

(An Autonomous Institute Affiliated to RGPV Bhopal)

Name of the course:			B. Tech in Artificial Intelligence and Data Science								
Semester and Year of study		B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester									
Subject Category			Engineering Science Course (PCC)								
Subject	SubjectCode: AI-2071 Subject Name: Big Data Analytics										
Maximum Marks Allotted									Total		
	Theory		Pra	ctical	Total	Com	actin	Juis	Credits		
End Sei	m Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Ρ	Crouito		
70	20	10	30	20		3		2	4		
Prerequ	uisites:										
Should h	ave knowledge of	i one Program	ming Langua	ge (Java prefe	rably), Prac	tice of S	SQL (q	uerie	s and sub		
queries),	exposure to Linux	Environment.									
Course	Objective:										
Unders	tand the Big Data	Platform and i	its Use cases								
Provide	an overview of A	pache Hadoop	)								
Provide	HDFS Concepts a	nd Interfacing	with HDFS								
Unders	tand Map Reduce	Jobs									
Provide	hands on Hodoo	p Eco System									
• Apply a	nalytics on Struct	ured, Unstruct	ured Data.								
• Exposu	re to Data Analyti	cs with R.									
Course	Outcomes: Aft	ter completio	on of this co	ourse studer	nts will be	able to	):				
<ul> <li>Identify</li> </ul>	Big Data and its B	Business Implic	cations.								
• List the	components of H	adoop and Ha	doop Eco-Sys	tem							
• Access	and Process Data	on Distributed	l File System								
• Manag	e Job Execution in	Hadoop Envir	onment								
Develo	o Big Data Solution	ns using Hadoo	op Eco Systen	n							
Analyze	e Infosphere BigIn	sights Big Data	Recommend	lations.							
Apply N	Aachine Learning <sup>-</sup>	Techniques us	ing R.								
UNITS			Descriptio	ns				lrs.	CO's		
	UNIT I : INT	<b>FRODUCT</b>	ION TO B	IG DATA A	AND HAD	DOOP					
	Types of Di	gital Data.	Introduction	on to Big	Data, Bi	g Dat	a				
	Analytics. Hi	story of Ha	doop. Apac	che Hadoon	Analysir	g Dat	a				
	with Unix too	ls Analysin	o Data with	Hadoon Ha	adoon Stre	amino	,	8	1,2		
Hadoon Echo System IBM Big Data Strategy Introduction to											
	Infosphere Bi	alneighte an	d Big Shee	te	, muouu						
	mosphere Di		u Dig Slice	18.							
			<b></b>								
	UNIT II : H	DFS(Hadoo	op Distribu	ited File Sys	stem)	_					
1	The Design of	f HDFS, HD	OFS Concep	ots, Commar	nd Line In	terface	,	8	3		
	Hadoop file s	ystem interfa	aces, Data f	flow, Data I	ngest with	Flum	e	5	5		
	and Scoop a	nd Hadoop	archives,	Hadoop I/0	O: Comp	ressior	I,				
	Serialization,	Avro and Fi	ile-Based D	ata structure	es.						

111	<b>UNIT III : Map Reduce</b> Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	8	4
IV	<ul> <li>Hadoop Eco System</li> <li>Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.</li> <li>Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.</li> <li>Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.</li> <li>Big SQL : Introduction</li> </ul>	8	5
V	<b>Data Analytics with R</b> Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	8	6,7
Guest I	actures (if any)		
Total H			
Suggest	ive list of experiments:		
<ol> <li>Implem Hive m Hive qu 6 hours</li> <li>Imple Hive viethe externation</li> <li>Imple the externation</li> <li>Implem database</li> <li>Sqoop.</li> <li>hours</li> <li>Implem database</li> <li>Sqoop.</li> <li>hours</li> <li>Progr Hadoopp partition</li> <li>hours</li> <li>Progr Source</li> <li>Progr Source</li> <li>Progr Source</li> <li>Progr Source</li> <li>Progr Source</li> <li>Implem</li> <li>Hadoopp</li> <li>Progr Source</li> <li>Progr</li> <li>Source</li> <li>Progr</li> <li>Source</li> <li>Progr</li> <li>Source</li> <li>Total L</li> </ol>	lement a program using Piglatin operators and user defined function ent a program using operators and Piglatin scripts Program using anipulation and data definition languages. Implement a program using there is with partitioning. ement a program using Hive indexes. Implement a program using ews Implement a program using Hive external table by accessing rmal file created by Pigor any other tool. Program using Hive and aggregate functions ement a program using Hive queries with bucketing and clustering. ent a program for data transfer between Hadoop and external e using sqoop. Program to import data and incremental data in ram to preserve the value in sqoop Program to export data from using sqoop Program to import data to hive and using hed hive tables ram for inverted index using solr Program for indexing operations us in solr. Program to search data using solr	s ng ing	
Text Boo Tom Whi	ok- te " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.		

• Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books-

Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R

Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

• Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

• Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

• Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007

• Pete Warden, "Big Data Glossary", O'Reily, 2011.

• Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

• ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

• Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

List and Links of e-learning resources:

1.

#### Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	CS & IT

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Dr. Kanak Saxena Chairperson



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Name of the course:			B. Tech in Artificial Intelligence and Data Science						
Semester and Year of study			B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester						
Subject	Category		Engineering Science Course (PCC)						
Subject	Code:AI-2072		Subject N	ame: Proba	abilistic G	Fraph	ical N	<b>leth</b>	ods
	Ma	iximum Mar	rks Allotted	1	r	Con	tact H	oure	
	Theory		Prac	tical	Total	Con		ours	Total
End Ser	n Mid- Sem	Quiz	End Sem	Lab- Work	Marks	L	Т	Р	Credits
70	20	10			100	3	1		4
Prerequi	sites:								
Students	are expecte	ed to have	backgrou	ind in bas	sic proba	bility	theo	ry, s	statistics,
program	ming, algorith	m design an	nd analysis						
Course (	Objective:								
The aim of this course is to develop the knowledge and skills necessary to design, implement and apply these models to solve real problems. The course will cover: (1) Bayesian networks, undirected graphical models and their temporal extensions; (2) exact and approximate inference methods;									
Course	Dutcomes: Af	ter completi	on of this $c$	ourse stude	nts will he	able	to:		
1 Solv	e real world p	roblems		ourse stude			10.		
2. Creati	ng both direct	ed and undi	rected gran	hical model	ls for data				
3 Identi	fving conditio	nal independ	dencies in g	pranhical m	odels				
4 Speci	ving distribut	ions for para	ameters of 1	nodel com	nonents th	at linl	c the r	node	l to data
5 Apply	ing exact infe	rence metho	ds to comr	ute margin	al probabi	lities	and m	axim	ally
probable	configuration	is given a m	odel (sum-	product and	l max-sum	n algor	rithms		lully
respectiv	velv)							,	
6. Apply	ing approximation	ate inference	e to learn m	odel param	eters usin	g exp	ectatio	on	
maximiz	ation (EM alg	orithm), var	iational inf	erence, and	l various N	Aarko	v chai	in Mo	onte
Carlo m	ethods includi	ng Metropol	lis Hastings	s sampling,	Gibbs san	npling	g, and	Ham	iltonian
Monte Carlo.									
7. Use th	e various vari	ous concept	s learnt to	present a ve	ery influen	tial re	ecent p	oroba	bilistic
model ca	model called the variational autoencoder.								
UNITs			Descriptio	ons			Η	rs.	CO's
Ι	Intro mode Proba Rand deno	duction: W eling? <u>Revi</u> e ability distr om variabl ising. RNA	hat is prol ew of prol ributions. les, <u>Real-w</u> structure	pabilistic g pability the Conditiona orld applic prediction	raphical eory: al probab cations: In . Syntact	oility. mage ic		8	1

	analysis of sentences. Optical character recognition. Language Modeling .		
II	<b>UNIT II: Representation</b> <u>Bayesian networks</u> : Definitions. Representations via directed graphs. Independencies in directed models. <u>Markov random fields</u> : Undirected vs directed models. Independencies in undirected models. Conditional random fields.	8	2,3
III	UNIT III Inference Variable elimination The inference problem. Variable elimination. Complexity of inference. Belief propagation: The junction tree algorithm. Exact inference in arbitrary graphs. Loopy Belief Propagation. <u>MAP inference</u> : Max-sum message passing. Graphcuts. Linear programming relaxations. Dual decomposition. Sampling-based inference: Monte-Carlo sampling. Forward Sampling. Rejection Sampling. Importance sampling. Markov Chain Monte-Carlo. Applications in inference. Variational inference: Variational lower bounds. Mean Field. Marginal polytope and its relaxations.	8	4,5
IV	Unit <i>IV Learning</i> : Learning in directed models: Maximum likelihood estimation. Learning theory basics. Maximum likelihood estimators for Bayesian networks. Learning in undirected models: Exponential families. Maximum likelihood estimation with gradient descent. Learning in CRFs. Learning in latent variable models: Latent variable models. Gaussian mixture models. Expectation maximization. Bayesian learning: Bayesian paradigm. Conjugate priors. Examples . <u>Structure learning</u> : Chow-Liu algorithm. Akaike information criterion. Bayesian information criterion. Bayesian structure learning .	8	6
V	UnitV:Bringing it all together: <u>The variational autoencoder</u> : Deep generative models. The reparametrization trick. Learning latent visual representations. <u>List of further</u> <u>readings</u> : Structured support vector machines. Bayesian non-parametrics.	8	7

Guest Lectures (if any)						
Total Hours 40						
Suggestive list of experiments: No Lab		<u> </u>				
Text Books: ("PGM") Probabilistic Graphical	Models: Principles and Techn	iques b	y Daphne			
Koller and Nir Friedman. MIT Press.						
Reference Books-						
<ul> <li>("GEV") Graphical models, exponential families, and variational inference by Martin J. Wainwright and Michael I. Jordan. Available <u>online</u>.</li> <li><i>Modeling and Reasoning with Bayesian Networks</i> by Adnan Darwiche. Available <u>online</u> (through Stanford).</li> <li><i>Pattern Recognition and Machine Learning</i> by Chris Bishop. Available <u>online</u>.</li> <li><i>Machine Learning: A Probabilistic Perspective</i> by Kevin P. Murphy. Available <u>online</u> (through Stanford).</li> <li><i>Information Theory, Inference, and Learning Algorithms</i> by David J. C. Mackay. Available <u>online</u>.</li> <li><i>Bayesian Reasoning and Machine Learning</i> by David Barber. Available <u>online</u>.</li> </ul>						
List and Links of e-learning resources:						
1. https://ermongroup.github.io/cs228	-notes/					
Modes of Evaluation and Rubric	monos in Trus mid somest	ал <b>Т</b> ал				
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.						
Recommendation by Board of studies on						
Approval by Academic council on						
Compiled and designed by	CS & IT					

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Jourene Dr. Kanak Saxena Chairperson



(An Autonomous Institute Affiliated to RGPV Bhopal)

#### Department of Computer Science and Engineering IT Syllabus applicable to July 2020 admitted

Name of the course:			B. Tech in Artificial Intelligence and Data Science						
Semester and Year of study			B. Tech 4	B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester					
Subject Category			Engineerii	Engineering Science Course (PCC)					
SubjectCode:AI-2073			Subject N	Subject Name: Deep Learning					
Maximum Ma			rks Allotted			Contact Hours		Tatal	
Theory		Practical		Total	00		Juis	l otal Credite	
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Ρ	oreans
70	20	10	30	20	150	3	-	2	4

Prerequisites:

Course Objective:

This course will introduce the theoretical foundations, algorithms, methodologies, and applications of neural networks and deep learning. It will help to design and develop an application-specific deep learning models and also provide the practical knowledge handling and analysing real world applications.

Course Outcomes: After completion of this course students will be able to

1. Have a good understanding of the fundamental issues and basics of machine learning

2. Ability to differentiate the concept of machine learning with deep learning techniques

3. Understand the concept of CNN and transfer learning techniques, to apply it in the classification problems

4. Learned to use RNN for language modelling and time series prediction.

5. Use autoencoder and deep generative models to solve problems with high dimensional data including text, image and speech.

6. Design and implement various machine learning algorithms in a range of real-world applications.

UNITs	Descriptions	Hrs.	CO's
Γ	Machine Learning Basics: Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.	5	1
II	Introduction to Deep Learning & Architectures Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders.	5	2
III	Convolutional Neural Networks	5	3

	Architectural Overview – Motivation - Layers – Filters –					
	Parameter sharing – Regularization, Popular CNN Architectures:					
	ResNet, AlexNet.					
IV	<b>Transfer Learning</b> Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet. <b>Sequence Modelling – Recurrent and Recursive Nets</b> Recurrent Neural Networks, Bidirectional RNNs – Encoder- decoder sequence to sequence architechures - BPTT for training RNN, Long Short Term Memory Networks.	7	3,4			
	Auto Encoders					
	Under complete Autoencoders - Regulraized Autoencoders -					
	stochastic Encoders and Decoders – Contractive Encoders					
V	Deep Generative Models	9	5,6			
	Deep Belief networks – Boltzmann Machines – Deep Boltzmann					
	Machine - Generative Adversial Networks.					
	Recentifiends					
Guest Le	ctures (if any)					
Total Ho	urs					
Suggest	ive list of experiments:					
<ul> <li>Suggestive list of experiments:</li> <li>1. Classification with Multilayer Perceptron using Scikit-learn (MNIST Dataset) 3 hours</li> <li>2. Hyper-Parameter Tuning in Multilayer Perceptron 3 hours</li> <li>3. Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch 2 hours</li> <li>4. Classification of MNIST Dataset using CNN 2 hours</li> <li>5. Parameter Tuning in CNN 2 hours</li> <li>6. Sentiment Analysis using CNN 2 hours</li> <li>7. Face recognition using Transfer Learning of CNN architectures 2 hours</li> <li>9. Recommendation system using Deep Learning 2 hours</li> <li>10. Dimensionality Reduction using RNN 2 hours</li> <li>11. Language Modeling using RNN 2 hours</li> <li>13. Sentiment Analysis using LSTM 2 hours</li> <li>14. Image generation using GAN 2 hours</li> </ul>						
l lext Boo	K- I. Ian Goodfellow, Yoshua Benglo and Aaron Courville,	Deep				
Learning", MIT Press, 2017. 2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017						
Referenc	e Books-					

1. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding

Deep Neural Networks" Apress, 2018.

2. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.

3. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall

of India, Third

Edition 2014.

4. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow:

Explore neural networks with Python", Packt Publisher, 2017.

5. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.

6. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

List and Links of e-learning resources:

1.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	
Approval by Academic council on	
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Name of the course:			B. Tech in Artificial Intelligence and Data Science						
Semester and Year of study			B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester						
Subject Category			Engineering Science Course (OEC)						
Subject	Code:AI-2074	(A)	Subject Name: Automata Theory and Compiler Design						
	Ma	ximum Ma	rks Allotte	d		C	Contac	ct	Total
	Theory		Prac	ctical	Total	]	Hours	5	Credits
End Sen	n Mid- Sem	Quiz	End Sem	Lab- Work	Marks	L	Т	Р	
70	20	10			100	3	-	-	3
		I.		1					
Prerequi	sites:								
Formal	Languages a	nd Autom	ata Theory	, Graph T	'heory.				
Course (	Objective:		·	<u> </u>	•				
To provi	de an underst	anding of a	utomata, g	rammars, la	anguage ti	ransla	tors.		
To knov	v the various t	techniques	used in cor	npiler cons	truction				
To be av	ware of the pro-	ocess of ser	mantic anal	lysis.					
To analy	ze the code o	ptimization	n & code ge	eneration te	chniques				
Course	Outcomes: Af	ter comple	tion of this	course stud	dents will	be ab	le to		
Explain	deterministic	and non-de	eterministic	machines.					
Comprel	hend the hiera	urchy of pro	blems arisi	ing in the c	omputer				
sciences									
Design a	a deterministic	c finite-state	e machine	to accept a	specified				
language	e.								
Explain	how a compil	er can be c	onstructed	for a simpl	e context				
free lang	guage.								
Determin	ne a language	's location	in the Chor	msky hiera	rchy (regu	lar			
sets, con	text-free, con	text-sensiti	ve, and rec	ursively en	umerable	langu	lages)	).	
UNITS			Description	ons			H	lrs.	CO's
	Formal Lang	guage and R	legular Exp	pressions: L	anguages	,			
	Definition La	anguages re	egular expr	essions, Fin	nite Auton	nata –	-	0	
1	DFA, NFA.C	Conversion	of regular	expression	to NFA, I	NFA t	0	8	1
	DFA. Applic	cations of F	inite Autor	nata to lexi	cal analys	as, lez	K		
	tools.		1 .	<u> </u>	C				
	Context Free	e grammars	and parsin	g: Context	Tree gran	1 mars	,		
derivation, parse trees, ambiguity LL(K) grammars and LL(1)									
п	Parsing Botto	Din up parsi	ng, nanule	pruning, L	rommore	dľ		0	2
11	raising, LAI	LK parsing,	parsing an	Evoluoting	Clocation	120		0	L
	Cluster Anal	amming sp	ns Altorno	.Evaluating	y Classifie	18,			
	Clusici Allal	y 515(K-1VICa	(k-Means, Alternatives to k-means),						
To be aware of the process of semantic analysis.         To analyze the code optimization & code generation techniques         Course Outcomes: After completion of this course students will be able to         Explain deterministic and non-deterministic machines.       Comprehend the hierarchy of problems arising in the computer         sciences.       Design a deterministic finite-state machine to accept a specified         language.       Explain how a compiler can be constructed for a simple context         free language.       Determine a language's location in the Chomsky hierarchy (regular sets, context-free, context-sensitive, and recursively enumerable languages).         UNITs       Descriptions         Hrs.       CO's         Formal Language and Regular Expressions: Languages, Definition Languages regular expressions to NFA, NFA to 8       1         DFA. Applications of Finite Automata to lexical analysis, lex tools.       Explain the grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing, handle pruning, LR Grammar       8       2         YACC programming specification Evaluating Classifiers.       8       2							CO's 1 2		

ш	Semantics : Syntax directed transla attributed grammars, Intermediate translation of simple statements an Context Sensitive features – Chorn and recognizers. Type checking, ty equivalence of type expressions, o operations.	8	3				
IV	Symbol table, Storage organization strategies scope access to now loca language facilities for dynamics str optimization Principal sources of o of basic blocks, peephole optimization optimization techniques.	8	4				
V	Code generation : Machine depend code forms, generic code generation allocation and assignment. Using I Block.	8	5				
Guest L	ectures (if any)						
Total H	lours						
Suggest	ive list of experiments:						
NO La	b						
<ol> <li>John E. Hopcroft, Rajeev M &amp; J D Ullman: "Introduction to Automata Theory Languages &amp;Computation", 3rd Edition, Pearson Education, 2007.</li> <li>Aho, Ullman, Ravisethi: "Compilers Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2000.</li> </ol>							
Reference Books- 1.Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010. 2. Appel W & Andrew G M: "Modern Compiler Implementation in C". 1st Edition							
Cambrie	lge University Press, 2003.			,			
3. Loud	en: "Compiler Construction, Princip	les & Practice", 1st Edition, 7	Thoms	on Press,			
2006.							
4. Sipser Michael: "Introduction to Theory of computation", 1 <sup>st</sup> Edition, Thomson, 2009.							
List and Links of e-learning resources:							
Modes of Evaluation and Rubric							
The evaluation modes consist of performance in Two mid-semester Tests Quiz/							
Assignments, term work, end-semester examinations, and end-semester practical							
examinations.							
Recommendation by Board of studies on							
Approval by Academic council on							
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parene Dr. Kanak Saxena Chairperson



(An Autonomous Institute Affiliated to RGPV Bhopal)

#### Department of Computer Science and Engineering IT Syllabus applicable to July 2020 admitted

Name of th	ne course:		B. Tech ir	. Tech in Artificial Intelligence and Data Science					ence
Semester	and Year of	study	B. Tech 4	thYear 7thSe	mester				
Subject Ca	ategory		Engineeri	ng Science	Course (C	DEC)			
SubjectCo	de: <b>AI-2074</b>	(B)	Subject N	ame: Recor	nmendatio	on Sy	stem		
	Μ	laximum Ma	rks Allotted			Cor	stact ∐/	oure	Tatal
	Theory		Prac	ctical	Total	al Contact Hours		Credits	
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Ρ	Oreans
70	20	10			100	3	-	-	3

#### Prerequisites:

Knowledge about the machine learning algorithms. Familiarity with linear algebra (inner product, matrix-vector product).

#### Course Objective:

1. Describe the purpose of recommendation systems.

2. Understand the components of data mining method for recommendation system including candidate generation, scoring, and re-ranking.

3. Understanding for basics of Content-based Recommender Systems.

4. Understanding for basics of Neighborhood-based Recommendation Methods.

5. Develop a deeper technical understanding of Collaborative Filtering.

Course Outcomes: After completion of this course students will be able to

UNITs	Descriptions	Hrs.	CO's
I	Introduction to Recommender Systems: Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Recommender Systems and Human Computer Interaction (Trust, Explanations and Persuasiveness, Conversational Systems, Visualization), Recommender Systems as a Multi-Disciplinary Field,	8	1
II	Data Mining Methods for Recommender Systems: Data Preprocessing (Similarity Measures, Sampling, Reducing, Denoising), Classification ( Nearest Neighbors, Decision Trees, Ruled-based Classifiers, Bayesian Classifiers, Artificial Neural Networks, Support Vector Machines, Ensembles of Classifiers, Evaluating Classifiers, Cluster Analysis(k- Means, Alternatives to k-means), Association Rule Mining.	8	2
111	Basics of Content-based Recommender Systems: A High Level Architecture of Content-based Systems, Advantages and Drawbacks of Content-based Filtering, State of the Art of Content-based Recommender Systems, Item Representation, Methods for Learning User Profiles, Trends and Future Research, The Role of User Generated Content in the Recommendation Process, Beyond Over-specializion,	8	3

IV	Neighborhood-based Recommendation the Problem, Overview of Recommenda Neighborhood Approaches, Neighborh Prediction, User-based Classification, Re based Recommendation, User-based VS	Methods: Formal Definition of tion Approaches, Advantages of ood-based (User-based Rating gression VS Classification, Item- Item-based Recommendation).	8	4
V	Advances in Collaborative Filtering: feedback, Matrix factorization models, S model ,Comparison Components of N Normalization, Similarity Weight Selection), Neighborhood models (Simila interpolation, Jointly derived interp neighbourhood, A factorized neighborh at neighborhood models.	Baseline predictors, Implicit SVD, SVD++, Time-aware factor eighborhood Methods (Rating Computation, Neighborhood arity measures, Similarity-based polation weights), A global ood model, Temporal dynamics	8	5
Guest L	ectures (if any)			
	puis			
NOLa	h			
Text Bo	ok-			
1.	Ricci, Francesco, Lior Rokach, and Brach	na Shapira. "Introduction to recor	nmende	r systems
	handbook." Recommender systems handbook	. Boston, MA: springer US, 2010. 1-	35.	
2.	Lops, Pasquale, Marco De Gemmis, and Giova State of the art and trends." <i>Recommender sy</i>	anni Semeraro. "Content-based reco s <i>tems handbook</i> (2011): 73-105.	mmende	r systems:
3.	Desrosiers, Christian, and George Karypis recommendation methods." <i>Recommender sy</i>	. "A comprehensive survey of ne stems handbook (2010): 107-144.	eighborh	ood-based
Referen	ce Books-			
1.	Ricci, Francesco, Lior Rokach, and Brach handbook." <i>Recommender systems handbook</i>	na Shapira. "Introduction to recor & Boston, MA: springer US, 2010. 1-3	nmende 35.	r systems
List and 1.https:/	Links of e-learning resources: //www.coursera.org/specializations/reco	ommender-systems?action=enr	oll	
Modes	of Evaluation and Rubric			
The eva	luation modes consist of performance	in Two mid-semester Tests, Qu	iz/ Assi	gnments,
term wo	ork, end-semester examinations, and en	d-semester practical examinati	ons.	
Recomm	nendation by Board of studies on			
Approva	al by Academic council on			
Compile	ed and designed by	Dr. Abhay Upadhyay		

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Course

Dr. Kanak Saxena Chairperson



(An Autonomous Institute Affiliated to RGPV Bhopal)

Name of the course:			B. Tech in Artificial Intelligence and Data Science						
Semest	ter and Year of	study	B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester						
Subject	Category		Open Elec	ctive Course	e (OEC)				
Subject	Code: AI-2074		Subject N	ame: Applica	tion Develo	pment			
	M	aximum Ma	rks Allotted			Cor	ataat U	oure	Tatal
	Theory		Prac	ctical	Total	CO		ours	l otal Credits
End Sei	m Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Ρ	Oreans
70	20	10	-	-	100	3	1	-	4
Prerequ	uisites:								
Course	Objective:								
1 To fac	cilitate students t	to understand	d android SD	Ж					
2. To he	lp students to ga	in a basic un	derstanding	of Android a	pplication	develo	opmei	nt	
3. To inc	ulcate working k	nowledge of	Android Stu	idio developr	nent tool				
Course	Outcomes: Aft	er completio	on of this co	ourse studer	nts will be	able	to		
1. Ident	ify various conc	epts of mobi	le programr	ning that ma	ike it uniqu	ue fro	m pro	ogram	ming for
other pl	atforms			-			·	-	-
2. Critiq	ue mobile applic	ations on the	eir design pr	os and cons					
3. Utiliz	e rapid prototypi	ing technique	es to design	and develop	sophisticat	ed mo	bile i	nterfa	ices.
4. Prog	ram mobile appl	lications for	the Android	l operating s	vstem that	use	basic	and a	dvanced
phone f	eatures. and				,				
5. Deplo	ov applications to	o the Android	l marketplac	e for distribu	tion.				
	,								
UNITs			Descriptio	ns			H	Irs.	CO's
						<b>E</b> . I' .			
	Introduction to	Android: If	ne Android	Platform, An	droid SDK,	Eclip	se		
I	Installation, An	droid Installa	ation, Building you First Android application				n,		
	Understanding	Anatomy of	Android Application, Android Manifest file.						
	Android Appli	cation Desig	n Essentia	ls: Anatomy	ofan	Andro	hid		
	annlications A	android term	unologies <i>L</i>	Application (	ontext Δι	tivitic			
II	Services Intent	ts Receiving:	and Broadca	sting Intents	Android N	/anife	s,		
	File and its corr	mon setting	s Using Into	nt Filtor Dor	nissions	anne	.50		
	Android Usor	Interface [	S, OSING INCE	ntiple: Lleor	Interface	Scro	n n		
	Allurolu User	interface L	Jesigii Esse	with Lave					
111	Alerting with	signing User	interiaces			по аг	iu		
		Animatian		with Layot	its, Drawi				
N /	LOCTING ANAROL	Animation.			its, Drawi				
		Animation. id application	ns, Publishi	ng Android	application	i, Usii	ng		
	Android prefer	Animation. id application rences, Mana	ns, Publishi aging Applica	ng Android	application	, Usii erarch	ng Iy,		
	Android prefer working with d	Animation. id application rences, Mana ifferent types	ns, Publishi aging Applica s of resource	ng Android ation resources.	application	, Usii erarch	ng Iy,		
	Android prefer working with d Using Commor	Animation. id application ences, Mana ifferent types n Android AF	ns, Publishin aging Applica s of resource Pls: Using A	ng Android ation resources. ndroid Data	application ces in a hie	, Usin erarch ge AP	ng Iy, Is,		
	Android prefer working with d Using Commor Managing data	Animation. id application ences, Mana ifferent types n Android AF a using Sqlite	ns, Publishi aging Applica s of resource Pls: Using A b, Sharing Da	ng Android ation resources. ndroid Data	application ces in a hid and Storag	ge AP ns wi	ng iy, Is, th		
v	Android prefer working with d Using Commor Managing data Content Provid	Animation. id application ences, Mana ifferent types n Android AF a using Sqlite ers, Using An	ns, Publishi aging Applica s of resource Pls: Using A e, Sharing Da adroid Netwo	ng Android ation resources. ndroid Data ata between orking APIs, L	application ces in a hie and Storag Applicatio Jsing Andro	ge AP ns wi bid We	ng iy, Is, th eb		
V	Android prefer working with d Using Commor Managing data Content Provid APIs, Using And	Animation. id application rences, Mana ifferent types n Android AF a using Sqlite ers, Using An droid Telepho	ns, Publishi aging Applica s of resource Pls: Using A c, Sharing Da droid Netwo ony APIs, De	ng Android ation resources. ndroid Data ata between orking APIs, L	application ces in a hie and Storag Applicatio Jsing Andro	ge AP ns wi bid We	ng Iy, Is, th eb to		

Guest Lectures (if any)		
Total Hours		
Suggestive list of experiments:		
NO Lab		
Text Book-		
1. T1. Lauren Darcey and Shane Conder, "Android Wireless Applicatio	n Devel	opment",
Pearson Education, 2nd ed. (2011)		
Reference Books-		
2. Reto Meier, "Professional Android 2 Application Development", Wiley In	dia Pvt L <sup>:</sup>	td
3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd		
4. Android Application Development All in one for Dummies by Barry Burd,	Edition:	
List and Links of e-learning resources:		
1.		
Modes of Evaluation and Rubric		
The evaluation modes consist of performance in Two mid-semester Tests, Q	uiz/ Assi	gnments,
term work, end-semester examinations, and end-semester practical examinat	ions.	
Recommendation by Board of studies on		
Approval by Academic council on		
Compiled and designed by		

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Covers Dr. Kanak Saxena Chairperson



(An Autonomous Institute Affiliated to RGPV Bhopal)

Name o	Name of the course: B. Tech in Artificial Intelligence and Data Scier						ence		
Semest	er and Year of	study	B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester           Professional Elective Course (PEC)						
Subject	Category		Profession	nal Elective	Course (F	PEC)			
Subject	Code: <b>AI-2075</b>		Subject N	ame: Mode	rn Tools f	or Da	ta Sci	ience	
	M	aximum Ma	rks Allotted			Co	atact H	loure	Tatal
	Theory		Pra	ctical	Total			louis	Credits
End Ser	m Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Ρ	Orodito
70	20	10	-	-	100	3	-	-	3
Prerequ	uisites:								
Data Sci	ence, Machine L	earning							
Course	Objective:								
1									
Course	Outcomes: Aft	er completi	on of this co	ourse stude	nts will be	able	to		
UNITs			Descriptio	ns			ŀ	Irs.	CO's
	Statistical An	ialysis Syst	em(SAS): (	Collection of	f Data, Sai	mple			
	Measurement	and Scaling	g Technique	s, Statistica	l Derivativ	ves an	d		
	Measures of C	Central Tend	lency, Meas	sures of Var	iation and				
	Skewness, Co	rrelation an	d Simple R	egression. T	'ime Serie	s			
I	Analysis Inde	x Numbers	Probability and Probability Rules						
	Probability Di	istributions	Tests of Hy	vnothesis_I	Tests of				
	Hypothesis _	II Chi-Sau	are Test	ypounesits i,	10505 01				
	Trypothesis –	n, em-squ							
	Apache Spark	: Introducti	on. Features	s. Spark buil	lt on				
	Hadoop.Com	ponents of S	Spark: Apac	he Spark Co	ore.				
	Spark SOL S	nark Stream	ning MLlib	(Machine I	earning				
II	Library) Gran	purk Sreun hX	ing, 112110		Journing				
	<b>BigML</b> : Web	Interface (	Command I	ine Interfac	ο ΔPI Cr	eating	т		
	a deen learnin	a model wi	th BigMI		c, / 11 1, C1	cating	5		
	Data-Driven	<u>Document</u>	$\frac{\text{III DIgivit}}{\text{S}(\mathbf{D3 is}) \cdot \text{In}}$	troduction	Web Stan	darde			
	HuperText M	arkun Lang	иодо (НТМ	I) Docume	nt Object	Mode			
	$(\mathbf{D}\mathbf{O}\mathbf{M})$ Case	aikup Laiig ading Style	Shoota (CS)	L), Docume	Vootor C	ronhi	21		
Ш	(DOM), Casca	ading Style	Sheets (CS)	5), Scalable	vector G	rapmo	28		
	(SVG), Javas	cript.		G					
	MatLab: Mat	lab Enviror	iment Setup	o, Syntax, Va	ariables,				
	Commands, M	/1-files, Data	atypes and (	Jperators.					
	Natural Lang	guage Tool	kit (NLTK)	):Tokenizing	g Text, Tra	aining	5		
N 7	Tokenizer & I	Filtering Sto	pwords, Lo	oking up w	ords in W	ordne	t		
IV	Stemming & I	Lemmatizat	ion, Natura	l Language '	Toolkit - V	Nord			
	Replacement,	Synonym &	& Antonym	Replacemen	nt.				

	<b>TensorFlow</b> : Convolutional Neural I Visualization, TensorFlow - Word En Linear Regression	Networks, TensorBoard mbedding, TensorFlow -		
	Tableau: Design Flow, File Types, I	Data Types, Data		
	Terminology, Data source, workshee	t and calculations.		
V	Scikit-learn: Introduction. Modelling	g Process. Data		
	Representation, Estimator API, Con	ventions, Linear Modeling.		
Guest L	ectures (if any)			
	burs			
Sugges	stive list of experiments:			
NO Lai				
1ext Bo	ОК-			
Referen	ce Books-			
5.				
List and	Links of e-learning resources:			
	1.			
Modes	of Evaluation and Rubric			
The eva	luation modes consist of performance	In Two mid-semester Tests, Qui	Z/ ASSIE	gnments,
	ork, enu-sernester examinations, and en		21 וע.	
Recomm	nendation by Board of studies on			
Approva	al by Academic council on			
Compile	ed and designed by	Ajay Kumar Goyal		

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Course Dr. Kanak Saxena Chairperson



(An Autonomous Institute Affiliated to RGPV Bhopal)

		B. Tech in Artificial Intelligence and Data Science						
er and Year of	study	B. Tech 4 <sup>th</sup> Year 7 <sup>th</sup> Semester						
Category		Departme	ental Electiv	e-3 (PEC-	-3)			
Code:Al-2075	PEC(3)	Subject Name: Distributed Systems						
Ma	ximum Ma	rks Allotted			Co	ntact H	PILIE	Total
Theory		Pra	ctical	Total	00	nacin	Juis	- Credits
m Mid-Sem	Quiz	End Sem	Lab-Work	Marks	L	Т	Р	
20	10	-	-	100	3	-	-	3
• • • • •								
uisites: Knowle	edge of Con	nputer net	works and C	Dperating	systen	n.		
Objective:	<u> </u>	1:00	.1 1' . '1	. 1 .				
rk of Operating	System 1s	different in	the distribution	ited enviro	onmen	it.		
s should under	stand Mess	sage passin	ig, RPC, Syn	chronizati	on, Lo	adBal	ancin	ıg.
on of processes	, Deadlock	manageme	ent etc in di	stributed	enviro	onmer	it.	
e Outcomes: Al	fter comple	tion of this	course stud	dents will I	be abl	e to	c	
<b>O</b> -1: Understa	and distribu	ited archite	cture, chara	cteristics a	and m	odels	for	
istributed proce	essing.	1 1	. , .	1 ,	1	1		1 1
CO-2: identify (	deadlock ai	nd mechani	ism to avoid	i, prevent	and re	solve	dead	locks.
CO-3: Explain a	and Analyz	e system n	nodels, agre	ement pro	tocols	and		
istributed file s	ystems.				•1			
CO-4: Evaluate	es the perfor	rmance and	i characteris	stics of Fai	ilure r	ecover	ry in	
	•• • •						•	
particular distr	ibuted syste	em.	C .	1 1 1 1		1 (		
particular distr C <b>O-5</b> :AnalyzeT	ibuted system Fransaction	em. and Concu	rrency Cont	rol in dist	ribute	d syste	ems.	
particular distr C <b>O-5</b> :AnalyzeT	ibuted syste Fransaction	em. and Concu	rrency Cont	rol in dist	ribute	d syste	ems.	
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	Code: AI-2075 Code: AI-2075 Ma Theory Mid-Sem 20 Uisites: Knowle Objective: rk of Operating s should under on of processes Outcomes: A CO -1: Understa istributed proce CO-2: identify CO-3: Explain istributed file s CO-4: Evaluate	Category         Code: Al-2075 PEC(3)         Maximum Ma         Theory         Mid-Sem       Quiz         20       10         uisites: Knowledge of Con         Objective:         rk of Operating System is         rs should understand Mess         on of processes, Deadlock         Outcomes: After comple         CO-1: Understand distributistributed processing.         CO-2: identify deadlock and         CO-3: Explain and Analyzistributed file systems.         CO-4: Evaluates the performance	Category       Department         Code: Al-2075 PEC(3)       Subject N         Maximum Marks Allotted       Theory         Theory       Prave         Mid-Sem       Quiz         20       10         20       10         -       Usisites: Knowledge of Computer network         Objective:       Theory         rk of Operating System is different in         cs should understand Message passing         con of processes, Deadlock management         con of processing.         CO-1:         Understand distributed archite         istributed processing.         CO-2:       identify deadlock and mechan         CO-3:       Explain and Analyze system n         istributed file systems.       CO-4:	Category       Departmental Electiv         Code:AI-2075 PEC(3)       Subject Name: Distri         Maximum Marks Allotted       Image: Departmental Electiv         Theory       Practical         m       Mid-Sem       Quiz         20       10       -         20       10       -         uisites:       Knowledge of Computer networks and C         Objective:       Image: Computer networks and C         rk of Operating System is different in the distributes should understand Message passing, RPC, Synthesis of processes, Deadlock management etc in diate of the course stude course stude of the	Image: Second study       Image: Second study         Category       Departmental Elective-3 (PEC)         Code: AI-2075 PEC(3)       Subject Name: Distributed System         Maximum Marks Allotted       Total         m       Mid-Sem       Quiz       End Sem       Lab-Work       Marks         20       10       -       -       100         uisites: Knowledge of Computer networks and Operating         Objective:         rk of Operating System is different in the distributed environs         schould understand Message passing, RPC, Synchronization of processes, Deadlock management etc in distributed         contromes:       After completion of this course students will         CO -1:       Understand distributed architecture, characteristics istributed processing.         CO-2:       identify deadlock and mechanism to avoid, prevent         CO-3:       Explain and Analyze system models, agreement profistributed file systems.         CO-4:       Evaluates the performance and characteristics of Fa	B. Fech 4 Feal 7 Semiester         Category       Departmental Elective-3 (PEC-3)         Code:Al-2075 PEC(3)       Subject Name: Distributed Systems         Maximum Marks Allotted       Cor         Theory       Practical       Total         n       Mid-Sem       Quiz       End Sem       Lab-Work       Marks       L         20       10       -       -       100       3         uisites: Knowledge of Computer networks and Operating system         Objective:         rk of Operating System is different in the distributed environments should understand Message passing, RPC, Synchronization, Loo on of processes, Deadlock management etc in distributed environments should understand Message passing, RPC, Synchronization, Loo on of processes, Deadlock management etc in distributed environments and distributed architecture, characteristics and m istributed processing.         CO-2: identify deadlock and mechanism to avoid, prevent and records istributed file systems.         CO-2: identify deadlock and mechanism to avoid, prevent and records istributed file systems.         CO-4: Evaluates the performance and characteristics of Failure records istributed the systems.	Category       Departmental Elective-3 (PEC-3)         Code:AI-2075 PEC(3)       Subject Name: Distributed Systems         Maximum Marks Allotted       Contact Ho         Theory       Practical       Total         n       Mid-Sem       Quiz       End Sem       Lab-Work       Marks       L       T         20       10       -       -       100       3       -         uisites: Knowledge of Computer networks and Operating system.         Objective:         rk of Operating System is different in the distributed environment.         cs should understand Message passing, RPC, Synchronization, LoadBallon of processes, Deadlock management etc in distributed environment         c Outcomes:       After completion of this course students will be able to         CO -1:       Understand distributed architecture, characteristics and models istributed processing.         CO-2:       identify deadlock and mechanism to avoid, prevent and resolve         CO-3:       Explain and Analyze system models, agreement protocols and istributed file systems.         CO-4:       Evaluates the performance and characteristics of Failure recover	Category       Departmental Elective-3 (PEC-3)         Code: AI-2075 PEC(3)       Subject Name: Distributed Systems         Maximum Marks Allotted       Contact Hours         Maximum Marks Allotted       Contact Hours         Main       Main       L       T       P         20       10       -       -       100       3       -         uisites:       Knowledge of Computer networks and Operating system.       Contact Hours         Objective:       Contact Hours       Contact Hours         rk of Operating System is different in the distributed environment.       coadBalancin         cs should understand Message passing, RPC, Synchronization, LoadBalancin       coadBalancin         co of processes, Deadlock management etc in distributed environment.       Co-1: Understand distributed architecture, characteristics and models for         ctributed processing.       CO-2: identify deadlock and mechanism to avoid, prevent and resolve dead         CO-3: Explain and Analyze system models, agreement protocols and       and istributed file systems.         CO-4: Evaluates the performance and characteristics of Failure recovery in

	problem, Consensus problem, Interactive consistency Problem,		
	Solution to Byzantine Agreement problem, Application of		
	Agreement problem, Atomic Commit in Distributed Database		
	system. Distributed Resource Management: Issues in		
	distributed File Systems, Mechanism for building distributed		
	file systems.		
	Design issues in Distributed Shared Memory, Algorithm for		
	Implementation of Distributed Shared Memory. Failure		
	Recovery in Distributed Systems: Concepts in Backward and		
IV	Forward recovery, Recovery in Concurrent systems, Obtaining	8	CO4
	consistent Checkpoints, Recovery in Distributed Database		
	Systems. Fault Tolerance: Issues in Fault Tolerance, Commit		
	Protocols, Voting protocols, Dynamic voting protocols.		
	<b>Transactions and Concurrency Control</b> : Transactions,		
	Nested transactions, Locks, Optimistic Concurrency control,		
	Timestamp ordering, Comparison of methods for concurrency		
V	control. Distributed Transactions: Flat and nested distributed	8	CO5
	transactions, Atomic Commit protocols, Concurrency control		
	in distributed transactions, Distributed deadlocks, Transaction		
	recovery. Replication: System model and group		
	communication, Fault Tolerance.		
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Guest L	ectures (if any)	-	-
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