	1. Implement suitable	e data streaming			
Algorithmic Techniques	algorithms (C3).				
Group Testing, Tree Method and Graph					
sketching.					
•					
Learning strategies, contact hours and	student learning time				
Learning strategies, contact hours and Learning strategy	student learning time Contact hours	Student learning			
Learning strategies, contact hours and Learning strategy	student learning time Contact hours	Student learning time (Hrs)			
Learning strategies, contact hours and         Learning strategy         Lecture	student learning time       Contact hours       30	Student learning time (Hrs) 60			
Learning strategies, contact hours and         Learning strategy         Lecture         Quiz	student learning time       Contact hours       30       02	Studentlearningtime (Hrs)6004			
Learning strategies, contact hours and         Learning strategy         Lecture         Quiz         Small Group Discussion (SGD)	student learning time       Contact hours       30       02       02	Studentlearningtime (Hrs)600402			
Learning strategies, contact hours and         Learning strategy         Lecture         Quiz         Small Group Discussion (SGD)         Self-directed learning (SDL)	student learning time       Contact hours       30       02       02       -	Studentlearningtime (Hrs)60040204			
Learning strategies, contact hours and Learning strategy Lecture Quiz Small Group Discussion (SGD) Self-directed learning (SDL) Problem Based Learning (PBL)	student learning time         Contact hours       30         30       02         02       02         02       02         02       02	Studentlearningtime (Hrs)600402040404			
Learning strategies, contact hours and Learning strategy Lecture Quiz Small Group Discussion (SGD) Self-directed learning (SDL) Problem Based Learning (PBL) Case Based Learning (CBL)	student learning time         Contact hours         30         02         02         -         02         -         02         -         02         -         02         -         02         -         02         -         02	Studentlearningtime (Hrs)6004020404-			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)Revision	student learning time           Contact hours           30           02           02           02           -           02           -           02           -           02           -           02           -           02           -           02	Studentlearningtime (Hrs)6004020404			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)RevisionAssessment	student learning time           Contact hours           30           02           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02	Student       learning         time (Hrs)       60         04       02         04       04         04       -         -       -         -       -         -       -         -       -         -       -         -       -         -       -			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)RevisionAssessmentTOTAL	student learning time         Contact hours         30         02         02         02         -         02         -         02         02         -         02         -         02         -         02         -         02         -         02         -         02         44	Student       learning         time (Hrs)       60         60       04         02       04         04       -         -       -         -       -         74       74			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)RevisionAssessmentTOTAL	student learning time           Contact hours           30           02           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           02           -           04           -           05           44	Student       learning         time (Hrs)       60         60       04         02       04         04       -         -       -         -       -         74       -			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)RevisionAssessmentTOTALAssessment Methods:	student learning time         Contact hours         30         02         02         -         02         -         02         -         02         -         02         -         02         -         02         -         02         -         02         -         02         -         04         05         44	Student       learning         time (Hrs)       60         04       02         04       04         04       -         -       -         -       -         74       -			
Learning strategies, contact hours andLearning strategyLectureQuizSmall Group Discussion (SGD)Self-directed learning (SDL)Problem Based Learning (PBL)Case Based Learning (CBL)RevisionAssessmentTOTALAssessment Methods:Formative:	student learning time         Contact hours       30         30       02         02       02         -       02         02       -         02       -         02       -         02       -         02       -         04       -         05       -         06       -         Suma	Student       learning         time (Hrs)       60         04       02         04       02         04       04         -       -         -       -         74       -         mative:       -			



Theory Assignments	End semester examination			
Lab Assignment & Viva	Viva			
Mapping of assessment wi	ith Cos			
Nature of assessment	CO 4			
Sessional Examination 1	*	*		
Sessional Examination 2		*	*	
Assignment/Presentation				*
End Semester Examination	*	*	*	*
Feedback Process •	Mid-Seme	ster feedb	back	
•	End-Semes	ster Feed	back	
Reference Material	1. Introdu	ction to .	Algorithms	- Thomas H. Cormen, Charles
	E. Leisersc	on, Ronal	d L. Rivest.	MIT Press.
	2. Data	Structure	s and Algo	orithms - Aho, Hopcroft and
	Ulmann. P	earson Pu	ublishers.	
	3. Data St	tructures	and Algori	thms in Python - Michael T.
	Goodrich,	Roberto	Tamassia,	and Michael H. Goldwasser.
	John Wiley	y & Sons		
	4. Data	Streams	: Algorithm	ns and Applications - S.
	Muthukrisl	hnan. Fo	oundations	and Trends in Theoretical
	Computer	Science	archive, Vo	lume 1 Issue 2, August 2005,
	Pages 117	- 236.		



Name o	Name of the Program:				ME in BDA								
Course	Title:				Algo	Algorithms and Data Structures for Big Data Lab							
Course	Code:	<b>BDA 60</b>	2L		Cour	Course Instructor: Deepak Rao B.							
Acader	nic Yea	r: 2020	-2021		Seme	Semester: First year, First semester							
No of Credits: 1					Prere	equisites	: Progra	mming in	C or Pyth	non			
<b>Synopsis:</b> 1. Students learn hov					w to d	esign op	otimal a	lgorithms	s with re	spect to t	ime and		
		spa	ice										
2. Students learn how					ow to i	mpleme	ent link	list, stac	k, queue	es, search	ing and		
		sor	ting tec	hnique	s, sets,	, sets, trees and graphs.							
3. Students learn to i					implen	mplement string and text processing techniques.							
4. Students learn to i					implen	nent Da	ta strear	n algorith	nms.				
Course	e												
Outco	mes	On suc	On successful completion of this course, students will be able to										
(COs):	:												
CO 1:		Evalua	te the p	erform	ance of Algorithms								
CO 2:		Develo	elop applications using suitable data structures										
CO 3:		Design	applic	ations u	using Data streaming and pattern matching algorithms								
Mappi	ing of (	COs to 1	POs										
COs	<i>PO</i> 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11		
CO 1	*	*	*						*				
CO 2	*	*	*			*							
CO 3	*	*	*		*	*							
Course content and outcomes:													
Conter	ıt				(	Compete	encies						
Unit 1	: Ele	mentary	y Data	Struct	ures								



Linked List, Stacks, Queues, Sorting	Implement Linked list, Stacks, Queues (C4).							
and Searching Techniques	Design applications using various searching and							
	Sorting techniques.							
Unit 2: Tree, Sets and Hash Table	<u> </u>							
Binary Tree, Binary search tree Implement Binary Tree and BST (C4)								
Sets and Hash Tables Design applications using Hash Tables								
Unit 3: Graph								
Representation of Graph	Implement Graph	and its tra	aversals (BFS, DFS)					
BFS and DFS	(C4).							
Shortest path algorithms	Design applicatior	ns with sho	rtest path algorithms					
	(C4)							
Unit 4: Pattern Matching and Data streaming								
	Implement pattern	matching a	llgorithms.					
Learning strategies, contact hours and student learning time								
Learning strategy	Contact hours		Student learning					
			time (Hrs)					
Lecture	12		-					
Seminar	-		-					
Quiz	-		-					
Small Group Discussion (SGD)	-		-					
Self-directed learning (SDL)	-		-					
Problem Based Learning (PBL)	-		-					
Case Based Learning (CBL)	03	-						
Clinic	-	-						
Practical	24	-						
Revision	03		-					
Assessment	06		-					
TOTAL	48		-					
Assessment Methods:	<b>I</b>		<u> </u>					
Formative:		Summative:						
Internal practical Test	Sessional examination							



Theory Assignments			End semester examination				
Lab Assignment & V	iva		Viva				
Mapping of assessment with Cos							
Nature of assessment		CO 1	CO 2		CO 3		
Sessional Examinatio	n 1	*	*				
Sessional Examinatio	n 2		*		*		
Assignment/Presentat	*	*		*			
End Semester Examin	nation	*	*		*		
Laboratory Examinat	ion	*	*		*		
Feedback Process	• Mi	d-Semester f	feedback				
	• En	d-Semester I	Feedback				
<b>Reference Material</b>	1. Da	ta Structure	s and Algorith	ıms in H	Python - Michael T.		
	Go	odrich, Rob	erto Tamassia,	, and M	lichael H. Goldwasser.		
	Jo	hn Wiley & S	Sons.				
	2. Da	ta Streams	: Algorithms	and A	Applications - S.		
	M	. Foundations	and T	rends in Theoretical			
	Co	mputer Scie	nce archive, V	olume 1	Issue 2, August 2005,		
	Pa	ges 117 – 23	6.				



Name of the Program:				ME in	ME in BDA							
Course	Title:				Archi	Architecture of Big Data Systems						
Course	Code:	BDA 62	3		Cour	Course Instructor: Deepak Rao B						
Acader	nic Yea	ar: 2020	-2021		Seme	ster: F	First Yea	ar, Semeste	er 1			
No of C	Credits:	3			Prere	equisites	: Progra	amming in	Python,	Java		
Synop	sis:	This C	ourse p	rovides	insigh	t on						
		1. Stu	dents 1	earn th	e conc	ept of t	oig data	character	ristics, b	oatch and	lambda	
		arc	hitectu	re.		1	C					
		2. This course introduces students to basics file systems in Big Data										
	3. This course helps the student to understand the concepts of Hadoo								Hadoop			
	framework, Spark framework and their internals.											
		4. Thi	is cours	se help	s the st	udents	to learr	n Map-red	luce pro	grammin	g, Spark	
programming.												
		5. Stu	dents l	earn the	e differe	ent laye	rs with	use cases	demons	trations.		
Course	e											
Outco	mog	On suc	cessful	compl	etion of	f this co	urea eti	udente wi	ll be abl	e to		
Outco	ines	On successful completion of this course, students will be able to										
(COs):												
CO 1:		Exami	ne the t	ype of	data in	big data	u (C3)					
CO 2:		To des	design applications based with Hadoop framework (C5)									
CO 3:		To des	ign app	licatior	ns based with spark architecture (C5)							
00.4		To build applications based on the Big Data Architecture platforms and										
CO 4:		analyse the results based on the outcome of the applications used (C6)										
Mappi	ng of (	COs to 1	POs									
COs	<i>PO</i> 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11	
CO 1	*	*	*			*						
CO 2	*	*	*		*		*			*		
CO 3	*	*	*		*		*			*		
CO 4	*	*	*		*	*	*			*		



#### Course content and outcomes:

Content	Competencies
Unit 1: Classifying Big Data Chara	cteristics
Analysis type - real time or batched for	1. Identify different types of Data
later analysis.	2. Identify processing methodology
Processing methodology - predictive,	
analytical, ad-hoc query, and reporting.	
Data frequency and size	
On demand, as with social media	
data	
Continuous feed, real-time -	
weather data, transactional data	
Time series - time-based data	
Data type - transactional, historical,	
master data and metadata.	
Content formats - structured,	
unstructured, semi-structured	
Data sources - Web and social media,	
humans, machines, transaction data and	
biometric data.	
Unit 2: Big Data processing - the Lan	nbda architecture
Append-only, immutable data	1. Understand Lambda architecture to handle
Batch layer	Big Data (C2).
Serving layer	2. Understand different layers in Lambda
Speed layer	Architecture (C2).
Case study: Druid - A Real-time	
Analytical Data Store	
Unit 3 Batch layer, Serving layer and S	Speed layer



Choosing a storage solution for the	1. Develop applications to store data in HDFS
batch layer: Distributed file systems,	(C4).
Vertical partitioning.	2. Develop applications for batch processing
MapReduce: a paradigm for Big Data	using Map Reduce technique (C4).
computing.	3. Understand the need of serving layer (C2).
Performance metrics for the serving	4. Design application to store data for
layer	processing in serving layer (C4).
Requirements for a serving layer	5. Understand the need of Speed layer for data
database	processing (C2).
Computing real time views	
Storing real time views	
Challenges of incremental computation	
Asynchronous versus synchronous	
updates	
Unit 4: Spark: Alternatives to Maj	pReduce
Spark Architecture	1. Understand Spark Architecture for data
Spark Session	processing (C2).
DataFrame	2. Design applications using DataFrames and
Transformations and Actions	RDDs (C4).
Spark SQL	
Resilient Distributed Datasets	
(RDDs)	
Unit 5: Stream Processing using Sp	park
Advantages and challenges of stream	1. Understand different stream processing
processing	techniques (C2).
Stream Processing Design Points	2. Design applications for handling real time
Streaming APIs	data using Structured Streaming (C4).
Structured Stream Processing	
Unit 6: Machine Learning using S	park
High level M-Lib concepts	1. Understand different libraries and packages
M Lib in Action	for machine learning in Spork (C2)



(Deemed to be University under Section 3 of the UGC Act, 1956)

		2. Design machine learning model using					
			Spark (C4	).			
Learning strategies, contact hou	irs and	student	learning	time			
Learning strategy		Conte	act hours		Student learning		
					time (Hrs)		
Lecture		30			60		
Quiz		02			04		
Small Group Discussion (SGD)		02			02		
Self-directed learning (SDL)		-			04		
Problem Based Learning (PBL)		02			04		
Case Based Learning (CBL)		-			-		
Revision		02			-		
Assessment		06			-		
TOTAL		44			74		
Assessment Methods:							
Formative:				Summati	ve:		
Internal practical Test				Sessional	onal examination		
Theory Assignments				End seme	ester examination		
Lab Assignment & Viva		Viva					
Mapping of assessment with Co	S						
Nature of assessment	CO 1	CO 2	CO 3	CO 4			
Sessional Examination 1	*	*					
Sessional Examination 2		*	*				
Assignment/Presentation				*			
End Semester Examination	*	*	*				
Laboratory examination	*	*	*	*			
Feedback Process • Mie	d-Semes	ster feed	back				
• End	d-Semes	ter Feed	back				



<b>Reference Material</b>	1.	Big Data: Principles and best practices of scalable real-time data						
		systems - Nathan Marz and James Warren. Manning Publisher.						
	2.	Hadoop: The Definitive Guide: Storage and Analysis at Internet						
		Scale – Tom White, O'Reilly Publication 4th Edition.						
	3.	Spark: The Definitive Guide: Big Data Processing Made Simple –						
		Bill Chambers, Matei Zaharia, O'Reilly Publication 1 <sup>st</sup> Edition.						
	4.	http://static.druid.io/docs/druid.pdf,						
		http://druid.io/docs/0.8.0/design/design.html						
	5.	Big data architecture and patterns - IBM developerWorks.						
		http://www.ibm.com/developerworks/library/bd-archpatterns1/						
	6.	Big Data and Analytics -IBM developerWorks.						
		http://www.ibm.com/developerworks/analytics/						
	7.	http://lambda-architecture.net/						
	8.	Apache HBase - <u>http://hbase.apache.org/</u>						
	9.	Apache Spark Streaming - <u>https://spark.apache.org/streaming/</u>						
	10	Summingbird MapReduce library -						
		https://github.com/twitter/summingbird						



Name o	Name of the Program: M					E in BDA					
Course	Title:				Arc	chitecture of Big Data Systems Lab					
Course	Code:	BDA 62	3L		Cou	ourse Instructor: Deepak Rao B.					
Acader	nic Yea	nr: 2020	-2021		Sen	nester: F	First year	, First ser	nester 1		
No of C	Credits:	1			Pre	requisites	: Progra	mming in	Python, J	lava	
Synop	sis:	1. Thi	is cour	se help	os the	e student	to unc	lerstand	the cond	cepts of	Hadoop
		frai	neworl	k, Spark	c fran	nework ar	nd their	internals			
		2. Thi	is cours	se helps	s the	students	to learn	Map-rec	duce pro	grammin	g, Spark
		pro	gramm	ing.							
		3. Thi	s cours	e helps	the st	udents to	build n	hachine le	earning n	nodel usii	ng Spark
	framework.										
Course	e										
Outco	mes	On suc	cessful	comple	etion	of this co	urse, stu	udents wi	ill be abl	e to	
(COs):	:										
CO 1:		Install	and dev	velop aj	oplica	tions usin	ng Hado	op and it	ts ecosys	tems	
CO 2:		Build a	pplicat	tions us	ing S	park frame work					
CO 3:		Build N	Machin	e Learn	ing n	models using Spark					
Mappi	ing of (	COs to 1	POs								
COs	<i>PO</i> 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO 5</i>	5 PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11
CO 1	*	*	*		*	*			*	*	
CO 2	*	*	*		*	*			*	*	
CO 3	*	*	*		*	*			*	*	
Course content and outcomes:											
Content					Compete	encies					
Unit 1	: Hao	loop ec	osyster	n							
Installa	ation a	and con	ıfigurin	ig Had	oop	1. Practi	ce appli	cations i	n HDFS	and YAF	RN. (C3)
ecosys	tem					2. Practi	ce appl	ications	using Sc	qoop, Hiv	ve, PIG.
						(C3)					
						3. Compute programs using MapReduce. (C3)					



Unit 2: Spark Framework							
Spark tool chain - RDD, DataFrame, 1. Develop applications using Spark DataFrame							
SQL and Streaming	and SQL (C4).						
	2. Design real ti	me applica	ations using Spark				
	Streaming (C4).						
Unit 3: Machine Learning using Spark							
MLIB	1. Compute machi	ne learning	models using Spark.				
	(C3)						
Learning strategies, contact hours and student learning time							
Learning strategy	Contact hours		Student learning				
			time (Hrs)				
Lecture	12		-				
Seminar	-		-				
Quiz	-	-					
Small Group Discussion (SGD)	-	-					
Self-directed learning (SDL)	-		-				
Problem Based Learning (PBL)	-		-				
Case Based Learning (CBL)	03	-					
Clinic	-		-				
Practical	24	-					
Revision	03	-					
Assessment	06	-					
TOTAL	48		-				
Assessment Methods:							
Formative:		Summativ	ve:				
Internal practical Test		Sessional	examination				
Theory Assignments		End seme	emester examination				
Lab Assignment & Viva		Viva					
Mapping of assessment with Cos							


Nature of assessment	CO 1	CO 2	CO 3					
Sessional Examinatio	n 1	*						
Sessional Examinatio	n 2		*	*				
Assignment/Presentat	ion	*	*	*				
End Semester Examin	nation	*	*	*				
Laboratory Examinat	ion	*	*	*				
Feedback Process	• 1	• Mid-Semester feedback						
	• E	End-Semester Feedback						
<b>Reference Material</b>	1. I	Big Data: Pr	inciples and best pr	cactices of scalable real-time				
	Ċ	lata systems	- Nathan Marz a	nd James Warren. Manning				
	F	Publisher.						
	2. H	Hadoop: The	e Definitive Guide	e: Storage and Analysis at				
	I	nternet Scale	e – Tom White, O'R	eilly Publication 4th Edition.				
	3. 5	Spark: The	Definitive Guide:	Big Data Processing Made				
	S	Simple – Bill	Chambers, Matei Z	Zaharia, O'Reilly Publication				
	1	st Edition.						



Name of the P	rogram:	ME in BDA					
<b>Course Title:</b>		Applied Probability and Statistics					
<b>Course Code:</b>	MCL 601	Course Instructor:					
Academic Yea	nr: 2020-2021	Semester: First Year, Semester 1					
No of Credits:	: 3	Prerequisites: Basic algebra and calculus					
Synopsis:	This course provides	an introduction to fundamental concepts in probability					
	and statistics that are essential for data science applications.						
Course							
Outcomes	On successful completion of this course, students will be able to						
(COs):							
CO 1:	Understand and apply the basic principles of sampling.						
CO 2:	Model random phenor	Model random phenomena using random variables.					
CO 3:	Calculate & interpret	Calculate & interpret probability as a measure of quantifying uncertainty.					
CO 4:	Construct Bayesian m	odels for analysing practical problems.					
CO 5:	Use sample informa appropriate statistical	tion and perform hypothesis-test analysis using an technique to explain attributes of a population.					

## Mapping of COs to POs

COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11
CO 1	*										
CO 2	*	*	*								
CO 3	*	*	*	*				*			
CO 4		*	*	*		*		*			
CO 5		*	*	*		*				*	

## **Course content and outcomes:**

Content	Competencies				
Unit 1: Counting, probability concepts	, and conditional probability				
Multiplication rule; permutation;	1. Understand and apply the basic principles of				
combination - Sampling: with/without	sampling (C1, C3).				
replacement and order matters/does not	2. Understand and apply the basic principles of				
	probability (C1, C3).				



matter - Binomial & multinomial	3.	Differentiate and relate frequency-based
coefficients - Distribution problems		interpretation of probability to classical
Set theory; sample space; outcomes;		approach (C4).
events - Frequency based definition of	4.	Apply Bayesian principle for modelling
probability - Equally likely vs. not		practical problems (C5).
equally likely outcomes - Axioms of		
probability		
Conditional probability; probability tree		
model; chain rule - Decomposition and		
the law of total probability - Bayes' rule		
- intuition, dependence/independence of		
events.		
Unit 2: Random variables		
Modelling using discrete random	1.	Understand and differentiate discrete and
variables: Bernoulli, geometric,		continuous random variables of practical
binomial, negative binomial,		interest (C2, C4).
hypergeometric, and Poisson	2.	Gain solid foundation in the mathematical
distributions - Probability mass		aspects of random variables (C2).
function and cumulative distribution	3.	Understand how to use random variables to
function - Expectation and variance:		model random phenomena (C4).
discrete case - Modelling using	4.	Compare and contrast practical applicability of
continuous random variables: uniform,		random variables (C6).
normal, log-normal, exponential, and		
beta distributions; probability density		
function - Expectation and variance:		
continuous case - Functions of random		
variables.		
Unit 3: Sampling and parameter estim	atio	n
Population and sample - Statistic &	1.	Differentiate population and sample (C4).
sampling distribution - Sample mean	2.	Describe population parameters using
and variance - Central limit theorem -		inferences drawn from a sample (C6).
intuition and applications		



Point estimation - Standard error -	3.	Design and apply appropriate hypothesis tests				
Interval estimation: interpretation of	for practical problems (C3).					
confidence interval - Hypothesis	4.	Communicate and explain the results of				
testing: p-values, significance level and	l	hypothesis testing (C6).				
their interpretations, application to						
analysis of one- /two-sample mean and						
paired data.						

## Learning strategies, contact hours and student learning time

Learning strategy			act hours		Student learning		
					time (Hrs)		
Lecture		30			60		
Quiz	02			04			
Small Group Discussion (SGD)	02			02			
Self-directed learning (SDL)	-			04			
Problem Based Learning (PBL)	02			04			
Case Based Learning (CBL)		-			-		
Revision		02			-		
Assessment					-		
TOTAL					74		
Assessment Methods:							
Formative:				Summati	ve:		
Internal practical Test				Sessional	al examination		
Theory Assignments				End seme	nester examination		
Lab Assignment & Viva				Viva			
Mapping of assessment with Co	S			·			
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5		
Sessional Examination 1	*	*					
Sessional Examination 2		*	*	*			
Assignment/Presentation	*	*	*	*	*		



End Semester Examin	*	*	*	*	*					
Feedback Process	Mid-Semester feedback									
	• End	• End-Semester Feedback								
<b>Reference Material</b>	1. Introduction to Probability, Charles M. Grinstead, American									
	Mathemati	Mathematical Society; 2nd Revised Edition 1997. Available online at								
	https://open.umn.edu/opentextbooks/textbooks/introduction-to-									
	probability									
	2. A First Course in Probability, Sheldon Ross, 9th Edition, Pearson									
	Education India; 9th Edition, 2013.									
	3. Biostati	stics (	Open Lea	arning tex	xtbook – Online	e resource from				
	University of Florida available at https://bolt.mph.ufl.edu/6050-6052/									
	4. All of Statistics: A Concise Course in Statistical Inference, Larry									
	Wasserman	n – Spri	inger.							



Name of the Program:				ME in	ME in BDA									
Course	Title:				Appli	Applied Probability and Statistics Lab								
Course	Code:	MCL 60	1L		Cour	Course Instructor:								
Acader	nic Yea	r: 2020-	2021		Seme	ster: Fin	st Year,	Semester	1					
No of Credits: 1Prerequisites: MCL 601														
Synop	sis: This course provides a hands-on introduction to fundamental concepts									cepts in				
		probab	ility an	d statis	tics the	at are es	sential	for data s	cience a	pplicatio	ns using			
		the R p	orogram	nming la	anguag	e.								
Course	e													
Outco	mes	On suc	cessful	comple	etion of	f this co	urse, st	udents wi	ll be abl	e to				
(COs):	:													
CO 1:		Apply	the bas	ic princ	iples o	f sampl	ing to p	ractical p	roblems.					
CO 2:		Visuali	ize proł	oability	concep	ots throu	igh frec	luency-ba	sed inter	pretation	s.			
CO 3.		Simula	te disc	rete an	d cont	inuous	randon	n variable	es for n	odelling	random			
005.		phenor	nena.											
CO 4:		Design	and ap	ply hyp	othesis	s tests f	ollowed	l by interp	retation	of results	3.			
		Interpr	et stat	istical	results	results and communicate them unambiguously and								
0.5:		effectiv	vely.											
Mappi	ing of (	COs to 1	POs											
COs	<i>PO</i> 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11			
CO 1	*	*	*		*									
CO 2		*	*		*									
CO 3	*	*	*	*	*									
CO 4		*	*	*	*	*								
CO 5				*	*	*		*		*				
Course	e conte	ent and	outcon	nes:										
Conter	ıt				(	Compete	encies							
Unit 1	: Coun	ting, pr	obabili	ity con	cepts, a	and con	ditiona	al probab	ility					



Multiplication rule; permutation;	1.	Understand the basic principles of the R
combination - Sampling: with/without		programming language (C1).
replacement and order matters/does not	2.	Develop short code snippets to understand the
matter - Binomial & multinomial		basic principles of sampling and probability
coefficients - Distribution problems		(C1, C3).
Set theory; sample space; outcomes;	3.	Visualise and interpret probability concepts
events - Frequency based definition of		through a frequency-based approach (C6).
probability - Equally likely vs. not	4.	Program and analyse Bayesian models for
equally likely outcomes - Axioms of		practical problems (C4).
probability		
Conditional probability; probability tree		
model; chain rule - Decomposition and		
the law of total probability - Bayes' rule		
- intuition, dependence/independence of		
events.		
Unit 2: Random variables		
Modelling using discrete random	1.	Understand and apply R functions to simulate
variables: Bernoulli, geometric,		discrete and continuous random variables (C3).
binomial, negative binomial,	2.	Using sampling, compute and interpret
hypergeometric, and Poisson		different attributes of random variables (C4).
distributions - Probability mass	3.	Visualise and interpret histograms and
function and cumulative distribution		probability mass/density functions of random
function - Expectation and variance:		variables using state of the art visualisation
discrete case - Modelling using		libraries in R (C4).
continuous random variables: uniform,	4.	Develop codes to model random phenomena
normal, log-normal, exponential, and		using appropriate random variables (C5).
beta distributions; probability density		
function - Expectation and variance:		
continuous case - Functions of random		
variables.		
Unit 3: Sampling and parameter estimation	atio	n



Population and sample - Statistic &	1.	Visualise sample data through histograms (C3).						
sampling distribution - Sample mean	2.	Compute estimates of population parameter						
and variance - Central limit theorem $- % \left( {{\left[ {{\left[ {{\left[ {\left[ {\left[ {\left[ {\left[ {{\left[ {$		using samples and communicate the uncertainty						
intuition and applications		in the estimates (C4).						
Point estimation - Standard error -	3.	Use R in-built functions for performing						
Interval estimation: interpretation of		hypothesis tests (C4).						
confidence interval - Hypothesis	4.	Interpret and communicate the results of						
testing: p-values, significance level and		hypothesis tests (C6).						
their interpretations, application to								
analysis of one- /two-sample mean and								
paired data								
Learning strategies, contact hours and	stu	dent learning time						

Learning strategy	Contact hours		Student	learning
			time (Hrs	)
Lecture	12		-	
Seminar	-		-	
Quiz	-		-	
Small Group Discussion (SGD)	-		-	
Self-directed learning (SDL)	-		-	
Problem Based Learning (PBL)	-		-	
Case Based Learning (CBL)	03		-	
Clinic	-		-	
Practical	24		-	
Revision	03		-	
Assessment	06		-	
TOTAL	48		-	
Assessment Methods:				
Formative:		Summativ	ve:	
Internal practical Test	Sessiona		al examination	
Theory Assignments		End seme	ester examination	
Lab Assignment & Viva		Viva		



Mapping of assessme	ent with Co	S			•				
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5			
Sessional Examinatio	n 1	*	*						
Sessional Examinatio			*	*					
Assignment/Presentat	*	*	*	*	*				
Laboratory examinati	*	*	*	*	*				
Feedback Process	• Mie	Mid-Semester feedback							
	• End	• End-Semester Feedback							
<b>Reference Material</b>	1. Introduction to Probability, Charles M. Grinstead, American								
	Mathemati	cal Soci	iety; 2nd	Revised	Edition 1997. Av	ailable online at			
	https://ope	n.umn.e	du/open	textbooks	/textbooks/introd	uction-to-			
	probability	,							
	2. A First	Course	in Prob	ability, Sh	eldon Ross, 9th	Edition, Pearson			
	Education	India; 9	th Editio	on, 2013.					
	3. Biostati	stics O	pen Lea	arning tex	ktbook – Online	e resource from			
	University	of Flori	da avail	able at htt	ps://bolt.mph.ufl.	.edu/6050-6052/			
	4. All of S	Statistic	s: A Cor	ncise Cou	rse in Statistical	Inference, Larry			
	Wasserman	n – Spri	nger.						



Name	of the P	rogram			ME in	n BDA						
Course	e Title:	~~~~	_		Mobi	le Web A	Applicati	on Develo	opment			
Course	e Code:	<u>CSE-62</u>	<u>5</u> 2021		Cour	se Instru	uctor:	<b>C</b>				
Acader	nic Yea	<b>r:</b> 2020	-2021		Seme	ester: F	irst Yea	r, Semeste	er I	of OOD'		ta Iava
NO 01 (	realts:	3			progr	amming	ianguag	e kno	wiedge	OF OOP S	s concep	us, Java
Synop	sis:	1.	This	course w	ould p	provide f	fundame	ental knov	wledge a	bout and	oid platf	orm.
		2.	The	course w	ill also	provide	skill se	ts to desig	gn and de	evelop sec	cured mol	bile web
	applications.											
	3. This course will provide basic knowledge about programming for technologies								nologies			
			avail	lable on s	mart p	hones.						
Course	e	Outco	mes	On succ	essful	complet	ion of tl	his course	e, studen	ts will be	able to	
(COs)	:											
CO 1:				Discuss	the cha	allenges	of mob	ile web a	pplicatio	on develop	oment.	
CO 2:				Apply 1	HTML	5, CSS	, javasc	ript and	DOM	API's in	web app	olication
				develop	ment.							
CO 3:				Use of p	orogran	ogramming for technologies available on smart phones.						
CO 4:				Design	and dev	nd develop secure mobile web applications.						
Mappi	ing of (	COs to 1	POs									
COs	<i>PO</i> 1	<i>PO</i> 2	PO S	3 PO 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	<i>PO</i> 8	<i>PO</i> 9	PO 10	PO 11	PO 12
CO 1	*	*										
CO 2		*	*		*							
CO 3		*	*		*							
CO 4		*	*	*	*							
Course	e conte	nt and	outco	omes:								
Conter	ıt				(	Compete	encies					
Unit 1	: Cha	llenges	of m	obile We	eb app	lication	develo	pment				
The li	mitatio	ns of	mobil	le netwo	orks.	1. I	Discuss	limitatior	n of mob	ile netwo	rks (C2)	
Reduci	ing the	page we	eight -	– the amo	ount	2. H	Explain	way of re	ducing t	he page w	veight (C	2)
of ma	arkup	and ex	kterna	al eleme	ents.	3. I	Discuss	limitatior	is impos	ed by batt	ery life (	(C2)
Avoidi	ing us	seless	netw	ork us	age.							
Unders	standing	g the "m	obile	-first" de	sign							
princip	oles. L	imitatic	ons i	imposed	by							
battery	life.											



Unit 2: Setting up a personal Web site		
Setting free VMs - micro-instances - on	1.	Set up VMs on AWS (C4)
AWS. Installing and configuring	2.	Discuss HTTP and REST API's (C2)
NGINX on AWS micro instances.	3.	Solve issues on installation and configuration NGIX
Working with routing and reverse		on AWS (C3)
proxies HTTP and REST APIs		
Unit 3: HTML5 and CSS for mobile of	levices.	
Media queries for handling mobile	1.	Discuss principles of responsive design (C2)
form-factors. Principles and practice of	2.	Use of media queries for handling mobile form-
responsive design. Mobile UX,		factors (C3)
Viewport, Fluid design and responsive		
images		
Unit 4: Programming with JavaScrip	t and D	OM APIs
Accessing document fragments. Using	1.	Explain jQuery and other light weight libraries (C2)
jQuery and other light-weight libraries.	2.	Discuss AJAX and asynchronous programming (C2)
AJAX and asynchronous programming		
Unit 5: Architecture of Android appli	cations	
Android application framework, core	1.	Discuss android application framework (C2)
libraries, android runtime, Linux kernel	2.	Explain android runtime system and core libraries
		(C2)
		(C2)
Unit 6: Programming for technologie	s availa	ble on smart phones
Unit 6: Programming for technologie Introduction to PhoneGap, Handling	s availa	(C2) ble on smart phones Use of PhoneGap in mobile web applications (C3)
Unit 6: Programming for technologie Introduction to PhoneGap, Handling Touch events. Making use of the	<b>s availa</b> 1. 2.	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)
Unit 6: Programming for technologie Introduction to PhoneGap, Handling Touch events. Making use of the accelerometer and the Location APIs.	<b>s availa</b> 1. 2.	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)
Unit 6:Programming for technologieIntroduction to PhoneGap, HandlingTouch events.Making use of theaccelerometer and the Location APIs.Accessing camera and media	<b>s availa</b> 1. 2.	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)
Unit 6: Programming for technologie Introduction to PhoneGap, Handling Touch events. Making use of the accelerometer and the Location APIs. Accessing camera and media devices	s availa 1. 2.	ble on smart phones Use of PhoneGap in mobile web applications (C3) Practice accelerometer and location APIs (C3)
Unit 6: Programming for technologie Introduction to PhoneGap, Handling Touch events. Making use of the accelerometer and the Location APIs. Accessing camera and media devices	s availa 1. 2.	ble on smart phones Use of PhoneGap in mobile web applications (C3) Practice accelerometer and location APIs (C3)
Unit 6:       Programming for technologie         Introduction to PhoneGap, Handling         Touch events.       Making use of the         accelerometer and the Location APIs.         Accessing camera and media         devices         Unit 7:       Developing offline facilities in	s availa 1. 2. mobile	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)         web applications
Unit 6:       Programming for technologie         Introduction to PhoneGap, Handling         Touch events.       Making use of the         accelerometer and the Location APIs.         Accessing camera and media         devices         Unit 7:       Developing offline facilities in         Localstorage and IndexDB APIs	s availa 1. 2. mobile 1.	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)         web applications         Discuss Localstorage and IndexDB APIs (C2)
Unit 6:       Programming for technologie         Introduction to PhoneGap, Handling         Touch events.       Making use of the         accelerometer and the Location APIs.         Accessing camera and media         devices         Unit 7:       Developing offline facilities in         Localstorage and IndexDB APIs         Unit 8:       Designing and developing sectors	s availa 1. 2. mobile 1. ure mob	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)         web applications         Discuss Localstorage and IndexDB APIs (C2)         bile web applications
Unit 6: Programming for technologie         Introduction to PhoneGap, Handling         Touch events. Making use of the         accelerometer and the Location APIs.         Accessing camera and media         devices         Unit 7: Developing offline facilities in         Localstorage and IndexDB APIs         Unit 8: Designing and developing sector         Understanding the single-origin policy,	s availa 1. 2. mobile 1. ire mol 1.	(C2)         ble on smart phones         Use of PhoneGap in mobile web applications (C3)         Practice accelerometer and location APIs (C3)         web applications         Discuss Localstorage and IndexDB APIs (C2)         bile web applications         Discuss different encryptions techniques used in



Principles of the secure socket layer and	2. Practice best practices in developing secure client-
HTTPS Practical encryption for client-	side code (C3)
server communication in Web	
applications. Best practices in	
developing secure client-side code	

Learning strategies, contact hours and student learning time									
Learning strategy	Contact hours	Student learning time (Hrs)							

Lecture		30			60
Quiz		02			04
Small Group Discussion (SGD)		02			02
Self-directed learning (SDL)		-			04
Problem Based Learning (PBL)		02			04
Case Based Learning (CBL)		-			-
Revision		02			-
Assessment		06			-
TOTAL		44			74
Assessment Methods:					
Formative:				Sumn	native:
Theory Assignment				Sessio	nal Examination
Lab Assignment				Unive	rsity End Semester Examination
Lab Test				Viva	
Viva					
Mapping of assessment with Co	S			•	
Nature of assessment	CO	CO 2	C	CO 3	CO 4
	1				
Sessional Examination 1	*	*			
Sessional Examination 2			*		*
Assignment/Presentation		*	*		*
End Semester Examination	*	*	*		*
Feedback Process • Mid	d-Seme	ester feedback	K		



	• End-S	Semester Fe	edback							
<b>Reference Material</b>	1. Learning	Web App I	Developme	nt (Build	Quickly	with Prove	n JavaScript			
	Techniques)	- Semmy	Purewal.	O'Reilly	Media.	2014. MSO	IS, MAHE,			
	Manipal 13									
	2. The	Browser	Securit	y Ha	ndbook.	Michal	Zalewski.			
	https://code.g	google.com/	p/browsers	ec/wiki/N	<u>Main</u>					
	3. High Perf	ormance R	esponsive 1	Design -	Tom Ba	rker. O'Reil	ly publisher.			
	2014.	2014.								
	4.	Apple	I	UI	De	esign	Basics.			
	https://develo	oper.apple.c	om/library/	/ios/docu	mentatior	/UserExperi	ence/Conce			
	ptual/Mobile	HIG/i ndex.	. <u>html</u>							
	5. Android D	esign Princ	iples. <u>https:</u>	://develor	er.androi	id.com/desig	n/index.html			
	6. An	droid	Applicati	ion	Develo	pment	Reference.			
	https://develo	pper.android	l.com/deve	lop/index	.html					



Name	of the P	rogram	:		ME in	n BDA							
Course	e Title:				Mobi	le Web .	Applicati	ion Develo	opment L	ab			
Course	e Code:	CSE-62:	5L		Cour	Course Instructor:							
Acade	mic Yea	<b>r:</b> 2020	-2021		Seme	Semester: First Year, Semester 1							
No of C	Credits:	1			Prere	equisites	E E	Basic kno	wledge	of OOP'	s concep	ots, Java	
C	<b>a•a</b> •	1	This		progr	amming	languag	e	- ladaa a	h and an de			
Synop	515:	1.	THIS	course v	vouia p	orovide	undame		vieuge a	loout and	fold plat	orm.	
		2.	The	course w	ill also	provide	skill se	ts to desig	gn and de	evelop see	cured mo	bile web	
			appl	ications.									
		3.	This	course w	vill pro	vide ba	sic knov	vledge ab	out prog	gramming	g for tech	nologies	
			avai	lable on s	smart p	hones.							
Cours	e	Outco	mes	On succ	essful	complet	tion of t	his course	e, studen	ts will be	able to		
(COs)	:												
CO 1:				Solve is	sues re	lated to	mobile	web appl	ication o	levelopm	ent		
CO 2: Apply HTML5, CSS, javascript and DC							DOM	API's in	web app	plication			
developmer					ment	nent							
CO 3:				Use of p	progran	nming f	or techn	ologies a	vailable	on smart	phones		
CO 4:				Constru	ct secu	re mobi	le web a	applicatio	ns				
Mapp	ing of (	COs to 1	POs										
Cos	<i>PO</i> 1	<i>PO</i> 2	PO.	3 PO 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	<i>PO</i> 8	PO 9	PO 10	PO 11	PO 12	
CO 1		*	*		*								
CO 2		*	*		*								
CO 3		*	*		*								
CO 4		*	*	*	*								
Cours	e conte	nt and	outco	omes:	1					1	1		
Conter	nt					Compete	encies						
Unit 1	: Inst	allation	n of A	ndroid S	Studio								
Installa	ation	of A	Andro	oid Stu	ıdio,	1. ]	dentify	different	features	in androi	d studio	(C1)	
enviro	nment	setting,	Proj	ect creat	tion,	2. 1	Explain	Android	manifest	file (C2)			
buildir	ng a pi	roject, 1	unnii	ng a sar	nple	3. 1	Discuss	DVM, D	DMS, ar	ndroid em	ulator (C	22)	
project	t					4. 1	Discuss	the issue	es relate	d running	g and de	bugging	
						ć	applicati	ions (C2)					



Unit 2: Introduction to HTML5 and CS	SS for mobile devices								
Implementation of mobile web	1. Practice to create more responsive mobile web								
applications using HTML5 and CSS	applications (C3)								
	2. Develop android applications using Mobile UX,								
	Viewport, Fluid design and responsive images (C4)								
Unit 3: Programming with JavaScript and DOM APIs									
Using jQuery and other light-weight	1. Develop mobile web applications using JQuery and								
libraries.	other light-weight libraries (C4)								
AJAX and asynchronous programming	2. Apply AJAX and asynchronous programming								
	techniques in mobile web applications(C3)								
Unit 4: Programming for technologies available on smart phones									
Introduction to PhoneGap, Handling	1. Write mobile web applications using PhoneGap								
Touch events. Making use of the	techniques (C3)								
accelerometer and the Location APIs.	2. Apply touch events in mobile web applications (C3)								
Accessing camera and media devices.	3. Demonstrate the use of accelerometer and location								
	APIs in mobile web applications (C3)								
Unit 5: Designing and developing secur	re mobile web applications								
Practical encryption for client-server	1. Use of various encryption techniques for								
communication in Web applications.	communications in mobile web applications (C3)								
Best practices in developing secure									
client-side code									
Learning strategies, contact hours and s	student learning time								
Learning strategy	Contact hours Student learning time (Hrs)								
Lecture	12 -								
Seminar									
Quiz									
Small Group Discussion (SGD)									
Self-directed learning (SDL)									
Problem Based Learning (PBL)									
Case Based Learning (CBL)	03 -								



Clinic	Clinic							-	
Practical			24					-	
Revision			03					-	
Assessment			06					-	
TOTAL			48					-	
Assessment Methods	S:								
Formative:						Summ	ativ	/e:	
Theory Assignment					Session	nal l	Examination		
Lab Assignment				Univer	sity	End Semester Examination	l		
Lab Test						Viva			
Viva									
Mapping of assessme	ent with Co	S							
Nature of assessment		CO 1		CO 2	C	03	C	04	
Sessional Examinatio	n 1	*		*					
Sessional Examinatio	on 2		*		*		*		
Assignment/Presentat	tion	*	*				*	*	
End Semester Examin	nation								
Laboratory examinati	on	*		*	*		*		
Feedback Process	• Mie	d-Semest	er feedt	back					
	• Enc	d-Semest	er Feedl	back					
<b>Reference Material</b>	1. Learnin	g Web A	pp Dev	velopme	ent	(Build	Qui	ckly with Proven JavaScri	pt
	Techniques	s) - Sen	nmy Pu	urewal.	0'	Reilly	Med	lia. 2014. MSOIS, MAH	Е,
	Manipal 13	3							
	2. The	Brow	vser	Securi	ty	Han	dbo	ok. Michal Zalewsk	ci.
	https://code	e.google.	com/p/t	prowser	sec	/wiki/M	ain		
	3. High Pe	erforman	ce Resp	onsive	De	esign - 🛛	Гот	n Barker. O'Reilly publishe	er.
	2014.								
	4.	App	le		UI			Design Basic	s.
	https://devo	eloper.ap	ple.com	n/library	/io	s/docum	enta	ation/UserExperience/Conce	<u>e</u>
	ptual/Mobi	ileHIG/i 1	ndex.hti	<u>nl</u>					



5. Android Design Principles. <u>https://developer.android.com/design/index.html</u>										
6.	Android	Application	Development	Reference.						
https://developer.android.com/develop/index.html										



Name o	of the P	rogram	:		ME in	ME in BDA							
Course	Title:				Prine	ciples of	f Data `	Visualizat	tion				
Course	Code:	BDA 62	2		Cour	se Instru	uctor:						
Academ	nic Yea	nr: 2020	-2021		Seme	Semester: First Year, Semester 1							
No of C	Credits:	3			Prere	Prerequisites: Programming in Python							
Synops	sis:	This C	ourse p	rovides	s insigh	insight on							
		1. Thi	is cours	e introc	luces da	ata visu	alizatio	n, the art a	nd scien	ce of turn	ing data		
		into	o reada	ble grap	phics.								
		2. Tea	ach hov	v to des	ign and	l create	data vis	sualization	ns based	on data a	vailable		
		and	l tasks 1	to be ac	hieved								
		3. Stu	3. Students learn how do data extraction, data modelling and data processing.										
		4. Stu	4. Students learn to map data attributes to graphical attributes, and strategic										
		vis	visual encoding based on known properties of visual perception										
Course	e												
Outco	mes	On suc	cessful	comple	etion of	f this co	urse, st	udents wil	ll be able	e to			
(COs):	:												
CO 1:		Extract	ting, tra	insform	ing and	l storing	g data fi	com variou	us data s	ources.			
-		An un	derstan	ding of	f the k	ey tech	niques	and theorem	ry used	in visua	lization,		
CO 2:		includi	ng data	model	, graphical perception and techniques for visual encoding								
		and int	eraction	n.	, <u>8</u> . I	, o r men							
		Euroa	una ta i	an make ar	of		lata da	maina and	d aamaa	nonding	analysia		
CO 3:		Exposi	ire to i	number	01 CO	of common data domains and corresponding analysis							
		tasks.											
CO 4:		Practic	al expe	rience	buildin	g and ev	valuatin	g visualiz	ation sys	stems.			
CO 5:		The ab	ility to	read an	d discu	ss resea	rch pap	ers from th	ne visual	ization li	terature.		
Mappi	ng of (	COs to 1	POs										
COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11		
CO 1	*		*		*	*							
CO 2	*	*			*								
CO 3	*	*	*										
CO 4	*	1	*		*			*					
CO 5	*	*	*	*									



Course content and outcomes:							
Content	Competencies						
Unit 1: Introduction to Web scrapi	ing						
Web scraping models and techniques,	1. Understanding various formats of data. (C1)						
Case study: BeautifulSoup, Scrapy,	2. Design programs to dynamically extract data						
Selenium	from web. (C4)						
	3. Design programs to read data from various data						
	sources. (C4)						
Unit 2: Data Analysis							
Data structures for analysis: numpy,	1. Understand and integrate various data						
pandas	structures for data analysis process (C2).						
Data Wrangling: Clean, Transform,	2. Create various techniques to clean and handle						
Merge, Reshape	missing data (C4).						
Data Aggregation and Group	3. Design data filtering and transformation						
Operations	techniques (C4).						
Case study: Exploratory analysis of							
public / scrapped datasets							
Unit 3: Data Visualization							
Data Visualization – classification,	1. Describe what is the purpose of Visualization.						
infographics versus data visualization,	(C2)						
visualization for supporting exploratory	2. Describe various ways of classifying						
data analysis, visual art, choosing	visualization. (C2)						
appropriate visual encodings, rules for	3. Explain what is explorative and explanative						
visualization - Visualization techniques:	visualization. (C2)						
time series, statistical distributions,	4. Differentiate data visualization and visual art.						
maps - Data visualization for web	(C2)						
	5. Create visualization for time series data. (C4)						
	6. Create visualization for statistical distributions.						
	(C4)						
	7. Create visualization for maps, Hierarchical data						
	and network data. (C4)						



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Learning strategies, contact hours and student learning time								
Learning strategy		Contact	hour	·S	Student learning			
					time (Hrs)			
Lecture		30			60			
Quiz		02			04			
Small Group Discussion (SGD)		02			02			
Self-directed learning (SDL)		-			04			
Problem Based Learning (PBL)		02			04			
Case Based Learning (CBL)		-			-			
Revision		02			-			
Assessment		06			-			
TOTAL		44			74			
Assessment Methods:					1			
Formative:				Summative	:			
Internal practical Test				Sessional ex	amination			
Theory Assignments				End semeste	r examination			
Lab Assignment & Viva				Viva				
Mapping of assessment with Co	S							
Nature of assessment	CO 1	CO 2	С	CO 4	CO 5			
			0					
			3					
Sessional Examination 1	*	*						
Sessional Examination 2			*	*				
Assignment/Presentation	*	*	*	*	*			
End Semester Examination	*	*	*	*	*			
Laboratory examination	*	*	*	*	*			
Feedback Process • Mi	d-Semest	er feedbac	k	I	1			
• End	d-Semest	er Feedbaa	ck					



<b>Reference Material</b>	1.	Website Scraping with Python: Using BeautifulSoup and
		Scrapy, Gábor & Hajba, APRESS Publications, 1 <sup>st</sup> Edition, 2018.
	2.	Web Scraping with Python: Collecting More Data from the
		Modern Web, Ryan Mitchell Shroff, O'Reilly, 2 <sup>nd</sup> Edition, 2018.
	3.	Designing Data Visualizations, Julie Steele and Noah Iliinsky;
		O'Reilly Media; 1 <sup>st</sup> Edition, 2011.
	4.	Python for Data Analysis, Wes McKinney; Shroff; O'Reilly; 2 <sup>nd</sup>
		Edition, 2018.



Name o	of the P	rogram	:		ME in	ME in BDA							
Course	Title:				Princ	Principles of Data Visualization Lab							
Course	Code:	BDA-62	2L		Cour	Course Instructor:							
Acader	nic Yea	r: 2020	-2021		Seme	Semester: First year, semester 1							
No of C	Credits:	1			Prere	equisites	: Progra	mming in	Python				
Synop	sis:	This C	ourse p	rovides	s insigh	t on							
		1. Thi	s cours	e introc	luces da	ata visu	alizatior	n, the art a	nd scien	ce of turn	ing data		
		into	o reada	ble gra	ohics.						_		
		2. Tea	ach hov	v to des	ign and	l create	data vis	ualizatior	ns based	on data a	vailable		
		and	l tasks 1	to be ac	hieved								
		3. Students learn how do data extraction, data modelling and data processing.									cessing.		
	4. Students learn to map data attributes to graphical attributes, and strate									strategic			
		visual encoding based on known properties of visual perception.											
Cours	e												
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, stı	udents wil	ll be able	e to			
(COs):	:			-									
CO 1:		Data so	crappin	g from	differe	nt data s	sources.						
CO 2:		Data C	leaning	g, transf	formation	ons and	Analys	is.					
CO 3:		Data V	isualiz	ation us	sing dif	ferent to	echniqu	es, tools a	and chart	s.			
Mappi	ng of (	COs to 1	POs										
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11		
CO 1	*	*	*		*				*	*			
CO 2	*	*	*		*	*		*	*	*			
CO 3	*	*	*	*	*	*		*		*			
Course content and outcomes:													
Conter	it				(	compete	encies						

Unit 1: Data Scrapping	
Web scrapping models	1. Identify different types of data sources (C2).
Installing and configuring tools to	2. Design applications to scrap static data (C4).
handle different data types.	



	3. Design applica	tions to	extract data from					
	dynamic web pages (C4).							
Unit 2: Data Analysis								
Working with packages like numpy,	1. Design scripts to clean, handle missing data							
pandas, sklearn	(C4).							
Perform exploratory data analysis.	2. Design scripts to	apply requ	ired transformations					
	to cleaned data	(C4).						
Unit 3: Data Visualization								
Creating different types of	1. Develop applie	ations for	r exploratory data					
Visualization.	visualization (C	C4).						
Creating different types of charts.	2. Develop scripts	to create	static visualization					
	using various v	isual encod	lings (C4).					
	3. Create dynamic	visualizatio	on for web (C4).					
Learning strategies, contact hours and	student learning t	me						
Learning strategy	Contact hours		Student learning					
			time (Hrs)					
Lecture	12		-					
Seminar	-		-					
Quiz	-		-					
Small Group Discussion (SGD)	-		-					
Self-directed learning (SDL)	-		-					
Problem Based Learning (PBL)	-		-					
Case Based Learning (CBL)	03		-					
Clinic	-		-					
Practical	24		-					
Revision	03		-					
Assessment	06		-					
TOTAL	48		-					
Assessment Methods:								
Formative:		Summativ	ve:					



Internal practical Test					Sessional examination		
Theory Assignments					End semester examination		
Lab Assignment & Viva					Viva		
Mapping of assessme	ent with Co	S					
Nature of assessment		CO 1	CO 2		CO 3		
Sessional Examinatio	n 1	*					
Sessional Examinatio		*		*			
Assignment/Presentat	*	*		*			
End Semester Examin	*	*		*			
Laboratory Examinat	ion	*	*		*		
Feedback Process	• Mi	d-Semester feedback					
	• End	d-Semester	Feedback				
<b>Reference Material</b>	5. Websi	te Scraping	g with Pytho	n: Usin	g BeautifulSoup and		
	Scrapy	y, Gábor & H	Hajba, APRESS	S Publica	ations, 1 <sup>st</sup> Edition, 2018.		
	6. Web S	Scraping wi	ith Python: Co	ollecting	g More Data from the		
	Moder	r <b>n Web</b> , Rya	an Mitchell Shr	off, O'R	eilly, 2 <sup>nd</sup> Edition, 2018.		
	7. Design	ing Data V	visualizations,	Julie St	eele and Noah Iliinsky;		
	O'Reilly Media; 1 <sup>st</sup> Edition, 2011.						
	8. Pythor	n for Data A	Analysis, Wes I	McKinn	ey; Shroff; O'Reilly; 2 <sup>nd</sup>		
	Editior	n, 2018.					



Name of	of the P	rogram	:		ME i	ME in BDA							
Course	Title:				Mini	Mini Project - 1							
Course	e Code:	BDA 6	95		Cour	Course Instructor:							
Acader	nic Yea	ar: 2020	- 2021		Sem	Semester: First Year, Semester 1							
No of C	Credits	: 4			Prer	equisites	: Any	/ program	ming la	nguage ai	nd circuit		
C	a <b>!</b> a.	Ctudon	ta ana a	vecato	basic	S last a m	nahlam i	n the ener	oftha	in interne	and the		
Synop	SIS:	Studen	is are e	expecte	a to se	elect a p		n the area	a or the	ir interes	and the		
		area of	their s	pecializ	zation t	that wou	ld requir	e an imp	lementa	tion in ha	rdware /		
		software or both in a semester											
Course	e												
Outco	mes	On suc	cessful	compl	etion o	of this co	ourse, stu	dents wil	ll be abl	e to			
(COs):	:			_									
<b>CO</b>	1.	Apply	the obj	ectives	of the	project	work an	d provide	e an ade	quate bac	kground		
	1:	with a	detaile	d literat	ture su	rvey							
		Breakd	lown th	e proje	ect into	sub blo	cks with	sufficien	t details	to allow	the work		
CO	2:	to be re	eproduc	ced by a	an inde	ependent	researcl	her					
		Compo	nee hor	dwara/a	oftwar	a design	algorit	hme flow	vehart 1	methodol	ogy and		
СО	3:	Compo		I wale/s	onwai	e desigi	i, aiguin	11115, 110v	venari, i	memodoi	ogy, and		
		block of	liagram	1									
CO	4:	Evalua	te the r	esults									
CO	5:	Summa	arize th	e work	carrie	d out							
Mappi	ing of (	COs to ]	POs										
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11		
CO 1				*									
CO 2					*			*					
CO 3							*			*			
CO 4						*					*		
CO5:							*						
Course	e conte	ent and	outcon	nes:	1	1	L	1	I	1	1		
Conten	ıt					Compet	encies						
Phase	1												



Problem identification, synopsis	At the end of the topic student should be able to:					
submission, status submission, mid	1. Identify the problem/specification (C1)					
evaluation.	2. Discuss the project (C2)					
	3. Prepare the outline (C3)					
	4. Describe the status of the project (C2)					
	5. Prepare a mid-term project presentation report					
	(C3)					
	6. Prepare and present mid-term project					
	presentation slides (C3, C5)					
	7. Develop project implementation in					
	hardware/software or both in chosen platform					
	(C5)					
Phase 2						
Status submission, final evaluation.	1. Prepare the progress report (C3)					
	2. Prepare the final project presentation report					
	(C3)					
	3. Prepare and present final project presentation					
	slides (C3, C5)					
	4. Modify and Develop implementation in					
	hardware/software or both in chosen platform					
	(C3, C5)					
	5. Justify the methods used and obtained results					
	(C6)					
Learning strategies, contact hours and	student learning time					
Learning strategy	Contact hours Student learning					
	time (Hrs)					
Lecture						
Seminar						
Quiz						
Small Group Discussion (SGD)	48 -					
Self-directed learning (SDL)						

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Problem Based Learning (PBL)



Case Based Learning	(CBL)		-		-			
Clinic	-		-					
Practical		-			-			
Revision	-		-			-		
Assessment	-		03		-			
TOTAL			51			09		
Assessment Methods	5:							
Formative:					ve:			
Project Problem Selec	ction				Mid-Term	Presentation		
Synopsys review				Second status review				
First status review					Demo & F	Final Presentation		
Mapping of assessme	ent with Co	s						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5		
Mid Presentation		*	*					
Presentation	*	*	*	*				
Feedback Process	• Enc	l-Semes	ster Feedb	ack		<b>i</b>		
<b>Reference Material</b>	Particular t	o the ch	iosen proj	ect				



Name o	of the P	rogram	:		ME in	ME in BDA						
Course	Title:				Semir	Seminar - 1						
Course	Code:	BDA 6	97		Cour	Course Instructor:						
Acader	nic Yea	r: 2020	- 2021		Seme	Semester: First Year, Semester 1						
No of C	Credits:	1			Prere	equisites	: Commun	icatior	n Skill			
Synop	sis:	1. To	select,	search	and lea	rn techr	nical literatu	ire.				
		2. To	Identif	y a cur	rent and	d releva	nt research	topic.				
		3. To	prepare	e a topi	c and d	eliver a	presentatio	n.				
	4. To develop the skill to write a technical report.											
		5. De	velop a	bility to	o work	in grou	ps to review	and r	nodify t	echnical	content.	
Course	e											
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, studer	nts wil	l be able	e to		
(COs):	:											
CO 1.		Show of	compet	ence in	identif	ying rel	evant inform	nation	, definir	ng and ex	plaining	
01.		topics	under d	iscussi	on.							
<u> </u>		Show competence in working with a methodology, structuring their oral work,										
CO 2.		and syn	nthesizi	ing info	ormatio	n.						
CO 3.		Use appropriate registers and vocabulary, and will demonstrate command of										
0.05.		voice r	nodula	tion, vo	ice pro	jection,	and pacing					
CO 4:		Demor	nstrate	that the	by have paid close attention to what others say and can							
CU 4:		respon	d const	ructive	ly.							
		Develo	p pers	suasive	speecl	h, prese	ent informa	ation	in a c	ompelling	g, well-	
		structu	red, and	d logica	al seque	ence, res	spond respe	ctfully	y to oppo	osing idea	as, show	
0.05:		depth	of kno	owledge	e of c	omplex	subjects,	and o	develop	their at	oility to	
		synthe	size, ev	aluate a	and refl	ect on i	nformation.					
Mappi	ing of (	COs to ]	POs									
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO	<i>PO</i> 9	PO 10	PO 11	
								8				
CO 1	*							*	*		*	
CO 2	*							*	*		*	
CO 3	*							*	*		*	
CO 4	*							*	*		*	
			1							1		



CO5: *			-		*	*			*	
Learning strategies.	contact hou	rs and stu	udent lea	rning ti	ne					
Learning strategy			Contact l	hours			Stu	ıdent	learning	
								time (Hrs)		
Lecture			_			-				
Seminar			-				-			
Quiz		-				-				
Small Group Discuss	ion (SGD)		14				-			
Self-directed learning	g (SDL)		-				-			
Problem Based Learn	ing (PBL)		-				-			
Case Based Learning	(CBL)		-				-			
Clinic			-				-			
Practical			-					-		
Revision			-					-		
Assessment			-							
TOTAL			14					-		
Assessment Method	s:									
Formative:					Sun	ımat	ive	8		
Seminar Topic Select	tion									
Synopsys review										
PPT Review										
Mapping of assessm	ent with Cos	S								
Nature of assessment		CO 1	CO 2 CO 3 CO 4		4	CO 5				
Presentation		*	*	*	*			*		
Feedback Process	• End	l-Semester	r Feedbac	:k						
Reference Material	Particular t	o the chos	en Semir	ıar						



Name of the H	Program:     ME in BDA							
<b>Course Title:</b>	Machine Learning for Big Data							
Course Code:	BDA-605 Course Instructor:							
Academic Yea	ar: 2020 - 2021Semester: First Year, Semester 2							
No of Credits	: 3 Prerequisites: Programming with Python and Data Visualization							
Synopsis:	This Course provides insight on							
	1. This course provide the concept of neurons and biological motivation,							
	activation functions and threshold units, supervised and unsupervised							
	learning, perceptron network models in Artificial Neural Networks.							
	2. This course provide the knowledge about learning from unclassified data							
	using clustering techniques.							
	3. This course provide the concept of Support Vector Machines for linear and							
	non-linear classification.							
	4. This course provide the concept of Deep Learning and design of convolutional							
	neural network for Deep Learning.							
	5. This course provide the knowledge about the applications and design of							
	Reinforcement Learning algorithms.							
Course								
Outcomes	On successful completion of this course, students will be able to							
(COs):								
	Describe activation functions, weights and threshold units used in artificial n							
CO 1:	networks, supervised and unsupervised learning, gradient descent approach, types							
	of perceptron models, overfitting							
CO 2.	Explain the concept of hierarchical clustering and non-hierarchical clustering,							
CO 2.	support vector machine, deep neural networks and reinforcement learning							
CO 3.	Demonstrate artificial neural network models, clustering models, support vector							
05.	classifier models, Deep learning models and reinforcement learning models							
CO 4:	Compare and contrast single layer, multilayer and deep neural networks in terms							
	of accuracy in classification							
	Design back propagation neural network, K-means and agglomerative clustering,							
CO 5:	deep neural network, reinforcement learning models and selection of a machine							
	learning algorithm for the given data analysis.							



Mapping of COs to POs												
COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11	
CO 1	*											
CO 2		*										
CO 3			*									
CO 4				*								
CO 5				*								
Course	e conte	nt and	outcon	nes:				I				
Conten	nt 🛛					Compete	encies					
Unit 1	: A	Artificia	al Neur	al Netv	vorks							
Neuror	ns and	biolo	gical	motivat	ion,	1. F	Relate	biological	neurons	with	artificial	
Activat	tion f	unctions	s and	thres	nold	neurons and the motivation for ANN						
units,	Superv	vised a	and ur	superv	ised	development. (C1)						
learnin	g,	Percep	otron	Mo	del:	2. Distinguish Supervised and unsupervised						
represe	ntation	al limit	ation a	nd grad	lient	learning (C2).						
descen	t traini	ng, Mu	ultilaye	r netw	orks	3. I	Describ	e about error	reducti	on techn	iques in	
and back propagation, Overfitting						used	Art	ificial Neu	ıral N	etworks	based	
					learn	ing (C	2)					
					4. V	Write	the usability	of di	fferent a	ctivation		
						func	tions fo	or ANN learn	ing syst	em. (C3)		
						5. I	Describ	e t	he	arcl	nitecture	
						of various perceptron networks. (C2)						
Unit 2	: (	Clusteri	ng									
Learnii	ng fro	om u	nclassif	fied of	lata,	1. Write the different methods of learning from						
Cluster	ring. Hi	erarchi	cal Agg	glomera	tive	unclassified data (C3).						
Cluster	ring,	Non-	· H	lierarch	nical	2. Explain the operations						
Cluster	ring -	· k-m	-means partitional			of various clustering models in machine						
cluster	lustering, Expectation maximization					learning (C5)						
(EM)	for	soft c	lusterir	ng, Se	emi-	3. Describe the methods used for measuring						
supervi	supervised learning with EM using						dissimilarity between two clusters. (C2)					
labelle	d and u	nlabelle	ed data.									



	4. Apply clustering techniques for data analysis.
	(C3)
Unit 3: Kernel Methods	
Dual Representations, Design of	1. Describe Dual Representations. (C2)
Kernels . 2	2. Explain the Kernel trick for learning non-linear
	functions (C5)
Unit 4: Support Vector Machines (SI	MV)
Maximum margin linear separators,	1. Describe about Maximum Margin and
Quadratic programming solution to	Support Vector Machine. (C2)
finding maximum margin separators,	2. Examine the advantages of maximum margin
Kernels for learning non-linear	linear separators technique in SVM (C4)
functions, Varying length pattern	3. Explain the Kernel trick for learning non-
classification using SVM	linear functions (C5)
	4. Show the relation between two forms of
	representation of a hyperplane (C3)
Unit 5: Deep Learning	
Unit 5:     Deep Learning       Introduction     to     Deep     Learning,	1. Define Deep Learning. (C1)
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeural	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning.</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeuralNetwork (CNN), CNN Architecture and	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductionLearning,IntroductiontoconvolutionalNetwork (CNN), CNN Architecture andIayers, Building simple CNN model for	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning,Introduction to convolutional NeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing the	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning,Introduction to convolutional NeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN model	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning,Introduction to convolutional NeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN model	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning,Introduction to convolutional NeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN modelUnit 6:Reinforcement Learning	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning,Introduction to convolutional NeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN modelUnit 6:Reinforcement LearningCharacteristics, N-arm Bandit Problem,	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN modelValueKeinforcement LearningCharacteristics, N-armBanditProblem,CalculatingtheValueFunction,	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit Problem (MABP). (C2)</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN modelCNN modelUnit 6:Reinforcement LearningCharacteristics, N-armBanditProblem,CalculatingtheValueFunction,AssociativeLearning–AddingStates,	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit Problem (MABP). (C2)</li> <li>Write the functions of Upper Confidence</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeuralNetwork (CNN), CNN Architecture andlayers, Building simpleCNN model forclassification, Training and Testing theCNN modelImage: CNN model forUnit 6:Reinforcement LearningCharacteristics, N-armBanditProblem,CalculatingtheValueFunction,AssociativeLearning–AddingStates,The MarkovProperty & MarkovDecision	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit Problem (MABP). (C2)</li> <li>Write the functions of Upper Confidence Bound (UCB) algorithm. (C3)</li> </ol>
Unit 5:Deep LearningIntroductiontoDeepLearning,IntroductiontoconvolutionalNeuralNetwork (CNN), CNN Architecture andlayers, Building simple CNN model forclassification, Training and Testing theCNN modelCNN modelCNN modelUnit 6:Reinforcement LearningCharacteristics, N-arm Bandit Problem,CalculatingtheValueFunction,AssociativeLearning – Adding States,The Markov Property & Markov DecisionProcess	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit Problem (MABP). (C2)</li> <li>Write the functions of Upper Confidence Bound (UCB) algorithm. (C3)</li> <li>Outline the learning process</li> </ol>
Unit 5:Deep LearningIntroduction to Deep Learning, Introduction to convolutional Neural Network (CNN), CNN Architecture and layers, Building simple CNN model for classification, Training and Testing the CNN modelUnit 6:Reinforcement LearningCharacteristics, N-arm Bandit Problem, Calculating the Value Function, 	<ol> <li>Define Deep Learning. (C1)</li> <li>Describe the applications of deep learning. (C2)</li> <li>Explain the architecture of Deep Neural Network and CNN (C5)</li> <li>Design a classifier for the image classification system. (C5)</li> <li>Explain the concept of Multi-Armed Bandit Problem (MABP). (C2)</li> <li>Write the functions of Upper Confidence Bound (UCB) algorithm. (C3)</li> <li>Outline the learning process and characteristics of reinforcement learning.</li> </ol>



	4. Explain about Markov decision process.							
	(C5)							
Learning strategies,	contact hor	irs and s	student lear	ning time				
Learning strategy			Contact he	ours		Student learning		
						time (Hrs)		
Lecture			30			60		
Quiz			02			04		
Small Group Discussi	ion (SGD)		02			02		
Self-directed learning	(SDL)		-			04		
Problem Based Learn	ing (PBL)		02			04		
Case Based Learning	(CBL)		-			-		
Revision			02			-		
Assessment			06			-		
TOTAL			44			74		
Assessment Methods	5:							
Formative:			Summative:					
Internal practical Test	ţ			Sessional examination				
Theory Assignments				End semester examination				
Lab Assignment & V	iva			Viva				
Mapping of assessme	ent with Co	S						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5		
Sessional Examination 1 *			*	*		*		
Sessional Examinatio	n 2	*	*	*	*	*		
Assignment/Presentat	*	*	*	*				
End Semester Examination *			*	*	*	*		
Feedback Process	• Mie	d-Semes	ter feedback					
	• End-Semester Feedback							
<b>Reference Material</b>	1. T. Mite	hell, "Ma	achine Learning", McGraw-Hill, 1997.					
	Iachine Learning", MIT Press, 2010.							



3	3. C. Bishop, "Pattern Recognition and Machine Learning", Springer,
2	2006.
4	4. R. Duda, E. Hart, and D. Stork, "Pattern Classification", Wiley
I	Interscience, 2000.
5	5. Satish Kumar, "Neural Networks - A Class Room Approach", Second
E	Edition, Tata McGraw-Hill, 2013.
6	5. T. Hastie, R. Tibshirani and J. Friedman," The Elements of Statistical
I	Learning: Data Mining", Inference and Prediction, Springer, 2nd Edition,
2	2009.
7	7. Jason Bell, "Machine Learning for Big Data", Wiley Big Data Series,
2	2016.
8	3. J. Shawe-Taylor and N. Cristianini, "Kernel Methods for Pattern
A	Analysis", Cambridge University Press, 2004.
9	9. S. Haykin, "Neural Networks and Learning Machines", Prentice Hall
C	of India, 2010.
1	10. Rama Murthy G, "Multidimensional Neural Networks Unified
Г	Theory", New Age International, 2008.
1	11. F. Camastra and A. Vinciarelli, "Machine Learning for Audio, Image
a	and Video Analysis – Theory and Applications", Springer, 2008.



Name of the Program:				ME in BDA										
Course Title:			Machi	Machine Learning for Big Data Lab										
Course Code: BDA 605L					Cours	Course Instructor:								
Academic Year: 2020-2021			Semes	ster: F	irst Year,	Semester	r 2							
No of Credits: 1					<b>Prere</b> Visual	<b>Prerequisites:</b> Programming with Python and Data Visualization								
Synops	is:	This Course provides insight on												
Course	:													
Outcon	nes	On successful completion of this course, students will be able to												
(COs):														
GO 4		Demonstrate activation functions, weights and threshold units in artificial												
		neural	networl	KS										
CO 2·		Demon	strate A	Artificia	al Neur	al Netv	vork, Clu	stering,	Suppor	t Vector	Machine,			
		Deep N	leural N	Vetworl	c and R	and Reinforcement Learning models								
CO 3·		Analyse Artificial Neural Network, Clustering, Support Vector Machine, Deep												
Neural Network and Rein						einforcement Learning models								
CO 4·		Compare and contrast single layer, multilayer and deep neural networks in terms												
		of accuracy in classification												
CO 5:		Design different types of artificial neural network models, clustering models,												
		deep neural network models, reinforcement learning models												
Mapping of COs to POs														
										_				
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11			
CO 1	*													
CO 2		*												
CO 3			*											
CO 4				*										
CO 5		*												
Course	conte	nt and	outcom	es:	1	1	1		1	1	1			
Content					Competencies									
Unit 1:	A	rtificial	Neura	l Netw	orks									



1. Demonstrate activation functions, weights					
and threshold units in artificial neural					
networks (C3)					
2. Demonstrate ANN models (C3)					
3. Design of ANN models for classification					
(C5)					
4. Analyse the performance issues (C4)					
1. Demonstrate various clustering models in					
machine learning (C3)					
2. Design different types of clusters (C5)					
3. Analyse the performance of clustering					
techniques on different data (C4)					
4. Apply clustering techniques for data					
analysis. (C3)					
1. Design of different kernel techniques (C5)					
MV)					
1. Demonstrate Maximum margin linear					
separators. (C3)					
2. Design SVM classifiers (C5)					
3. Analyse the performance of SVM (C4)					
1. Develop Deep Neural Network/ CNN (C5)					


Introduction to convolutional Neural	2. Design a	classifier	r for the image			
Network (CNN)	classification sys	tem. (C5)				
CNN Architecture and layers	3. Compare performance of CNN and ANN for					
Building simple CNN model for	image classificati	on (C4)				
classification						
Training and Testing the CNN model						
Unit 6: Reinforcement Learning						
Characteristics	1. Apply reinfor	cement 1	learning model using			
N-arm Bandit Problem	different principl	es (C3)				
Calculating the Value Function	2. Analyse varie	ous rein	forcement learning			
Associative Learning – Adding States	techniques (C4)					
The Markov Property & Markov Decision	3. Design of re	einforcem	ent learning models			
Process	(C5)					
Learning strategies, contact hours and s	tudent learning tin	ne				
Learning strategy	Contact hours		Student learning time			
			(Hrs)			
Lecture	12		-			
Seminar	-		-			
Quiz	-		-			
Small Group Discussion (SGD)	-		-			
Self-directed learning (SDL)	-		-			
Problem Based Learning (PBL)	-		-			
Case Based Learning (CBL)	03		-			
Clinic	-		-			
Practical	24		-			
Revision	03		-			
Assessment	06		-			
TOTAL	48		-			
Assessment Methods:						
Formative:	S	ummativ	/e:			



Internal practical Test - yes Sessional examination Theory Assignments End semester examination - yes Viva Lab Assignment & Viva - yes Mapping of assessment with Cos Nature of assessment CO 1 CO<sub>4</sub> CO 5  $CO_2$ CO 3 Sessional Examination 1 \* \* \* \* Sessional Examination 2 \* \* \* Assignment/Presentation \* \* \* Laboratory examination Feedback Process Mid-Semester feedback • **End-Semester Feedback Reference Material** 1. Machine Learning, T. Mitchell, McGraw-Hill, 1997 2. Machine Learning, E. Alpaydin, MIT Press, 2010 3. Pattern Recognition and Machine Learning, C. Bishop, Springer, 2006 4. Pattern Classification, R. Duda, E. Hart, and D. Stork, Wiley-Interscience, 2000 5. Neural Networks - A Class Room Approach, Satish Kumar, Second Edition, Tata McGraw-Hill, 2013 6. The Elements of Statistical Learning: Data Mining, Inference and Prediction, T. Hastie, R. Tibshirani and J. Friedman, Springer, 2nd Edition, 2009 7. Machine Learning for Big Data, Jason Bell, Wiley Big Data Series 8. Kernel Methods for Pattern Analysis, J. Shawe-Taylor and N. Cristianini, Cambridge University Press, 2004 9. Neural Networks and Learning Machines, S. Haykin, Prentice Hall of India, 2010 10. Multidimensional Neural Networks Unified Theory, Rama Murthy G 11. F.Camastra and A.Vinciarelli, Machine Learning for Audio, Image and Video Analysis – Theory and Applications, Springer, 2008



Name o	of the P	rogram:	:		ME	ME in BDA					
Course Title:			Mod	Modern Database for Big Data							
Course Code: BDA 616			Cou	rse Instru	uctor:						
Academ	nic Yea	r: 2020	-2021		Sem	emester: First Year, Semester 2					
No of C	Credits:	3			Prer	requisites	: Database	s with S	QL Que	ries	
Synops	sis:	This C	Course	provid	es ins	sight on	Basic	MapF	Reduce	Partition	ing and
		combir	ning,	Key-Va	alue I	Database	s, Docum	ent Da	tabases,	Column	-Family
		Stores,	Graph	Databa	ses						
Course	e										
Outco	mes	On suc	cessful	comple	etion o	of this co	urse, stude	ents wil	l be able	e to	
(COs):	:										
CO	1:	Exami	ne diffe	erent typ	bes of	data.					
CO	2:	Design	querie	s to han	dle di	ifferent d	ata types.				
CO	3:	Explain	n differ	ent data	u mod	els.					
CO	4:	Explain	n the co	oncepts	of ma	p reduce	in handlir	ng of da	ita.		
Mappi	ng of (	COs to 1	POs								
COs	<i>PO</i> 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	<i>PO</i> 8	<i>PO</i> 9	PO 10	PO 11
CO 1	*		*		*						
CO 2	*	*	*		*						
CO 3	*		*								
CO 4	*		*		*						
Course	e conte	nt and	outcon	nes:							
Conten	nt					Compete	encies				
Unit 1	: Iı	ntroduc	tion								
Introdu	iction to	o growtł	n of trac	litional	and	Analyze	traditiona	l and r	nodern	database	systems
modern	n datab	ase syste	ems			(C4)					
Unit 2	: SQ	L									
Syntax	and Se	emantics	5			Design v	arious SQ	L quer	ies (C5)		
Unit 3	: N	OSQL 1	Databa	se							
Why N	loSQL	? - Data	Models	8		Limitati	ons of trad	itional	database	es.(C2)	
						Various	Data Mo	dels to	handle	huge am	ount of
						data. (C2	2)				



Unit 4: Distribution models for sca	lability				
Horizontal partitioning Data sharding. Understand different distribution models for					
-Master-slave replication. Peer-to-peer	Scalability (C3)				
replication Version stamps – business	Describe achie	eve Data shardinng? (C2)			
and system transactions.					
Unit 5: Consistency Models					
Update consistency, Read Consistency,	Understating I	Data consistency techniques (C2).			
CAP Theorem	Implementing	CAP theorem (C3).			
Unit 6: MapReduce					
Basic MapReduce Partitioning and	Understanding	MapReduce technique (C2).			
combining Composing MapReduce	Design applic	ations using suitable MapReduce			
calculations Two-stage map-reduce	techniques (C4	ł).			
example. Incremental MapReduce.					
Unit 7: Case study					
Key-Value Databases - Document Databases	ases Design a	pplications using different types of			
- Column-Family Stores -Graph Database	es databases (C4).				
Unit 8: Beyond NoSQL					
File systems, Event sourcing, Men	ory Alternate	techniques to NoSQL databases			
Image, Version control, XML Datab	ase, (C4)				
Object Database					
Unit 9:	·				
Choosing your database	Design steps to choose proper databases based				
	on user requirements (C4).				
Learning strategies, contact hours and	student learni	ng time			
Learning strategy	Contact hou	rs Student learning			
		time (Hrs)			
Lecture	30	60			
Quiz	02	04			
Small Group Discussion (SGD)	02	02			
Self-directed learning (SDL)	-	04			
Problem Based Learning (PBL)	02	04			



Revision			02		-
Assessment			06		-
TOTAL			44		74
Assessment Methods	5:				
Formative:				Summativ	ve:
Internal practical Test	t			Sessional	examination
Theory Assignments				End seme	ster examination
Lab Assignment & V	iva			Viva	
Mapping of assessme	ent with Co	S		·	
Nature of assessment		CO 1	CO 2	CO 3	CO 4
Sessional Examinatio	*	*			
Sessional Examination 2			*	*	*
Assignment/Presentat	ion	*	*	*	*
End Semester Examin	nation	*	*	*	*
Feedback Process	• Mi	d-Semeste	r feedback		
	• End	d-Semeste	r Feedback		
<b>Reference Material</b>	1. Databa	ase Systen	n Concepts,	, Avi Silberschat	z, Henry F. Korth,
	and S.	Sudarshan	. McGraw H	Hill, 6 <sup>th</sup> Edition, 2	2010.
	2. <b>NoSQ</b>	L Distilled	l: A Brief G	uide to the Em	erging World of
	Polygl	ot Persiste	ence, Pramo	d J. Sadalage, M	artin Fowler,
	Addisc	on-Wesley	, 2012.		
	3. Seven	Database	s in Seven V	Veeks: A Guide	to Modern
	Databa	ases and t	he NoSQL	<b>Movement</b> , Eric	Redmond, Jim R.
	Wilson	n, Pragmat	ic Bookshelt	f. 2012.	



Name of the Program: M			ME i	IE in BDA							
Course Title: N				Mod	ern Data	bases fo	or Big Da	ta Lab			
Course Code: BDA 616L Cou					Cour	urse Instructor:					
Acader	nic Yea	ar: 2020	-2021		Sem	ester: F	First year	, Second	semester		
No of (	Credits	: 1			Prer	equisites	: Program	mming in	Java, SQ	L, Python	
Synop	sis:	This C	ourse p	provides	insigl	nt on					
		1. Thi	is cours	se helps	studer	nts to wr	ite SQL	queries	to work	on data.	
		2. Dea	als with	h differe	ent dat	a models	8				
		3. Dis	scuss th	ne distri	buted a	architect	ure to h	andle dat	ta which	is scalabl	e.
		4. Stu	dents v	work wi	th diff	erent typ	es of N	oSQL da	tabases.		
Cours	e										
Outco	mes	On suc	cessful	l comple	etion o	of this co	urse, sti	idents wi	ill be able	e to	
(COs):	:										
CO 1:		Design queries to extract required data.									
CO 2:		Experi	ment w	ith diff	erent t	ypes No.	SQL da	tabases to	o handle	Big Data	
CO 3:		Analys	e prop	er datab	ases w	hich are	fault to	lerant an	d scalabl	e.	
Mappi	ing of (	COs to l	POs								
COs	PO	<i>PO</i> 2	PO	PO	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11
	1		3	4							
CO 1	*	*	*		*					*	
CO 2	*	*	*		*	*				*	
CO 3	*	*	*		*	*	*			*	
Course content and outcomes:											
Conter	ıt					Compete	encies				
Unit 1	: Nos	SQL DB	5								
Installi	ng No.	SQL dat	abase.			Design c	jueries t	o get dat	a stored	in NoSOI	
Queryi	ng No	SQL DB	5			database	(C4).	C			

## **Unit 2: Data Distribution and Scalable**



Horizontal partitioning and data shrading. MapReduce in databases. Unit 3: Case study Choose proper database based on need	Configure database and scalability (C4 Develop applicatio to handle the data ( Design application appropriate database	es for handl ). ons with Ma (C4). s to handle se (C4).	ing data distribution pReduce technique data using	
Learning strategies, contact hours and	student learning ti	ime		
Learning strategy	Contact hours		Student learning	
			time (Hrs)	
Lecture	12		-	
Seminar	-		-	
Quiz	-		-	
Small Group Discussion (SGD)	-		-	
Self-directed learning (SDL)	-		-	
Problem Based Learning (PBL)	-		-	
Case Based Learning (CBL)	03		-	
Clinic	-		-	
Practical	24		-	
Revision	03		-	
Assessment	06		-	
TOTAL	48		-	
Assessment Methods:				
Formative:		Summativ	ve:	
Internal practical Test		Sessional	examination	
Theory Assignments		End seme	lester examination	
Lab Assignment & Viva		Viva		



Mapping of assessm	Mapping of assessment with Cos							
Nature of assessment			CO 1	CO 2	CO 3			
Sessional Examinatio	n 1		*					
Sessional Examinatio	n 2			*	*			
Assignment/Presentat	tion		*	*	*			
Laboratory Examinat	ion		*	*	*			
Feedback Process	•	Mid-Semester feedback						
	•	End	d-Semester	·Feedback				
	•	Lin	d Demester	Teedback				
<b>Reference Material</b>	1.	Databa	ase Systen	n Concepts, A	vi Silberschatz, Henry F. Korth,			
		and S.	and S. Sudarshan. McGraw Hill, 6 <sup>th</sup> Edition, 2010.					
	2.	NoSQI	L Distilled	: A Brief Gui	le to the Emerging World of			
		Polyglot Persistence, Pramod J. Sadalage, Martin Fowler,						
		Addiso	Addison-Wesley, 2012.					
	3.	Seven Databases in Seven Weeks: A Guide to Modern						
		Databa	ases and tl	he NoSQL Mo	vement, Eric Redmond, Jim R.			
		Wilson	, Pragmati	c Bookshelf. 2	012.			
	1							



Name of the P	rogram:	ME in BDA				
<b>Course Title:</b>		Advanced Applications of Probability and Statistics				
<b>Course Code:</b>	MCL 602	Course Instructor:				
Academic Yea	ar: 2020-2021	Semester: First Year, Semester 2				
No of Credits	: 3	Prerequisites: MCL 601				
Synopsis:	This course provides	an introduction to advanced applications of probability				
	and statistics for mult	ivariate and time series data.				
Course						
Outcomes	On successful completion of this course, students will be able to					
(COs):	(COs):					
CO 1:	Compute and interpret descriptive statistics for multivariate data					
CO 2:	Apply linear and logistic regression models for practical problems and assess model performance					
CO 3:	Interpret the output of pr	rincipal component analysis (PCA) applied to multivariate data				
	Identify multivariate	lata with mixed data type features and cluster using an				
CO 4:	appropriate technique	ata with mixed data type reatures and cluster using an				
CO 5:	Understand the basics o	f time series modelling and apply to real-life problems				

# Mapping of COs to POs

COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	<i>PO</i> 8	PO 9	PO 10	PO 11
CO 1	*		*								
CO 2	*	*	*	*							
CO 3	*	*	*	*				*			
CO 4		*	*	*	*	*					
CO 5	*	*	*								

## **Course content and outcomes:**

Content	Competencies			
Unit 1: Multivariate Distributions				
Mean vector, covariance and correlation	1. Understand the organisation of multivariate			
– population vs. sample - The	data (C2).			
multivariate Gaussian ioint	2. Relate multivariate population and sample			
induvariate Gaussian – joint-,	parameters (C4).			
marginal-, and conditional distributions,	3. Understand and apply multivariate Gaussian			
Mahalanobis distance and outliers -	modelling to practical problems (C2, C3).			



Properties of the multivariate Gaussian	4. Compare parameter estimation using different
- Parameter estimation: maximum	probabilistic approaches (C4).
likelihood estimation (MLE) and	
maximum aposteriori estimation	
(MAP).	

# Unit 2: Linear and Logistic Regression

Simple linear regression – regression	1.	Model a linear relationship between input and output variables, and assess model performance
model, estimating and interpreting		(C5).
coefficients, accuracy of coefficient	2.	Use different performance metrics to conclude
estimates and model, ANOVA, R2	3	what is a good linear fit to the data (C6). Interpret model coefficients and investigate the
statistic - Multiple linear regression -	5.	effect of input variables on output through
estimating coefficients, qualitative		sensitivity analysis (C6).
predictors, interaction effects, potential	4.	Apply logistic regression modelling for binary
problems - Logistic regression - binary		performance (C6).
and multinomial logistic regression		
models, estimating and interpreting		
coefficients, assessing model		
calibration and discrimination, area		
under the ROC curve.		

# Unit 3: Principal Component Analysis, Cluster Analysis

Geometric intuition of principal	1. Understand the mathematical foundation of principal component analysis (PCA) (C2)
components - Maximum variance	2. Perform and interpret the output of PCA
perspective – algebraic setup,	applied to multivariate data for dimension
eigenvectors and eigenvalues of sample correlation matrix - Interpretation and application of principal components for dimension reduction.	<ul> <li>reduction (C6).</li> <li>3. Assess when PCA is applicable for clustering multivariate data (C6).</li> <li>4. Compare and contrast methods for clustering multivariate data with mixed data types (C6).</li> </ul>
Dissimilarity measures for mixed data types - Partition around medoids (PAM)	



vs. K-means algorithms - Selecting the number of clusters.

### Unit 4: Bootstrapping, Time Series Analysis

Time series concepts: stationarity, trend, seasonality, autocorrelation -Autoregressive moving average (ARMA) models - Resampling, smoothing, windowing, and rolling average - First and second order differencing - Validating time series predictions.

- 1. Understand the basic principles of bootstrapping as an experimental method to estimate the sampling distributions of a statistic (C2).
- 2. Understand the basic mathematical principles of time series modelling (C2).
- 3. Apply time series modelling to practical problems (C3).
- 4. Interpret the results of times series model predictions (C3).

#### Learning strategies, contact hours and student learning time

Learning strategy	Contact hours		Student learning	
			time (Hrs)	
Lecture	30		60	
Quiz	02		04	
Small Group Discussion (SGD)	02		02	
Self-directed learning (SDL)	-		04	
Problem Based Learning (PBL)	02		04	
Case Based Learning (CBL)	-	-		
Revision	02		-	
Assessment	06		-	
TOTAL	44		74	
Assessment Methods:				
Formative:		Summativ	ve:	
Internal practical Test		Sessional examination		
Theory Assignments		End semester examination		
Lab Assignment & Viva		Viva		



Mapping of assessme	nent with Cos							
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5		
Sessional Examinatio	n 1	*	*					
Sessional Examinatio	n 2		*	*	*			
Assignment/Presentat	ion	*	*	*	*	*		
End Semester Examin	*	*	*	*	*			
Feedback Process	<ul><li>Mic</li><li>Enc</li></ul>	l-Semes l-Semes	ster feedl ster Feed	back				
Reference Material								
Kererence Wateria	1. An Introduction to Statistical Learning with Applications in R,							
	Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani,							
	Springer; 1	st Editi	on, 2013	, Corr. 7th	n printing 2017 E	dition.		
	2. An Intr	oductio	n to Ap	plied Mul	tivariate Analysi	s with R, Brian		
	Everitt and	Torster	n Hothor	n– Spring	er Publications,1s	st Edition, 2011.		
	3. Machin	e Learn	ing - A F	Probabilist	ic Perspective, K	evin P. Murphy,		
	The MIT P	ress; 1s	t Edition	, 2012.				
	4. Mathematics for Machine Learning, Marc Peter Deisenroth, A Aldo							
	Faisal, and Cheng Soon Ong, Cambridge University Press, 2020							
	Online resource from Cambridge University Press available at							
	https://mm	l-book.g	github.io	/book/mm	ll-book.pdf			



Name of the Program:						ME in BDA						
Course Title:					Adva	Advanced Applications of Probability and Statistics Lab						
Course Code: MCL 602L						Course Instructor:						
Acader	nic Yea	<b>r:</b> 2020-	-2021		Seme	ester: Fin	st Year,	Semester	2			
No of C	Credits:	1			Prere	equisites	: MCL	602				
Synop	sis:	This co	ourse p	rovides	an int	roductio	on to ac	dvanced a	application	ons of pro	obability	
		and st	atistics	for an	alysing	g multiv	variate	and time	series	data usin	g the R	
	programming language.											
Course	e											
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, st	udents w	ill be abl	e to		
(COs):	1											
CO 1:		Compu	ite and	interpr	et desci	riptive s	tatistics	s for mult	ivariate (	data		
CO 2:		Build a	and asso	ess line	ar and	logistic	regress	ion mode	ls for pra	actical pro	oblems	
CO 2.		Perform	n prin	cipal c	ompon	ent ana	lysis (l	PCA) for	r dimens	sion redu	ction in	
CO 3:		multivariate data										
CO 4:	CO 4: Cluster multivariate data with mixed data types											
<b>CO 5:</b> Apply time series modelling to real-life problems												
Mappi	ng of (	COs to ]	POs									
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11	
CO 1	*	*	*		*							
CO 2		*	*	*	*			*				
CO 3		*	*	*	*			*				
CO 4		*	*	*	*	*		*				
CO 5	*	*	*									
Course content and outcomes:												
Content Competencies												
Unit 1	: Multi	variate	Distri	butions	5							
Mean v	vector,	covaria	nce and	correla	tion	1. Com	pute d	escriptive	statistic	es of mul	ltivariate	
– poj	oulation	n vs.	sampl	е -	The	he data (C2).						
multivariate Gaussian – joint-,												



marginal-, and conditional distributions,	2.	Perform exploratory data analysis of
Mahalanobis distance and outliers -		multivariate data (C4).
Properties of the multivariate Gaussian	3.	Identify outliers in multivariate data (C3).
- Parameter estimation: maximum	4.	Visualise and understand the properties of
likelihood estimation (MLE) and		multivariate Gaussian data (C3).
maximum aposteriori estimation		
(MAP).		
Unit 2: Linear and Logistic Regression	n	
Simple linear regression - regression	1.	Use in-built functions in R to build linear
model, estimating and interpreting		models for practical problem (C3).
coefficients, accuracy of coefficient	2.	Compute different performance metrics to
estimates and model, ANOVA, R2		assess model performance (C6).
statistic - Multiple linear regression -	3.	Interpret model coefficients and investigate the
estimating coefficients, qualitative		effect of input variables on output through
predictors, interaction effects, potential		sensitivity analysis (C6).
problems - Logistic regression - binary	4.	Use in-built functions in R to build logistic
and multinomial logistic regression		regression models for practical binary
models, estimating and interpreting		classification problems and assess model
coefficients, assessing model		performance (C6).
calibration and discrimination, area		
under the ROC curve.		
Unit 3: Principal Component Analysis	s, Cl	uster Analysis
Geometric intuition of principal	1.	Visualise the geometric interpretation of
components - Maximum variance		principal component analysis (PCA) (C3).
perspective – algebraic setup,	2.	Use in-built functions in R to perform PCA on
eigenvectors and eigenvalues of sample		multivariate data (C3).
correlation matrix - Interpretation and	3.	Compare and contrast PCA for variance
application of principal components for		maximization vs. clustering of multivariate data
dimension reduction.		(C6).
Dissimilarity measures for mixed data	4.	Cluster multivariate data with mixed data types
types - Partition around medoids (PAM)		using in-built functions in R (C3).



vs. K-means algorithms - Selecting the					
number of clusters.					
Unit 4: Bootstrapping, Time Series Ana	lysis				
Time series concepts: stationarity,	1. Apply bootstrapping on a practical data				
trend, seasonality, autocorrelation -	and assess j	performanc	e (C3).		
Autoregressive moving average	2. Understand	and apply	in-built functions in		
(ARMA) models - Resampling,	R for time s	series mode	elling (C3).		
smoothing, windowing, and rolling	3. Apply time	e series mo	odelling to practical		
average - First and second order	problems (	C3).			
differencing - Validating time series	4. Interpret th	e results of	f times series model		
predictions.	predictions	(C3).			
Learning strategies, contact hours and s	student learning ti	ime			
Learning strategy	Contact hours		Student learning		
			time (Hrs)		
Lecture	12		-		
Seminar	-		-		
Quiz	-		-		
Small Group Discussion (SGD)	-		-		
Self-directed learning (SDL)	-		-		
Problem Based Learning (PBL)	-		-		
Case Based Learning (CBL)	03		-		
Clinic	-		-		
Practical	24		-		
Revision	03		-		
Assessment	06		-		
TOTAL	48		-		
Assessment Methods:	1		<u>'</u>		
Formative:		Summati	ve:		
Internal practical Test		Sessional	examination		
Theory Assignments	End semester examination				



Lab Assignment & V	iva		Viva				
Mapping of assessm	ent with Co	S					
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	
Sessional Examinatio	n 1	*	*				
Sessional Examinatio	on 2			*	*	*	
Assignment/Presentat	tion	*	*	*	*	*	
Laboratory examination		*	*	*	*	*	
Feedback Process	ess • Mid-Semester feedback						
	• End	d-Semes	ster Feed	back			
<b>Reference Material</b>	1. An Inti	oductio	n to Sta	atistical L	earning with	Applications in R,	
	Gareth Jan	nes, Da	niela Wi	tten, Trev	or Hastie an	d Robert Tibshirani,	
	Springer; 1	st Editi	on, 2013	, Corr. 7t	h printing 20	17 Edition.	
	2. An Intr	oductio	n to Ap	plied Mu	ltivariate Ana	alysis with R, Brian	
	Everitt and	l Torstei	n Hothor	m– Spring	ger Publicatio	ns,1st Edition, 2011.	
	3. Machin	e Learn	ing - A I	Probabilis	tic Perspectiv	e, Kevin P. Murphy,	
	The MIT F	Press; 1s	t Edition	n, 2012.			
	4. Mathematics for Machine Learning, Marc Peter Deisenroth, A Aldo						
	Faisal, and Cheng Soon Ong, Cambridge University Press, 2020						
	Online re	source	from C	ambridge	University	Press available at	
	https://mm	l-book.g	github.io	/book/mn	nl-book.pdf		



Name of the Program:						E in BDA						
Course Title:					Mu	Multimedia Analytics						
Course Code: BDA 618					Co	Course Instructor:						
Acader	nic Yea	ar: 2020	-2021		Ser	nester:	First Ye	ar, Semeste	er 2			
No of C	redits				Pre	erequisite	s: Bas	ic Program	ming			
Synop	SIS:	This C	ourse p	rovides	5 1NS1	gnt on						
		1.	Time of	domain	audi	o process	ing tecl	nniques.				
		2.	Identif	y diffe	rent i	mage rep	resenta	tion metho	ods.			
		3.	Impler	menting	g diff	erent ima	ge feati	are extract	ion metho	ds.		
		4.	Impler	nenting	g diffe	erent Vid	eo class	sification 1	models.			
Course	e											
Outco	mes	On suc	cessful	compl	etion	of this co	ourse, s	tudents wi	ll be able t	0		
(COs)	:											
CO 1:		Exami	ne diffe	erent au	dio e	ncoding	echniq	ues.				
CO 2:		Illustra	te Tim	e doma	in au	dio proce	ssing te	chniques.				
CO 3:		Identify different image representation methods.										
CO 4:		Analys	e diffe	rent im	age fe	eature ext	raction	methods				
CO 5:		Analys	e diffe	rent Vio	leo c	lassificat	ion mod	dels				
Mappi	ing of (	COs to 1	POs									
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	PO S	5 PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11	
CO 1	*	*	*									
CO 2	*	*	*			*						
CO 3	*	*	*		*	*						
CO 4	*	*	*	*	*					*		
CO 5	*	*	*		*							
Course	e conte	ent and	outcon	nes:								
Conter	ıt					Compe	encies					
Unit 1	: A	udio A	cquisit	ion Re	prese	entation a	and Sto	orage				
Sound	Physic	es, Prod	uction	Percept	ion,	1. Unc	lerstand	sound ph	ysics (C2).			
Audio	Encod	ling and	Stora	ge For	mat,	2. Imp	lement	different	Audio enc	oding and	l storage	
Time Domain Audio processing Image						ge techniques (C4).						



and Video Acquisition, Representation	Design applications for Image and Vide									
and Storage	acquisition and Storage (C4).	acquisition and Storage (C4).								
Unit 2: Image Handling and Proce	essing									
Reading images from files, Simple	1. Understand different image p	rocessing techniques								
Image transformations, Matrices,	(C2).									
Colors and Filters, Contours and	2. Design application to handle	different filters (C4).								
Segmentation, Object detection and	3. Implement object detection	n and recognition								
recognition	algorithms (C4).									
Unit 3: Video										
Video Principles, Standards, Video	1. Understand different Video s	tandards (C2).								
classification models, Motion	2. Develop applications using	video classification								
Detection, Object Tracking in Video	models (C4).									
	3. Design applications of mo	otion detection and								
	Object tracking (C4).									
Unit 4: Case study										
Speech and hand writing recognition -	1. Design applications for – Spe	ech and handwriting								
Automatic Face recognition, Sign board	recognition (C4).									
detection, Lane change detection -	. Design application to detect and classify images									
Video segmentation and key frame	(C4).									
extraction	3. Design application to extra	ct information from								
	given Video (C4).									
Learning strategies, contact hours and	student learning time									
Learning strategy	Contact hours	Student learning								
		time (Hrs)								
Lecture	30	60								
Quiz	02	04								
Small Group Discussion (SGD)	02	02								
Self-directed learning (SDL)	-	04								
Problem Based Learning (PBL)	02	04								
Case Based Learning (CBL)	-	-								
Revision	02	-								
Assessment	06	-								



TOTAL	TOTAL				7	/4
Assessment Methods	5:					
Formative:				Summa	tive:	
Internal practical Test	-			Sessiona	al examina	tion
Theory Assignments				End sem	nester exar	nination
Lab Assignment & V	iva			Viva		
Mapping of assessme	ent with	Cos		1		
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5
Sessional Examinatio	n 1	*	*			
Sessional Examinatio	n 2			*	*	
Assignment/Presentat	ion	*	*	*	*	*
End Semester Examin	nation	*	*	*	*	*
Feedback Process	•	Mid-Semest	er feedback		-	
	•	End-Semest	er Feedback			
<b>Reference Material</b>	1.	Machine L	earning for A	Audio, In	nage and	Video Analysis,
		Francesco	Camastra and	l Alessar	ndro Vinc	ciarelli Springer's
		Publication,	2nd edition. 2	015.		
	2.	Practical Py	thon and Open	CV, An Ir	ntroductor	y, Example Driven
		Guide to In	nage Processir	ng and Co	omputer V	vision, Dr. Adrian
		Rosebrock,	4th edition, 20	19		
3. Computer V			ision with Pytl	hon Cook	book: Lev	erage the power of
		OpenCV	3 and Pyth	hon to	build	computer vision
		applications	, Aleksei Spiz	zhevoi, A	leksandr	Rybnikov, Packt
		Publishing,	1st Edition, 20	)18.		



Name o	of the P	rogram	:		ME in	n BDA						
Course	Course Title:				Multi	Multi Media Analytics Lab						
Course Code: BDA 618L					Cour	Course Instructor:						
Acader	nic Yea	ar: 2020	-2021		Seme	ster: F	First year	, Second s	emester			
No of (	Credits:	: 1			Prere	equisites	: Progra	umming ir	n Python			
Synop	sis:	This C	ourse p	rovides	insigh	t on						
		1. Stu	dents u	Indersta	nd the	physics	behind	Audio, it	s encodi	ng techni	ques.	
		2. Students learn how to read and represent images.										
		3. Students learn various image processing and information extraction									traction	
		techniques.										
		4. Students learn to handle video data and extract information from it.										
Course	e											
Outco	mes	On suc	cessful	comple	etion of	f this co	urse, stu	idents wil	ll be able	e to		
(COs):	<b>ys):</b>											
CO 1:		Experi	ment aj	oplication	ons to e	extract i	nformat	ion from	Audio.			
CO 2:		Design	applic	ations f	or Ima	ge Anal	ysis.					
CO 3:		Develo	op Mod	els for `	Video a	analysis						
Mappi	ing of (	COs to 1	POs									
COs	PO	<i>PO 2</i>	PO	PO	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11	
	1		3	4								
CO 1	*	*	*		*	*						
CO 2	*	*	*	*	*	*			*	*		
CO 3	*	*	*	*	*	*			*	*		
Course content and outcomes:												
Conter	ıt				(	Compete	encies					
Unit 1	: Au	dio Ana	lysis									

Chit I. Mudio Marysis	
Audio encoding and processing	Implement different audio encoding techniques (C4).



	Develop applications to perform audio analysis			
	(C4).			
Unit 2: Image Analysis				
Image encoding, filters and transformations.	Implement various image storing and reading techniques (C4). Develop image processing techniques (C4).			
Unit 3: Video Analysis				
Video encoding and processing techniques.	Develop applications to extract object of interest from input video (C4).			
Learning strategy	Contact hours		Student learning	
0 02			time (Hrs)	
Lecture	12		-	
Seminar	-		-	
Quiz	-		-	
Small Group Discussion (SGD)	-		-	
Self-directed learning (SDL)	-		-	
Problem Based Learning (PBL)	-		-	
Case Based Learning (CBL)	03	-		
Clinic	-		-	
Practical	24		-	
Revision	03		-	
Assessment	06		-	
TOTAL	48		-	
Assessment Methods:				
Formative:		Summati	ve:	
Internal practical Test		Sessional	examination	
Theory Assignments		End semester examination		



Lab Assignment & V	iva	Viva	Viva						
Mapping of assessme	Mapping of assessment with Cos								
Nature of assessment			CO 1	CO 2	CO 3				
Sessional Examinatio	n 1		*	*					
Sessional Examinatio	n 2			*	*				
Assignment/Presentat	ion		*	*	*				
Laboratory Examination	ion		*	*	*				
Feedback Process	•	Mic	d-Semester feedba	ck					
	•	Enc	l-Semester Feedba	ick					
Poforonco Matorial	1	Ma	china Laarning for	· Audio Image and V	ideo Analysis				
Reference Wateria	1.	The maximum contraction and Alexandra Vincing III Springer's							
		Duk	lication 2nd edition	on 2015	arem springer s				
	2	I ut	atical Duthon and	On. 2013. OpenCV An Introdu	otomy Example				
	۷.	Pla		openev, An introduc	ctory, Example				
		Dri	ven Guide to Imag	ge Processing and Col	mputer Vision, Dr.				
		Adı	rian Rosebrock, 4t	h edition, 2019					
	3.	. Computer Vision with Python Cookbook: Leverage the power							
		of OpenCV 3 and Python to build computer vision							
		app	lications, Aleksei	Spizhevoi, Aleksandı	r Rybnikov, Packt				
		Pub	olishing, 1st Editio	on, 2018.					



Name of	of the P	rogram			ME in	ME in BDA					
Course	Title:				DevC	DevOps for Cloud					
Course Code: CDC-607 Cou			Cour	Course Instructor:							
Acaden	nic Yea	<b>r:</b> 2020	-2021		Seme	ster: F	First Ye	ar, Semester	2		
No of C	Credits:	3			Prere	equisites	: UI	ountu OS, N	letworking	and Softv	ware Life
G	•	This			Cycle	<b>.</b>					
Synop	SIS:	This C	ourse p	rovides	s insign	t on					
Course	e										
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, s	tudents will	be able to	С	
(COs):											
CO	1:	Explain	n the co	oncept	of autor	mation of	of Proc	luct Life Cy	cle stages	•	
		Demor	strate	Contin	nuous	Integrat	ion /	Continuou	is Testin	g / Con	ntinuous
co	2:	Deploy	ment o	of Produ	lct.						
	2	Compare and contrast existing Software Methodologies with Devops Life Cy							fe Cycle		
CO	3:	stages.									
CO	4:	Design	and D	evops 1	nethod	ologies	for Pro	duct develo	pment an	d Release	e.
CO	5:	Explain	n the co	oncepts	of Too	ols used	in eacl	n stages of I	Devops.		
Mappi	ng of (	COs to 1	POs								
COs	PO	<i>PO 2</i>	PO	PO	<i>PO</i> 5	PO 6	PO	PO 8	PO 9	PO 10	PO 11
	1		3	4			7				
CO 1	*	*					*				
CO 2			*		*						*
CO 3		*	*			*					
CO 4	*							*	*		
CO 5	*									*	
Course	e conte	ent and	outcon	nes:							<u> </u>
Conten	nt				(	Compete	encies				
Unit 1	:	DevOp	s Intro	oductio	n						
Unders	tandin	g D	evelop	ment	-	1. I	Explair	n about t	he Prod	uct Life	Cycle
Develo	pemen	t SDLC	C : W	aterFal	1 &	S	Softwa	re methodol	ogies (C2	2)	
Agile - Understanding Operations -				-							



Dev vs Ops - DevOps to the rescue -	2. D	Describe Devops life cycle for Product
What is DevOps - DevOps SDLC -	D	Development and Release (C2)
Continous Delivery model -	3. E	Explain the stages of Devops (C2)
DevOps tools for DevOps SDLC -	4. D	Describe about Continuous Integration /
DevOps Roles & Responsiblities.	C	Continuous Deployment pipeline. (C2)
	5. W	Vrite the significance of automation in
	P	roduct life cycle management. (C3)
	6. D	Describe different between standard software
	m	nethodologies and Devops software
	m	nethodologies. (C2)
Unit 2: Linux		
Linux Introduction, Principles & Linux	1. E	Explain the evolution of Linux OS (C2)
distro - Booting - Command line	2. E	Explain Linux File System (C2)
utililities & Basic commands - Linux	3. D	Demonstrate Linux Users and Groups (C3)
Filesystem - Filters & I/O	4. D	Describe OS Level Virtualization techniques
Redirections - Users & Group	lil	ke Containers (C3)
administration - File permissions &	5. D	Demonstrate basic Linux Commands (C4)
Ownerships - Sudo - Software		
Managemen - Useful tools: ssh, telnet,		
scp, rsync, disk utils, backups		
etc - Service & Process management -		
Shell Scripting - Systems and HW stats		
- Linux Containers (lxc) - Dockers -		
Kubernetes and Microservices .		
Unit 3: Networking fundamental	5	
Components of computer networks -	1. E	Explain Computer network and devices (C2)
Classification: LAN, WAN, Peer to	2. D	Demonstrate subnetting and its need (C3)
Peer network, Server based - Switches	3. E	Explain IPV4 Addressing scheme (C2)
- Routers - Network Architecture -	4. D	Demonstrate type of Network Devices like
Protocols - Port numbers - DNS -	S	witches, Hub, Router using Simulator Tools
DHCP - IP Addresses - Ip Addresses	(0	C4)



& Subnet Masks - IP Address Ranges	5.	Describe networking Services like DNS ,
- Subnetting - Private Vs Public		DHCP, NACL, FTP etc (C4)
networks - High Availaiblity -		
Firewalls & NACL - Web Application		
Architecture - Infrastructure -		
Network layout - Services &		
Components - Architecture from a		
DevOps perspective.		
Unit 4: Automation, Orchestration	n & Co	nfig Management
Version control system with Git :	1.	Explain need and types of version control
What is VCS & why it is needed -		software (C1)
DevOps use cases - Setup your own	2.	Describe architecture of Distributed version
repo with git - Manage your code		control systems (C2)
base/source code with GIT & GITHUB	3.	Explain Git and Github as case study (C3)
Unit 5: Continuous Integration v	vith Jen	lkins
Introduction to continuous integration	1.	Describe about Continuous Integration /
Build & Release and relation with		Continuous Deployment pipeline. (C2)
DevOps - Understanding	2.	Write the significance of automation in
development and developers - Why		Product life cycle management. (C3)
Continuous integration Jenkins	3.	Describe different between standars software
introduction and setup - Jenkins		methodologies and Devops software
projects/jobs - Jenkins plugins		methodologies. (C2)
Jenkins administration: Users -	4.	Give examples for Automation of stages of
Nodes/slaves - Managing plugins -		Product development using Devops . (C2)
Managing software versions -	5.	Write the limitation of a Current Software
Introduction - Phases - Java builds		methodologies for Product Development.
- Build and Release job/project setup		(C3)
Nexus: Intro & Setup - Software	6.	Describe the architecture of Continuous
versioning & Hosted repository -		Integration server. (C2)
Integration with Jenkins - Continuous	7.	Apply Devops methodologies for Product
integration job/project setup   Complete		Development and Release(C3)
Jenkins project: Packinging Artifacts -		



Static code Analysis - Tomcat setup	
Staging & productions - Artifacts	
deployments to webservers from	
Jenkins - Build Pipeline - Jenkins	
not just CI tool anymore - More	
DevOps use cases of Jenkins	
Unit 5: Ansible	
Configuration Management &	1. Write the steps in Automation of Testing in
Automation - What is Ansible & its	Web development. (C3)
features - Ansible setup on local &	2. Explain the operations Continuous Testing.
cloud - Understanding Ansible	(C5)
architecture & Execution - Inventory	3. Write the taxonomy of Continuous Integration
Ad hoc commands: Automating	/ Continuous Delivery / Continuous
change Management with Ad Hoc	Deployment (C3)
commands - Playbook Introduction -	4. Design a Workflow for Automation of
Ansible configuration with ansible.cfg $\ -$	Product life cycle using Devops (C5, P3).
Ansible documentation - Modules,	5. Construct a Continuous Integration /
modules & lots of modules - Writing	Continuous Deployment pipeline (C5)
playbook for webserver & DB server	6. Compare Standard Software methodologies
deployments - Tasks - Variables -	vs Devops methodologies for Product
Templates - Loops - Handlers -	Development. (C6, P2)
Conditions - Register - Debugging -	7. Describe about Containers and Container
Ansile Roles - Identify server roles -	Orchestration Services. (C2)
Roles structure - Creating, Managing	8. Examine the advantages of using Containers
and executing roles - Ansible Galaxy -	in Web development(C4)
Exploring Roles from Galaxy -	9. Describe Container orchestration services
Download Galaxy roles and integrate	architecture(C2)
with your code - Ansible Advanced	10. Show the function of Container orchestration
Execution - Improving execution time	services(C3)
- Limiting and selecting tasks -	11. Define Configuration Management tools and
Troubleshooting and Testing.	its need. (C1)



12. Describe the features of Configuration
Management. (C2)
13. Explain the architecture of Configuration
Management (C5)
14. Design a Configuration Management Codes
to administrate infrastructure of organization
(C5)
15. Explain the need of Continuous Monitoring
tools (C5)
16. Design an Architecture Continuously
Monitor infrastructure (C4)

Learning strategies, contact hours and student learning time						
Learning strategy		Contact hou	rs		Student learning	
					time (Hrs)	
Lecture		30			60	
Quiz		02			04	
Small Group Discussion (SGD)		02			02	
Self-directed learning (SDL)		-			04	
Problem Based Learning (PBL)		02			04	
Case Based Learning (CBL)		-			-	
Revision		02			-	
Assessment		06			-	
TOTAL		44			74	
Assessment Methods:						
Formative:			Summative:			
Internal practical Test			Sessional examination			
Theory Assignments	End semester examination					
Mapping of assessment with Co	s					
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	



Sessional Examinatio	n 1	*	*					
Sessional Examinatio	n 2			*	*	*		
Assignment/Presentat	ion				*	*		
End Semester Examin	nation	*	*	*	*	*		
Feedback Process	• Mic	l-Semeste	er feedback		I			
	• Enc	l-Semeste	er Feedback					
<b>Reference Material</b>	[1]. Eric Fo	oster-John	nson , John C.	Welch , N	Iicah And	erson, Beginning		
	Shell Scrip	ting (Pro	grammer to Pro	ogrammer	), Wrox Pu	ublications		
	[2]. Randal	K. Mich	ael "Mastering	g Unix She	ll Scripting	g: Bash, Bourne,		
	and Korn S	hell Scri	pting for Progr	ammers, S	System Ad	ministrators, and		
	UNIX Gur	us", 2nd l	Edition, Wiley	Publicatio	ons			
	[3]. Bintu I	Harwani,	"UNIX & She	ll Program	ming", Ox	xford		
	Publication	ns, 2013						
	[4]. John F	erguson S	Smart, "Jenkins	s: The Def	initive Gu	ide",O'reilly		
	Publication	IS						
	[5]. Mitesh	Soni, "Je	enkins Essentia	als", Packt	Publicatio	ons		
	[6]. Rafal I	Leszko, "(	Continuous De	livery with	h Docker a	and Jenkins",		
	Packt Publ	ications						
	[7]. Veselin	n Kantsev	v, "Implementi	ng DevOp	s on AWS	", Packt		
	Publication	IS						
	[8]. Randal	l Smith,	"Docker Orche	estration",	Packt Pub	olications		
	[9]. Alan B	lan Berg, "Jenkins Continuous Integration Cookbook", Packt						
	Publication	IS						
	[10]. Kum	aran S., S	Senthil, "Pract	tical LXC	and LXD	Linux Containers		
	for Virtuali	zation an	d Orchestratio	n", Apress	s Publicatio	ons		
	[11]. Kons	stantin Iva	anov, " Contain	nerization	with LXC	", Packt		
	Publication	IS						
	[12]. Karl	Matthias	, Sean Kane, "	Docker: U	Jp & Runn	ing:Shipping		
	Reliable Containers in Production", O'Reilly Media							



Name of the	Program:	ME in Cloud Computing		
<b>Course Title</b>	•	Devops for Cloud Lab		
<b>Course Code</b>	e: CDC 607L	Course Instructor:		
Academic Y	ear: 2020-2021	Semester: First Year, Semester 2		
No of Credit	s: 1	<b>Prerequisites:</b> Ubuntu OS, Networking and Software Life Cycle		
Synopsis:	This Course provides	insight on		
Course Outcomes (COs):	On successful completion of this course, students will be able to			
CO 1:	Explain the concept of automation of Product Life Cycle stages			
CO 2:	Design an Devops me	Design an Devops methodologies for Product development and Release		
CO 3:	Demonstrate Continuous Integration / Continuous Testing / Continuous Deployment of Product			
CO4:	Explain the concepts of Tools used in each stages of Devops .			
CO5:	Demonstrate Continuous Monitoring of Production Environment			
Mapping of	COs to POs			

COs	PO	<i>PO</i> 2	PO	PO	<i>PO</i> 5	<i>PO</i> 6	<i>PO</i> 7	<i>PO</i> 8	<i>PO</i> 9	PO 10	PO 11
	1		3	4							
CO 1	*	*			*						
CO 2	*		*								
CO 3		*	*		*						
CO 4		*	*		*						
CO 5							*	*			

**Course content and outcomes:** 

Content		Competencies
Unit 1:	<b>DevOps Introduction</b>	



Understanding Development 1. Demonstrate differences between - Developement SDLC : WaterFall & Waterfall and agile software development Agile - Understanding Operations methodologies (C2) Dev vs Ops - DevOps to the rescue - What is DevOps - DevOps SDLC - Continous Delivery model -DevOps tools for DevOps SDLC - DevOps Roles & Responsiblities. Unit 2: Linux Linux Introduction, Principles & 1. Design Ubuntu based VM using Linux distro – Booting – Command hypervisor to understand booting process, line utililities & linux file system, linux networking, Basic commands - Linux Filesystem Users, Groups and Permissions, tools (ssh Filters & I/O Redirections -Users , scp etc ) (C3) & Group administration File 2. Design a docker environment to permissions & containerize web application (C3) **Ownerships** 3. Design a Kubernetes cluster to deploy Sudo -Software Managemen -\_ containerized application using Useful tools: ssh, telnet, scp, rsync, Kubernetes deployment and service disk utils, backups models (C4) Service & Process management etc -Shell Scripting - Systems and HW Linux Containers stats (lxc) -Dockers -**Kubernetes** and Microservices Unit 3: **Networking fundamentals** 



Components of computer networks - Classification: LAN, WAN, Peer to Peer network, Server based - Switches - Routers - Network Architecture - Protocols - Port numbers - DNS - DHCP - IP Addresses - Ip Addresses & Subnet Masks - IP Address Ranges - Subnetting - Private Vs Public networks - High Availaiblity - Firewalls & NACL - Web Application Architecture - Infrastructure - Net work layout - Services & Components - Architecture from a DevOps perspective.	<ol> <li>Design a College/ University network using packet tracer to understand computer networking devices like Hub , Switches , Routers and Firewalls (C3)</li> <li>Design a Network project using Packet tracer to understand Networking services like DNS , DHCP , FTP etc (C3)</li> </ol>
Unit 4: Automation, Orchestration	& Config Management
Version control system with Git	1. Create Github account and set up

<ul> <li>Version control system with Git</li> <li>What is VCS &amp; why it is needed</li> <li>DevOps use cases - Setup your own repo with git - Manage your code base/source code with GIT &amp; GITHUB</li> <li>Unit 5: Continuous Integration with 3</li> </ul>	<ol> <li>Create Github account and set up repository and use git commands to Clone         <ul> <li>Fork and commit files to Github repositories (C4)</li> </ul> </li> <li>Jenkins</li> </ol>
Introduction to continuous integration. - Build & Release and relation with DevOps - Understanding development and developers - Why Continuous integration Jenkins introduction and setup - Jenkins projects/jobs - Jenkins plugins   Jenkins administration: Users	<ol> <li>Design a Continuous Integration server using Jenkins in Master Slave architecture (C3)</li> <li>Demonstrate CI/CD for JAVA/PHP/nodejs web application (C4)</li> </ol>



- Nodes/slaves - Managing plugins	3. Design an Eclipse Selenium testing project
- Managing software versions	to automate Web application Testing
- Introduction - Phases - Java	Process (C4)
builds - Build and Release job/project	
setup   Nexus: Intro & Setup	
- Software versioning & Hosted	
repository - Integration with Jenkins	
- Continuous integration job/project	
setup   Complete Jenkins	
project: Packinging Artifacts - Static	
code Analysis - Tomcat setup Staging	
& productions	
- Artifacts deployments to	
webservers from Jenkins - Build	
Pipeline - Jenkins not just CI tool	
anymore - More DevOps use cases of	
Jenkins	
Unit 6: Ansible	
Configuration Management	1. Design a Configuration management
$0$ A $\frac{1}{1}$ $\frac{1}{1}$ $\frac{1}{1}$ $\frac{1}{1}$ $\frac{1}{1}$ $\frac{1}{1}$ $\frac{1}{1}$	
& Automation - what is Ansible &	service using Ansible to administer group
its features - Ansible setup on local &	service using Ansible to administer group of nodes in lab (C2)
its features - Ansible setup on local & cloud - Understanding Ansible	service using Ansible to administer group of nodes in lab (C2) 2. Demonstrate installation of Software
architecture & Execution - Inventory	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysgl on</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc commands - Playbook	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc commands - Playbook Introduction - Ansible configuration	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers for different dervices like CPU Utilization</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc commands - Playbook Introduction - Ansible configuration with ansible.cfg - Ansible	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers for different dervices like CPU Utilization , RAM Usage, Network Bandwidth.</li> </ul>
& Automation - What is Ansible &its features - Ansible setup on local &cloud - Understanding Ansiblearchitecture & Execution - Inventory  Ad hoc commands: Automatingchange Management with Ad Hoccommands - PlaybookIntroduction - Ansible configurationwith ansible.cfg - Ansibledocumentation - Modules, modules	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git, Eclipse, Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers for different dervices like CPU Utilization , RAM Usage, Network Bandwidth, Apache server logs. Database server logs</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc commands - Playbook Introduction - Ansible configuration with ansible.cfg - Ansible documentation - Modules, modules & lots of modules - Writing playbook	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git , Eclipse , Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers for different dervices like CPU Utilization , RAM Usage , Network Bandwidth , Apache server logs , Database server logs etc (C5)</li> </ul>
Automation - What is Ansible & its features - Ansible setup on local & cloud - Understanding Ansible architecture & Execution - Inventory   Ad hoc commands: Automating change Management with Ad Hoc commands - Playbook Introduction - Ansible configuration with ansible.cfg - Ansible documentation - Modules, modules & lots of modules - Writing playbook for webserver & DB server	<ul> <li>service using Ansible to administer group of nodes in lab (C2)</li> <li>2. Demonstrate installation of Software packages like git , Eclipse , Mysql on group of nodes using Ansible (C4)</li> <li>3. Design a Continuous monitoring server using Nagios to monitor group of servers for different dervices like CPU Utilization , RAM Usage , Network Bandwidth , Apache server logs , Database server logs etc (C5)</li> </ul>



Templates - Loops -Handlers -Conditions - Register - Debugging Ansile Roles - Identify server roles -\_ Roles structure -Creating, Managing executing and roles - Ansible Galaxy - Exploring Roles from Galaxy - Download Galaxy roles and integrate with your code - Ansible Advanced Execution -Improving execution time -Limiting and selecting tasks - Troubleshooting and Testing

Learning strategies, contact nours a	ind student learning	time			
Learning strategy	Student learning				
			time (Hrs)		
Lecture	12		-		
Seminar	-		-		
Quiz	-		-		
Small Group Discussion (SGD)	-		-		
Self-directed learning (SDL)	-	-			
Problem Based Learning (PBL)	-	-			
Case Based Learning (CBL)	03	-			
Clinic	-		-		
Practical	24		-		
Revision	03		-		
Assessment	06		-		
TOTAL	48		-		
Assessment Methods:	·				
Formative:		Summati	tive:		
Internal practical Test		Sessional examination			
Theory Assignments		End semester examination			

#### 4.1 4.1 ...



Lab Assignment & V	Assignment & Viva			Viva				
Mapping of assessm	ent with Co	s		1				
Nature of assessment		CO 1	CO 2		CO 3			
Sessional Examinatio	on 1	*	*		*			
Assignment/Presentation			*		*			
Laboratory Examinat	Laboratory Examination		*		*			
Feedback Process	• Mie	d-Semester f	eedback					
	• End	l-Semester H	Feedback					
				1 1				
Reference Material	[1]. Eric Fo	oster-Johnso	n, John C. We	lch , Mi	cah Anderson,			
	Beginning	Beginning Shell Scripting (Programmer to						
	Programme	er), Wrox Pu	ublications					
	[2]. Randal	K. Michael	"Mastering U	nix Shell	Scripting: Bash,			
	Bourne, an	d Korn Shel	1 Scripting for	Program	mers, System			
	Administra	tors, and UI	NIX Gurus", 2n	d Editio	n, Wiley Publications			
	[3]. Bintu l	Harwani, "U	NIX & Shell P	rogramn	ning", Oxford			
	Publication	ns, 2013						
	[4]. John F	erguson Sm	art, "Jenkins: T	ĥe				
	Definitive	Guide",O're	illy Publication	S				
	[5]. Mitesh	Soni, "Jenk	tins Essentials"	, Packt F	Publications			
	[6]. Rafal I	Leszko, "Co	ntinuous Delive	ery with	Docker and			
	Jenkins", P	ackt Publica	ations					
	[7]. Veselin	n Kantsev, "	Implementing 1	DevOps	on			
	AWS", Pac	ckt Publicati	ons					
	[8]. Randal	ll Smith, "De	ocker Orchestra	ation", I	Packt Publications			
	[9]. Alan B	Berg, "Jenkir	is Continuous I	ntegratio	on			
	Cookbook	', Packt Pub	lications					
	[10]. Kum	aran S., Sen	thil, " Practica	l LXC a	nd LXD Linux			
	Containers	for Virtuali	zation and					
	Orchestrati	on", Apress	Publications					



[11]. Konstantin Ivanov, "Containerization with LXC"
, Packt Publications
[12]. Karl Matthias, Sean Kane, "Docker: Up
& Running: Shipping Reliable Containers
in Production", O'Reilly Media



Name of the	Program:	ME in BDA					
<b>Course Title</b>	:	Natural Language and Text Processing					
Course Code	e: BDA 621	Course Instructor:					
Academic Y	ear: 2020-2021	Semester: First Year, Semester 2					
No of Credit	s: 3	Prerequisites: Programming in Python					
Synopsis:	This course introduce	es fundamental concepts in natural language and text					
	processing.						
Course							
Outcomes	On successful comple	tion of this course, students will be able to					
(COs):							
CO 1:	Understand syntax and semantics of text.						
CO 2:	Perform text processing by implementing lexical analysis, word stemming word stop, and term selection.						
CO 3:	Perform categorizing	and tagging of words.					
CO 4:	Classification and info	ormation extraction from text.					
CO 5:	Design models for ser	ntiment and semantic analysis from text.					
Mapping of	COs to POs						

COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11
CO 1	*										
CO 2	*	*									
CO 3	*	*									
CO 4		*	*	*							
CO 5		*	*	*	*						

Course content and outcomes:

Content

Competencies

Unit 1:	Natural	Language	<b>Basics;</b>	Acces	ssing,	Process	sing	and	Unders	tanding	Text;
Categorizing and Tagging Words											
Natural	Langı	lage, Li	nguistics	5, 1.	Under	rstand tl	he ba	asic	principles	s of orga	anizing

	U	U /	U		ŕ		1	
Language Sem	antic	es, Tex	t Corpo	ra.		textual data (C2).		


AED BY (Decines to	00 0144	ersity under Section 5 of the OGO (10, 1950)
Accessing Text Corpora, from the Web	2.	Understand how to access text corpora from
and from Disk, Conditional Frequency		different media (C2).
Distributions, Regular Expressions for	3.	Understand how words can be used as building
Detecting Word Patterns, Tokenization.		blocks for textual analysis (C2).
Using a Tagger, Tagged Corpora,	4.	Understand different types of tagging (C2).
Automatic Tagging, N-Gram Tagging,		
Transformation-Based Tagging.		
Unit 2: Classification and Information	Ext	traction; Text Similarity and Clustering
Automated Text Classification, TF-IDF	1.	Understand the mathematical principles of
Model, Advanced Word Vectorization		word vectorization (C2).
Models, Classification Algorithms - Multinomial Naïve Bayes, Support Vector Machines. Text Summarization and Information Extraction - Text Normalization, Feature Extraction, Keyphrase Extraction, Topic Modelling, Automated Document Summarization. Term Similarity, Analysing Document Similarity, Document Clustering.	<ol> <li>2.</li> <li>3.</li> <li>4.</li> </ol>	Compare and contrast different classification algorithms for text analysis (C6). Understand how to perform feature extraction for text analysis (C3). Understand how to compare and cluster text documents (C3).
Unit 3: Semantic and Sentiment Analy	sis	
Exploring WordNet, Word Sense	1.	Understand how to access the WordNet lexical

Exploring WordNet, Word Sense						
Disambiguation, Named Entity		database (C3).				
Recognition, Analysing Semantic	2.	Understand how to perform	n semantic	analysis		
Representations, Sentiment Analysis.		of natural language expressions (C3).				
-	3.	Understand how to perform	n sentiment	analysis		
		of text documents (C3).				
Learning strategies, contact hours and	stu	dent learning time				
Learning strategy	(	Contact hours	Student	learning		
			time (Hrs)			



Lecture			30		60			
Quiz			02		04			
Small Group Discussion (SGD)			02		02			
Self-directed learning (SDL)			-			04		
Problem Based Learning (PBL) Case Based Learning (CBL) Revision			02		04			
Case Based Learning (CBL)						-		
Revision						-		
Assessment	ssessment					-		
TOTAL	ΓAL					74		
Assessment Methods	5:		•					
Formative:					Summativ	ve:		
Internal practical Test	ţ				Sessional	exam	examination	
Theory Assignments				End semester examination			xamination	
Lab Assignment & V	iva			Viva				
Mapping of assessme	ent with Co	s			·			
Nature of assessment		CO 1	CO 2	CO 3	CO 4		CO 5	
Sessional Examinatio	n 1	*	*					
Sessional Examinatio	n 2		*	*	*			
Assignment/Presentat	ion	*	*	*	*		*	
End Semester Examir	nation	*	*	*	*		*	
Feedback Process	• Mic	l-Semes	ter feedl	back				
	• Enc	l-Semes	ter Feed	back				
Deference Motorial								
Kelerence Material	1. Text A	nalytics	with P	ython: A	Practitioner	's Gu	ide to Natural	
	Language	Process	sing, D	ipanjan S	arkar; Publ	lisher	: Apress, 2nd	
	Edition, 20	19.						
	2. Natural	Langua	ge Proce	ssing with	Python: An	alyzir	ng Text with the	
	Natural La	inguage	Toolki	, by Stev	en Bird, E	wan	Klein, Edward	
	Loper, O'R	eilly Me	edia, Inc	, 1st editio	n 2009.			



3. Hands-On Natural Language Processing with Python: A practical
guide to applying deep learning architectures to your NLP applications,
Rajesh Arumugam, Rajalingappaa Shanmugamani, Packt Publishing
Limited, 2018.



Name of the H	Program:	ME in BDA			
<b>Course Title:</b>		Natural Language and Text Processing Lab			
<b>Course Code:</b>	BDA 621L	Course Instructor:			
Academic Yes	ar: 2020-2021	Semester: First Year, Semester 2			
No of Credits	:1	Prerequisites: BDA 621			
Synopsis:	This course provides	an introduction to programming principles for natural			
	language and text processing.				
Course					
Outcomes	On successful completion of this course, students will be able to				
(COs):					
CO 1:	Access text corpora from different media				
CO 2:	Use regular expressions for analysing and extracting patterns in text data				
CO 3:	Perform text processing using state of the art software libraries				
CO 4:	Classify text documents				
CO 5:	Implement models for sentiment and semantic analysis from text				
Mapping of	COs to POs				

COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	<i>PO</i> 8	PO 9	PO 10	PO 11
CO 1	*				*						
CO 2		*	*		*						
CO 3			*		*						
CO 4			*	*	*						
CO 5		*	*	*	*						

## **Course content and outcomes:**

Content	Competencies	

Unit 1: Natural Language Basics; Accessing, Processing and Understanding Text; Categorizing and Tagging Words

Natural	Language,	Linguistics,	1.	Understand how to access text corpora from
Language S	Semantics, Text	Corpora.		different media (C2).
			2.	Use software libraries for text tokenization
				(C3).



Accessing Text Corpora, from the Web	3. Implement regular expres	ssions for detecting
and from Disk, Conditional Frequency	word patterns (C3).	
Distributions, Regular Expressions for	4. Implement different type	s of word tagging
Detecting Word Patterns, Tokenization.	(C3).	
Using a Tagger, Tagged Corpora,		
Automatic Tagging, N-Gram Tagging,		
Transformation-Based Tagging.		
Unit 2: Classification and Information E	Extraction; Text Similarity a	nd Clustering
Automated Text Classification, TF-IDF	1. Implement different tech	niques to represent
Model, Advanced Word Vectorization	words as vectors, compar	e and contrast them
Models, Classification Algorithms -	(C6).	
Multinomial Naïve Bayes, Support	2. Apply classification algor	rithms for text data
Vector Machines. Text Summarization	(C3).	
and Information Extraction - Text	3. Implement building	blocks of text
Normalization, Feature Extraction,	summarization (C4).	
Keyphrase Extraction, Topic	4. Perform document cluste	ring using software
Modelling, Automated Document	libraries (C3).	
Summarization.		
Term Similarity, Analysing Document		
Similarity, Document Clustering.		
Unit 3: Semantic and Sentiment Analysi	S	
Exploring WordNet, Word Sense	1. Access the WordNet lexica	al database (C3).
Disambiguation, Named Entity 2	2. Perform semantic analysis	of natural language
Recognition, Analysing Semantic	expressions (C3).	
Representations, Sentiment Analysis.	3. Perform sentiment analysi	s of text documents
	(C3).	
Learning strategies, contact hours and s	tudent learning time	
Learning strategy	Contact hours	Student learning
		time (Hrs)
Lecture	-	-



Seminar			-			-		
Quiz	Quiz Small Group Discussion (SGD) Self-directed learning (SDL) Problem Based Learning (PBL) Case Based Learning (CBL)					-		
Small Group Discussi	ion (SGD)		-		-			
Self-directed learning	(SDL)		4		10			
Problem Based Learning (PBL)						10		
Case Based Learning	(CBL)		4			10		
Clinic						-		
Practical Pavision						56		
Revision Assessment						10		
Assessment			6			-		
TOTAL			48			96		
Assessment Methods	5:		•					
Formative:					ve:			
Internal practical Test – yes					examination			
Theory Assignments				End semester examination				
					yes			
Lab Assignment & Vi	iva – <b>yes</b>				Viva			
Mapping of assessme	ent with Co	S						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO	5	
Sessional Examinatio	n 1							
Sessional Examinatio	n 2							
Assignment/Presentat	ion	*	*	*	*		*	
End Semester Examin	nation	*	*	*	*		*	
Laboratory examination *			*	*	*		*	
Feedback Process	• Mie	d-Semes	ter feed	back				
	End-Semester Feedback							
Deference Material	1 Toxt An	Tent Analytics with Dath on A Drastition als Children M. to 14						
Reference Material	Processing	Dinania	n Sarkar	Publisher	Apress 2nd I	Edition $20$	19	
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Name of the	Program	•		ME in	ME in BDA					
Course Title	:			Entre	preneurs	hip				
Course Cod	e: ENP	-601		Cour	se Instr	uctor:	~			
Academic Y	ear: 2020	- 2021		Seme	ster: I	First Ye	ar, Semester	2		
No of Credit	s: 3			Prere	equisites	-				
Synopsis:	This co	This course introduces students to the theory of entrepreneurship and its practical								
	implen	implementation. It focuses on different stages related to the entrepreneurial								
	process	s, inclu	uding l	ousines	s mode	l inno	vation, mo	netizatior	n, small b	ousiness
	manag	management as well as strategies that improve performance of new business								
	venture	ventures. Centered on a mixture of theoretical exploration as well as case studies								
	of real-	of real-world examples and guest lectures, students will develop an understanding								
	of suc	cesses,	opport	unities	and ris	ks of	entrepreneu	urship. Tł	nis course	has an
	interdi	sciplina	ary app	roach a	nd is the	erefore	open to stu	idents from	m other M	ajors.
Course										
Outcomes	On suc	cessful	compl	etion of	f this co	urse, st	tudents will	l be able t	o:	
(COs):										
CO 1.	To imp	oart kno	owledge	e on the	e basics	of entr	epreneurial	skills and	d compete	ncies to
CO 1.	provid	e the pa	articipa	nts with	n necess	ary inp	outs for crea	ation of ne	ew venture	es.
<b>CO 2</b>	To fam	niliarize	the pa	rticipan	ts with	the con	cept and ov	verview of	fentrepren	eurship
CO 2:	with a	view to	o enhan	ce entre	epreneu	rial tale	ent			
CO 3:	To app	raise th	ne entre	preneu	rial proc	cess sta	rting with J	pre-ventu	re stage	
CO 4:	To Cre	eate and	l exploi	it innov	ative bu	isiness	ideas and n	narket op	portunities	5
CO 5.	To Bu	ild a n	nind-se	t focusi	ing on o	develo	ping novel	and uniq	ue approa	iches to
0.05	market	opport	tunities							
<u> </u>	To exp	plore r	new vi	stas of	entrep	reneurs	hip in 21s	st century	environ	ment to
CO 0:	genera	te inno	vative l	ousines	s ideas t	hrough	a case studi	es.		
Mapping of	COs to 1	POs								
COs PO	PO 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11
CO 1 *										
CO 2			*							
CO 3		*			<u> </u>				-	



CO 5			*				
CO 6					*		
Course content and outcomes:					I		
Content	Compe	tencies					
Unit 1: Introduction to Entrepreneurship							
Meaning and Definition of	1.	Explain	the meaning	of Entre	preneursh	ip (C1)	
Entrepreneurship-Employment vs	2.	Discuss	the theories	of Entre	preneurshi	ip (C1)	
Entrepreneurship, Theories of	3.	Discuss	the approac	thes to	Entrepren	eurship	
Entrepreneurship, approach to		(C1)					
entrepreneurship, Entrepreneurs VS							
Manager							
Unit 2: Entrepreneurial Traits							
Personality of an entrepreneur, Types of	1.	Discuss	the Personali	ity traits	of entrepr	eneurs.	
Entrepreneurs		(C2)					
Unit 3: Process of Entrepreneurship							
Factors affecting Entrepreneurship	1.	Identify	the fundame	entals an	d responsi	bilities	
process		of entre	preneurship (	(C2)			
	2.	Exempl	ify one's cap	abilities	in relation	n to the	
		rigors o	f successful v	ventures	(C3)		
	3.	Identify	and diffe	rentiates	s the di	ifferent	
		characte	eristics and	compe	etencies	of an	
		entrepre	eneurs (C2)				
Unit 4: Business Start-up Process							
Idea Generation, Scanning the	1.	Explain	the Process of	of Busin	ess start u	p (C1)	
Environment, Macro and Micro	2.	Develop	o creativity	and crit	tical think	ting in	
analysis		identify	ing opportun	ities (C5	)		
	3.	Apply i	nnovative ap	proache	es in envis	sioning	
		ones en	trepreneurial	career (	C3)		
Unit 5: Business Plan writing							
Points to be considered, Model Business	1.	Identify	different bus	siness m	odels (C3)	)	
plan	2.	Describ	e different pa	rts of a b	ousiness pl	an(C2)	
Unit 6: Case studies							



(Deemed to be University under Section 3 of the UGC Act, 1956)

Indian and Interna	ational	1. Perform	n self-a	ssessme	nt and	analyse	
Entrepreneurship		entrepr	eneurial	persor	nal trai	ts and	
		compet	tencies (C4	4)			
		2. Evalua	te oneself :	and plan	courses o	f action to	
		help	develop	one'	s entre	preneurial	
		charact	eristics and	d compe	etencies. (C	25)	
Learning strategies, contact ho	urs and s	tudent learni	ng time				
Learning strategy		Contact hou	rs		Student	learning	
					time (Hrs	)	
Lecture		30			60		
Quiz		02			04		
Small Group Discussion (SGD)		02			02		
Self-directed learning (SDL)		-			04		
Problem Based Learning (PBL)		02			04		
Case Based Learning (CBL)		-			-		
Revision		02			-		
Assessment		06 -					
TOTAL		44			74		
Assessment Methods:							
Formative:			Summa	tive:			
Internal practical Test			Sessiona	l exami	nation		
Theory Assignments			End sem	ester ex	amination		
Lab Assignment & Viva			Viva				
Mapping of assessment with Co	)S						
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	
Sessional Examination 1	*	*					
Sessional Examination 2			*	*			
Assignment/Presentation					*	*	
End Semester Examination	*	*	*	*	*	*	



Feedback Process	•		Mid-Semester feedback					
	•		End-Semester Feedback					
<b>Reference Material</b>	1	•	NVR Naidu and T. Krishna Rao, "Management and					
			Entrepreneurship", IK International Publishing House Pvt. Ltd					
			2008.					
	2		Mohanthy Sangram Keshari, "Fundamentals of					
			Entrepreneurship", PHI Publications, 2005					
	Ĵ	<b>}.</b>	Butler, D. (2006). Enterprise planning and development. USA:					
			Elsevier Ltd. Gerber, M.E. (2008) Awakening the entrepreneur					
			within. NY: Harper Collins.					



Name of the Program:			ME in	ME in BDA									
Course	Title:				Entre	Entrepreneurship Lab							
Course	Code:	ENP-60	)1L		Cour	Course Instructor:							
Acader	nic Yea	nr: 2020	- 2021		Seme	Semester: First Year, Semester 2							
No of C	Credits:	1			Prere	equisites	: -						
Synop	sis:	This Co	This Course provides insight on										
		This course introduces students to the theory of entrepreneurship and its											
		practical implementation. It focuses on different stages related to the											
		entrepreneurial process, including business model innovation, monetization,											
		small business management as well as strategies that improve performance of						nance of					
		new bu	siness	venture	s. Cant	ered on	a mixtu	re of theor	retical ex	kploration	n as well		
		as case	studies	of real	-world	exampl	es and g	uest lectu	res, stud	lents will	develop		
		an und	erstand	ling of	succes	ses, op	portunit	ies and r	isks of	entrepren	eurship.		
		This co	ourse ha	as an in	terdisci	iplinary	approac	ch and is t	herefore	e open to	students		
		from of	ther Ma	ajors.									
Course	e												
Outco	mes	On suc	cessful	comple	etion of	f this co	urse, stu	idents wil	l be able	e to			
(COs):	:												
CO 1:		Unders	tand th	e conce	ept of e	ntreprei	neurship	)					
CO 2.		To app	raise th	e entre	preneui	rial proc	ess star	ting with j	pre-vent	ure stage	through		
0.02.		group o	liscussi	ion									
		To Bui	ld a m	ind-set	focusir	ng on de	evelopin	ig novel a	nd uniq	ue appro	aches to		
CO 3:		market	opport	unities	by con	sidering	g case st	udies and	underst	and the c	omplete		
		flow of	entrep	reneurs	ship								
Mappi	ing of (	COs to 1	POs										
COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO 8	PO 9	PO 10	PO 11		
CO 1	*					*		*					
CO 2						*							
CO 3								*		*			
Course	Course content and outcomes:												



Content	Competencies				
Unit 1: Introduction to Entrepreneur	ship				
Meaning and Definition of	1. Discuss the theories	of Entrepreneurship			
Entrepreneurship-Employment vs	(C1)				
Entrepreneurship, Theories of	2. Discuss the approaches	s to Entrepreneurship			
Entrepreneurship, approach to	(C1)				
entrepreneurship, Entrepreneurs VS					
Manager					
Unit 2: Process of Entrepreneurship					
Factors affecting Entrepreneurship	1. Exemplify one's capal	bilities in relation to			
process	the rigors of successful	l ventures (C3)			
	2. Identify and differen	tiates the different			
	characteristics and c	ompetencies of an			
	entrepreneurs (C2)				
Unit 3: Business Plan writing					
Points to be considered, Model Business	1. Identify different business models (C3)				
plan	Describe different parts of a business plan(C2)				
Unit 4: Case studies					
Indian and International	1. Perform self-assessn	nent and analyse			
Entrepreneurship	entrepreneurial pers	sonal traits and			
	competencies (C4)				
	2. Evaluate oneself and p	lan courses of action			
	to help develop or	ne's entrepreneurial			
	characteristics and con	npetencies. (C5)			
Learning strategies, contact hours and s	student learning time				
Learning strategy	Contact hours	Student learning			
		time (Hrs)			
Lecture	12	-			
Seminar	-	-			



Quiz		-		-	
Small Group Discussion (SGD	)	-	-		
Self-directed learning (SDL)		-	-		
Problem Based Learning (PBL	)	-		-	
Case Based Learning (CBL)		03		-	
Clinic		-		-	
Practical		24		-	
Revision		03		-	
Assessment		06		-	
TOTAL		48		-	
Assessment Methods:					
Formative:			Summati	ve:	
Internal practical Test			examination		
Theory Assignments			ester examination		
Lab Assignment & Viva					
Mapping of assessment with	Cos				
Nature of assessment	CO 1	CO 2		CO 3	
Sessional Examination 1	*	*			
Sessional Examination 2		*		:	
Assignment/Presentation		*	*		
Laboratory Examination	*	* *		:	
Feedback Process	Mid-Semeste	er feedback			
• 1	End-Semeste	er Feedback			
Deference Material 1	WD Noid	u and T Vric	han Doo	"Managament and	
	nvic Indici	u allu I. Kiis	tional Dubli	ishing House Dut I to	
	2008.	isinp , ix interna	uonai ruon	isning flouse rvi. Lla	
2. 1	Mohanthy	Sangram K	eshari,	"Fundamentals of	
	Entrepreneur	rship", PHI Publi	)5		



3.	Butler, D. (2006). Enterprise planning and development. USA:
	Elsevier Ltd. Gerber, M.E. (2008) Awakening the entrepreneur
	within. NY: Harper Collins.

Name of the P	rogram:	ogram: ME in BDA					
<b>Course Title:</b>		Mini Project - 2					
Course Code:	BDA 696	Course Instructor:					
<b>Academic Year:</b> 2020 - 2021		Semester: First Year, Semester 2					
No of Credits:	: 4	Prerequisites: Any programming language and circuit					
		basics					
Synopsis:	Students are expected	to select a problem in the area of their interest and the					
	area of their specialization that would require an implementation in hardware /						
	software or both in a semester						



Course	e											
Outco	mes	On suc	On successful completion of this course, students will be able to									
(COs):	:											
CO	1.	Apply the objectives of the project work and provide an adequate background										
	1.	with a	with a detailed literature survey									
	2	Breakd	Breakdown the project into sub blocks with sufficient details to allow the work									
0	2:	to be reproduced by an independent researcher										
		Compose hardware/software design, algorithms, flowchart, methodology, and							ogy, and			
co	3:	block d	liagram	1								
CO	4:	Evalua	te the r	esults								
CO	5:	Summa	arize th	e work	carri	ed	out					
Маррі	ing of (	COs to l	POs									
COs	PO 1	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	PO 5	5	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11
CO 1				*								
CO 2					*				*			
CO 3								*			*	
CO 4							*					*
CO5:								*				
Course	e conte	nt and	outcon	nes:	l							
Conten	ıt					(	Compete	encies				
Phase	1											
Problem	m i	dentifica	ation,	sync	psis	I	At the en	nd of the t	opic stu	ident sh	ould be a	ble to:
submis	sion,	status	submis	ssion,	mid	8	3. Iden	tify the pro-	oblem/s	specifica	ation (C1)	)
evaluat	tion.					9	). Disc	uss the pro	oject (C	22)		
						1	0. Prep	are the ou	tline (C	(3)		
						1	1. Desc	ribe the st	tatus of	the pro	ject (C2)	
						1	2. Prep	are a mid-	-term p	roject p	resentatio	on report
(C3)												
						1	3. Prep	are and	pres	ent m	id-term	project
							prese	entation sl	ides (C	3, C5)		



	14. Develop pr	oject in	mplementation in
	hardware/softw	vare or both	h in chosen platform
	(C5)		
Phase 2			
Status submission, final evaluation.	6. Prepare the pro	gress repor	rt (C3)
	7. Prepare the fi	nal project	t presentation report
	(C3)		
	8. Prepare and pr	esent final	project presentation
	slides (C3, C5)	)	
	9. Modify and	Develop	implementation in
	hardware/softw	vare or both	h in chosen platform
	(C3, C5)		
	10. Justify the me	thods used	and obtained results
	(C6)		
Learning strategies, contact hours and	student learning t	ime	
Learning strategy	Contact hours		Student learning
			time (Hrs)
Lecture	-		-
Seminar	-		-
Quiz	-		-
Small Group Discussion (SGD)	48		-
Self-directed learning (SDL)	-		-
Problem Based Learning (PBL)	-		-
Case Based Learning (CBL)	-		-
Clinic	-		-
Practical	-		-
Revision	-		-
Assessment	03		-
TOTAL	51		09
Assessment Methods:	·		
Formative:		Summati	ve:



Project Problem Selection					Mid-Term Presentation		
Synopsys review	Second status	Second status review					
First status review					Demo & Final Presentation		
Mapping of assessme	ent with Co	S					
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	
Mid Presentation		*	*				
Presentation		*	*	*	*	*	
Feedback Process	End-Semester Feedback						
<b>Reference Material</b>	Particular t	to the ch	nosen proj	ect			

Name of the F	Program: ME in BDA					
<b>Course Title:</b>		Seminar - 2				
Course Code: BDA 698		Course Instructor:				
Academic Year: 2020 - 2021		Semester: First Year, Semester 2				
No of Credits	: 1	Prerequisites: Communication Skill				
Synopsis:	1. To select, search a	. To select, search and learn technical literature.				
	2. To Identify a curr	ent and relevant research topic.				
	3. To prepare a topic	e and deliver a presentation.				
	4. To develop the sk	4. To develop the skill to write a technical report.				
	5. Develop ability to	work in groups to review and modify technical content.				



Cours	e													
Outco	mes	On suc	cessful	compl	etion of	f this co	urse, stude	ents wi	ll be	able	e to			
(COs)	:													
CO 1.		Show of	compete	ence in	identif	ying rel	evant infor	mation	n, def	finir	ng and ex	plaining		
		topics	under d	iscussi	on.									
		Show of	Show competence in working with a methodology, structuring their oral work,											
CO 2:		and synthesizing information.												
		Use appropriate registers and vocabulary, and will demonstrate command of												
CO 3:		voice r	nodulat	tion, vo	oice pro	jection, and pacing.								
<u> </u>		Demor	strate	that the	ey have	e paid close attention to what others say and can								
CO 4:		respond constructively.												
		Develop persuasive speech, present information in a compelling, well-												
CO 5.		structured, and logical sequence, respond respectfully to opposing ideas, show												
0.0.5.		depth of knowledge of complex subjects, and develop their ability to												
	synthesize, evaluate and ref					lect on i	nformation	1.						
Mappi	ing of (	COs to 1	POs											
COs	<i>PO 1</i>	<i>PO</i> 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	PO 6	<i>PO</i> 7	PO	PO	9	PO 10	PO 11		
								8						
CO 1	*							*	*			*		
CO 2	*							*	*			*		
CO 3	*							*	*			*		
CO 4	*							*	*			*		
CO5:	*							*	*			*		
Learn	ing str	ategies,	contac	t hour	s and s	tudent	learning t	ime						
Learni	ng strai	egy				Conta	ct hours			Stı	ıdent	learning		
										tin	ne (Hrs)			
Lectur	e					-				-				
Semina	ar					-					-			
Quiz						-				-				
Small	Group	Discussi	ion (SC	iD)		14				-				
Self-di	rected	learning	(SDL)			-					-			



Problem Based Learn	Problem Based Learning (PBL)					-			
Case Based Learning	(CBL)		-			-			
Clinic			-			-			
Practical			-			-			
Revision			-			-			
Assessment			-			-			
TOTAL			14			-			
Assessment Methods:									
Formative:					Summat	tive:			
Seminar Topic Select	ion								
Synopsys review									
PPT Review									
Mapping of assessme	ent with Co	S							
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5			
Presentation		*	*	*	*	*			
Feedback Process	l-Semeste	er Feedbac	:k						
<b>Reference Material</b>	Particular t	to the chos	sen Semir	nar					

Name of the H	Program:	ME in BDA								
<b>Course Title:</b>		Project Work								
Course Code:	BDA 799	Course Instructor:								
Academic Yea	ar: 2020 - 2021	Semester: Second Year, Semester 3, 4								
No of Credits	: 25	Prerequisites: SDLC, Communication Skills, technical								
		skills.								
Synopsis:	The project work aims to challenge analytical, creative ability and to allow									
	students to synthesiz	e, apply the expertise and insight learned in the core								
	discipline.									
	Students build self-	confidence, demonstrate independence, and develop								
	professionalism on su	accessfully completion of the project.								



Course	e													
Outco	mes	On suc	cessful	compl	etion	of t	this co	urse, stud	ents wil	l be able	e to			
(COs):	:													
CO	1.	To be a	acquain	ted wit	h wo	rking environment and processes that in place at the								
	1.	relevar	nt Indus	stries.										
CO	2:	To fan	niliarize	the ch	alleng	ges	as rele	evant professionals.						
<b>CO 3:</b> Review the literature and							develop solutions for real time onboard projects.							
<b>CO 4:</b> Write technical report and							deliver presentation.							
<b>CO 5:</b> Apply engineering and m						inag	gemen	t principle	es to ach	nieve pro	oject goal			
Mappi	ing of (	COs to 1	POs											
COs	PO 1	PO 2	<i>PO 3</i>	<i>PO</i> 4	<i>PO</i> 5	;   j	PO 6	<i>PO</i> 7	PO 8	<i>PO</i> 9	PO 10	PO 11		
CO 1						:	*	*	*	*	*	*		
CO 2					*									
CO 3	*	*	*	*	*									
CO 4	*	*	*	*										
CO5:						:	*	*	*	*	*	*		
Course	e conte	ent and	outcon	nes:	1									
Conter	ıt					Ca	ompetencies							
Phase	1:													
Proble	m i	dentific	ation,	sync	psis	At the end of the topic student should be able to:								
submis	ssion,	status	submis	ssion,	mid	1.	Ident	tify the pr	oblem/s	specifica	tion (C1)	)		
evaluat	tion.					2.	Disc	uss the pr	oject (C	22)				
						3.	Prep	are the ou	ıtline (C	3)				
						4.	Prep	are a mid	-term p	roject pi	resentatio	on report		
							(C3)							
						5.	Prep	are and	pres	ent m	id-term	project		
							prese	entation s	lides (C	3, C5)				
						6.	Deve	elop p	oroject	imple	ementatio	on in		
							hard	ware/soft	ware or	both in	chosen ]	platform		
							(C5)							
Phase	2													



SPIRED BY LIFE	(Deemed to be University under Section 3 of the UGC Act, 1956)	
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Status submission, final evaluation.	1.	Prepare the progress report	t (C3)	
	2.	Prepare the final project	presentatio	on report
		(C3)		
	3.	Prepare and present final	project pre	esentation
		slides (C3, C5)		
	4.	Modify and Develop	implement	ation in
		hardware/software or both	n in chosen	platform
		(C3, C5)		
	5.	Justify the methods used	and obtaine	ed results
		(C6)		
Learning strategies, contact hours and	stu	ident learning time		
Learning strategy		Contact hours	Student	learning

Learning strategy	Contact no	<i>u</i> 15	Sindeni ieurning
			time (Hrs)
Lecture	-		-
Seminar	-		-
Quiz	-		-
Small Group Discussion (SGD)	14		-
Self-directed learning (SDL)	-		-
Problem Based Learning (PBL)	-		-
Case Based Learning (CBL)	-		-
Clinic	-		-
Practical	-		-
Revision	-		-
Assessment	-		-
TOTAL	14	time         - <tr tr=""></tr>	-
Assessment Methods:			•
Formative:		Summati	ive:
Project Problem Selection		Mid-Tern	n Presentation
Synopsys review		Second st	tatus review
First status review		Demo &	Final Presentation



Mapping of assessment with Cos										
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5					
Mid Presentation	*	*								
Presentation	*	*	*	*	*					
Feedback Process	• End	l-Semes	ster Feedb	ack						
<b>Reference Material</b>	Particular t	Particular to the chosen project								





## PROGRAM OUTCOMES (POS) AND COURSE OUTCMES (COS) MAPPING



SI.No.	Course Code	Course Name	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	BDA 601	Fundamentals of Machine Learning	3	*	*	*		*						
2	BDA 602	Algorithms and Data Structures for Big Data	3	*	*	*		*						
3	BDA 603	Probability and Statistical Inferences	3	*	*	*		*						
4	BDA 604	Large Scale Distributed Computing Systems	3	*	*	*		*						
5		Elective - 1	3	*	*	*		*						
6	BDA 601L	Fundamentals of Machine Learning Lab	1		*	*	*	*						
7	BDA 602L	Algorithms and Data Structures for Big Data Lab	1		*	*	*	*						
8	BDA 603L	Probability and Statistical Inferences Lab	1		*	*	*	*						
9	BDA 604L	Large Scale Distributed Computing Systems Lab	1		*	*	*	*						
10		Elective – 1 Lab	1		*	*	*	*						
11	BDA 695	Mini Project - 1	4				*	*	*	*	*	*	*	*
12	BDA 697	Seminar - 1	1	*							*	*		*
13	BDA 605	Machine Learning for Big Data	3	*	*	*		*						
14	BDA 606	Architecture of Big Data Systems	3	*	*	*		*						
15	BDA 607	Multiple Linear Regression and Logistic	3	*	*	*		*						
16	BDA 608	HealthCare Informatics	3	*	*	*		*						
17		Elective - 2	3	*	*	*		*						



18	BDA 605L	Machine Learning for Big Data Lab	1		*	*	*	*						
19	BDA 606L	Architecture of Big Data Systems Lab	1		*	*	*	*						
20	BDA 607L	Multiple Linear Regression and Logistic Lab	1		*	*	*	*						
21	BDA 608L	Healthcare Informatics lab	1		*	*	*	*						
22		Elective – 2 Lab	1		*	*	*	*						
23	I BDA 696	Mini Project - 2	4				*	*	*	*	*	*	*	*
24	BDA 698	Seminar - 2	1	*							*	*		*
25	BDA 799	Project Work	25	*	*	*	*	*	*	*	*	*	*	*