Estd. 1962
"A++" Accredited by NAAC(2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA
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शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४,महाराष्ट्र
दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी विभाग २३१–२६०९०९३/९४

SU/BOS/Science/ 020 **Date: 30- 09- 2022**

To,
The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject :- Regarding syllabi of M. Sc., Part- I (NEP-2020) degree programme under the Faculty of Science and Technology as per National Education Policy, 2020 .

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M. Sc. Part- I Information Technology** under the Faculty of Science and Technology **as per National Education Policy, 2020 .**

Sr.No.	Faculty of Science and Technology	Programme/ Course
1	**Computer Science Engineering and Technology**	M. Sc. Part- I . Information Technology

This syllabi and nature of question paper shall be implemented from the Academic Year **2022-2023** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

SHIVAJI UNIVERSITY, KOLHAPUR

NAAC "A++" Grade with CGPA 3.52

Choice Based Credit System with Multiple Entry and Multiple Exit Option(NEP-2020)

Syllabus for

Master of Science
In
Information Technology

(Under Faculty of Science and Technology)

PART I SEMESTER I & II

(Syllabus to be implemented from Academic year 2022-23)

Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
M.Sc.Program Structure
M.Sc.Part–I(Level-8)

Semester -I (Duration- Six Month)										
Sr. No	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment(IA)		
		Theory	Practical	Credit	Maximum Marks	Minimum Marks	Exam Hours	Maximum Marks	Minimum Marks	Exam Hours
1	CC-101 Research Computing	04		04	80	32	03	20	08	01
2	CC-102 Advanced Web Technology	04		04	80	32	03	20	08	01
3	CC-103 CloudComputing	04		04	80	32	03	20	08	01
4	CC-104 Elective i) Machine Learning Processing ii) Advanced Database Management System iii) Soft Computing Techniques	04		04	80	32	03	20	08	01
5	CCPR-105 Research Computing Lab		02	02	50	20	02			
6	CCPR-106 Advanced Web Technology Lab		02	02	50	20	02			
7	CCPR-107 CloudComputing Lab		02	02	50	20	02			
8	CCPR-108		02	02	50	20	02			

	Elective Lab I									
		16	8	**24**	520			80		
Non-CGPA	AEC-109 Communicative English-I	2	2	2	--	--	--	50	20	2
Semester -II (Duration- Six Month)										
1	CC-201 Data Science	04		04	80	32	03	20	08	01
2	CC-202 Advanced Java Programming	04		04	80	32	03	20	08	01
3	CC-203 Big Data Analytics	04		04	80	32	03	20	08	01
4	CC-204 Elective i) Modern Networking ii) Natural Language Processing iii) Deep Learning	04		04	80	32	03	20	08	01
5	CCPR-205 Data Science Lab		02	02	50	20				
6	CCPR-206 Advanced Java Programming Lab		02	02	50	20				
7	CCPR-207 Big Data Analytics Lab		02	02	50	20				
8	CCPR-208 Elective Lab II		02	02	50	40				
9	CCPR-209		04	04	100	40		80		

	Minor Project									
		16	12	**28**						
Total(A+B)			Total	**52**						

• Studentcontacthoursper week: **56**Hours(Min.)	• Total Marks forM.Sc.-I : **1300**
• TheoryandPracticalLectures:**60** MinutesEach	• TotalCredits forM.Sc.-I (SemesterI&II):**52**
• CC-CoreCourse • CCPR-CoreCoursePractical • AEC-MandatoryNon-CGPAcompulsoryAbilityEnhancement Course • SEC-MandatoryNon-CGPA compulsorySkill Enhancement Course	• **PracticalExaminationis Semester wise after theory examination**. • Examination for CCPR-105, CCPR-106, CCPR-107 and CCPR-108shall be based on Semester I Practical. • ExaminationforCCPR-205, CCPR-206, CCPR-207 and CCPR-208shallbebased onSemester IIPractical. • *DurationofPracticalExaminationasperrespectiveBOS guidelines • *Separate passing is mandatory for Theory, Internal and PracticalExamination*
• **RequirementforEntryatLevel8:** **Completedallrequirementsofthe relevantBachelor'sdegree(Level7) .**	
• **ExitOptionatLevel8:**Studentscanexitafter Level8with **PostGraduateDiplomain Information Technology**if he/shecompletesthe coursesequivalentto minimumof48credits.	

Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
M.Sc. Program Structure
M.Sc.Part–II(Level-9)

SEMESTER-III(Duration-SixMonth)												
	Sr. No.	CourseCode	TeachingScheme			ExaminationScheme						
			TheoryandPractical			UniversityAssessment(UA)			InternalAssessment(IA)			
			Lectures (Perweek)	Hours (Perweek)	Credit	Maximum Marks	Minimum Marks	Exam.Hours	Maximum Marks	Minimum Marks	Exam. Hours	
CGPA	1	CC-301 Artificial Intelligence	4		4	80	32	3	20	8	1	
	2	CC-302 Image Processing	4		4	80	32	3	20	8	1	
	3	CC-303 Advanced Python Programming	4		4	80	32	3	20	8	1	
	4	CC-304 Elective i) R Programming ii) Micro services Architecture iii) Cyber Security	4		4	80	32	3	20	8	1	
	5	CCPR-305 Artificial Intelligence Lab		2	2	50	40	3	--	--	*	
	6	CCPR-306 Image Processing Lab		2	2	50	40	3	--	--	*	
	7	CCPR-307 Advanced Python Programming Lab		2	2	50						
	8	CCPR-307 Elective Lab III		2	2	50						

Total(C)			**16**	**8**	**24**	**520**	**--**	**--**	**80**	**--**	
Non-CGPA	**1**	AEC-308: Communicative English-II	2	2	2	--	--	--	50	20	2
	2	EC(SWMMOOC)-309:	Number of Lectures and credit shall be specified on SWAYAM MOOC								
SEMESTER-IV(Duration-SixMonth)											
CGPA	1	CCPR-401:Research Seminar		1	4				100	40	*
	6	CCPR-402: Research /Industrial Project		-	16	300	120	--	100	40	*
	Total(D)		--	**1**	**20**	**300**	**--**	**--**	**200**	**--**	**--**
Total(C+D)					**44**	**820**	**--**	**--**	**280**	**--**	**--**

- Studentcontacthoursper week: **34**Hours(Min.)
- TheoryandPracticalLectures:**60** MinutesEach
- CC-CoreCourse
- CCS-CoreCourseSpecialization
- CCPR-CoreCoursePracticalandProject
- DSE-DisciplineSpecificElective
- AEC-MandatoryNon-CGPAcompulsoryAbilityEnhancement Course
- SEC-MandatoryNon-CGPA compulsorySkill Enhancement Course
- EC(SWM MOOC)-Non-CGPAElectiveCourse
- GE-MultidisciplinaryGenericElective

- TotalMarks forMSc.-II : **1100**
- TotalCreditsforMSc.-II (SemesterIII&IV):**44**
- **PracticalExaminationis Semester wise after theory examination.**ExaminationforCCPR-305, CCPR-306, CCPR-307 and CCPR-308shallbebased onSemester IIIPractical.
- ExaminationforCCPR-401and CCPR-402shallbebasedonSemesterIVPractical.
- *DurationofPracticalExaminationasperrespectiveBOSguidelines
- ***SeparatepassingismandatoryforTheory,InternalandPracticalExamination***

- **RequirementforEntry atLevel9:**
  CompletedallrequirementsoftherelevantPost GraduateDiplomain Information Technology(Level8)
- **ExitatLevel9:**Studentswillexit after Level9with**Master's DegreeinInformation Technology**ifhe/shecompletesthecoursesequivalenttominimumof96credits.

	M.Sc.I	M.Sc. II	Total
Marks	**1300**	**1100**	**2400**
Credits	**52**	**44**	**96**

ThenameoftheprogrammeshallbeMasterofScience(**M.Sc**.**Information Technology)**

DurationoftheProgram

- TheM.Sc.Programmewillbeafull-timetwoyearsi.e.4semesters.PatternofexaminationwillbeSemesterSystem.

MediumofInstruction

- ThemediumofInstructionwillbeEnglishonly**.**

AdmissionProcedure

- Eligibility:B.Sc.ComputerScience(Entire/optional)/B.Sc.IT/ BCA(Under Science Faculty),B.Sc.Mathematics,B.Sc. Statistics,B.Sc. Electronics, B.Sc Animation, B.Sc Physics,B.Sc Chemistry/ BSc. Microbiology.
- AdmissionthroughUniversityEntranceexamonly.
- Onlyentrancemarksshouldbeconsideredforadmissionprocess.
- ReservationofSeatsasperrulesofGovernmentofMaharashtra**.**

Projectwork

AttheendofI,II&IIIsemesterstudenthastocarryoutaprojectwork.

1. Project workatendofsemestershouldbedoneingroups,eachstudentmustbegivenaresponsibilityforadistinctmoduleandcareshouldbetakentoseetheprogressofindividual modulesisindependentofothers.
2. Students should take guidance from an internal guide and prepare a ProjectReporton"ProjectWork"tobesubmittedtotheDepartmentafterevaluation .
3. The Project Report should contain an Introduction to Project, which shouldclearlyexplaintheprojectscopeindetail.Database/Webpage/UIdesignsandalistofoutputreportsshouldbeincludedalongwithreferences.
4. The project Work should be of such a nature that it could prove useful orshouldberelevantfromthesocietal/commercial/researchangle.
5. The project report will be duly accessed by the internal guide of the projectandinternalmarkswillbecommunicatedbytheconcernedguide.
6. Projectviva-vocebytheUniversitypanelwillbeconductedaspartofEvaluation.

At the end of the Fourth semester of study, a student will be examined in thecourse "Industrial/ResearchProject".

1. Fourth semester Project work can be carried out as industrial training offour months in the Industry or in the Institute as Research project withpriorpermissionoftheInstitute.
2. Project viva-voce by the University panel will be conducted at the end ofsemester.
3. The project report should be prepared in a format prescribed by theUniversity,whichalsospecifiesthecontentsandmethodsofpresentation.
4. Projectworkmaybedoneindividuallyoringroupsincaseofbiggerprojects.

5. The major project work carry 50 marks for internal assessment and 150marksforExternalviva.Theexternalvivashallbeconductedbyapanelofex ternalexaminers.

OR

1.The student will be allowed to formulate a proposal for start-up and the samewillberatedequivalenttoanindustrialproject.Adetailedproblemstatements howing innovationalongwithmark ability, businessplanandcashflowwillbepartoftheEvaluationcriteria.

ResearchSeminar

At the end of fourth semester student shall deliver seminar on one of the advancedtopic chosen in consultation with the guide after compiling the information from thelatest literature and also internet. The concepts must be clearly understood

andpresentedbystudent.Priortopresentation,he/sheshallcarryoutthedetailedliterature survey from standard references such as International & National journalsandperiodicalsrecentlypublishedreferencebooksetc.Ahardcopyofthereport(A4size, 12 fonts, Times New Roman, Single spacing both side printed) should besubmitted to the Department before delivering the seminar. This seminar will beevaluatedinternallyfor100marksbytherespectiveguides.

Assessment

Thefinaltotalassessmentofthecandidateismadeintermsofaninternalassessmen tandanexternalassessmentforeachcourse.

1. For each theory paper, 20% marks will be based on internal assessment and80%marksforsemesterexamination(externalassessment),unlessotherwise stated.
2. Internal assessment of theory papers should be in the form of two internaltestsof10markseach.Total20marks.
3. Theprojectswillbeevaluatedbytheuniversityappointedpanel.
4. Thefinalpracticalexaminationwillbeconductedbytheuniversityappointed panel at the end of semester for each lab course and marks will besubmitted to the university by the panel.The pattern of final PracticalExaminationwillbeasfollows-

1	Coding and Execution of Program	40Marks
2	Viva-voce	05Marks
3	Journal	05Marks
	Total	50marks

6. The internal marks will be communicated to the University at the end of eachsemester,butbeforethesemesterendexaminations.Thesemarkswillbeconsideredf orthedeclarationoftheresults.

Natureofquestionpaper

NatureofquestionpaperisasfollowsforUniversityendsemesterexamination

a. **TheoryExamination**:Therewillbeseven(7)questionsof16Marksandoutofwhich four (4) to be attempted from question no 2 to 6. Question No.1 iscompulsoryandisofmultiplechoicequestions.

b. **PracticalExamination**:

i. DurationofPracticalExamination:3Hrs

ii. NatureofQuestionpaper:Therewillbethreequestionsoutofwhichanytwoqu estionstobeattemptedandeachquestioncarries30Marks.

StandardofPassing

Internal as well as external examination will be held at the end of semester. Thecandidate must score 40% marks in each head of internal as well as externalExamination.

BoardofPaperSetters/Examiners

For each Semester and examination there will be one board of Paper setters andexaminersforeverycourse.

AwardofClass

There will be numerical marking on each question. At the time of declaration of theresultthemarksobtainedbythecandidateisconvertedintoclassesasperUniversitynor ms.

Creditsystemimplementation

AspertheUniversitynorms

ClarificationofSyllabus

The syllabus Committee should meet at least once in a year to study and clarify anydifficulties from the Institutes. The Workshop on syllabi should be organized at thebeginningofevery semester.

RevisionofSyllabus

Asthecomputertechnologyischangingveryfast,revisionofthesyllabusshouldbeconsideredevery3years.

PEO'sforM.Sc. Information Technology Program

ProgramEducationalObjectivesistopreparegraduatesto:

1. Apply and continuously acquire knowledge, both theoretical and applied, related tocoreareasofinformation technology
2. Demonstrate the ability to work effectively as a team member and/or leader in anever-changingprofessionalenvironment
3. Workproductivelyascomputerprofessionals(intraditionalcareers,graduateschool,or academia) by demonstrating effective use of oral and written communication,workingcompetentlyasamemberofateamunit,adheringtoethicalstandards intheprofession.

ProgramOutcomes(POs)

AttheendoftheMasterofScience(Information Technology)Programme,graduatingstudents/graduateswillbeableto:

1. Communicate Information Technology concepts, designs, and solutions effectively andprofessionally
2. Apply knowledge of computing to produce effective designs and solutions for specificproblems
3. Identify, analyse, and synthesize scholarly literature relating to the field of information technology Use software development tools, software systems, and modern computingplatforms.
4. PrepareforacademicrolesthroughNET/SET/PhD
5. Apply design and development principles in the construction of software systems ofvaryingcomplexity.

ProgramSpecificOutcomes(PSOs)

1. Ability to apply the knowledge of Information Technology with recent trends aligned withresearch andindustry.
2. Ability to apply IT in the field of Computational Research, Soft Computing, Big DataAnalytics,DataScience,ImageProcessing,ArtificialIntelligence,NetworkingandCloudComputing.
3. Ability to provide socially acceptable technical solutions in the domains of InformationSecurity, Machine Learning, Internet of Things and Embedded System, Infrastructure Services asspecializations.
4. Ability to apply the knowledge of Intellectual Property Rights, Cyber Laws and CyberForensics and various standards in interest of National Security and Integrity along with ITIndustry.
5. Ability to write effective project reports, research publications and content developmentandto workinmultidisciplinary environment in thecontext of changing technologies.

StudentContacthoursperweek:**56** Hours(Min)	TotalMarksforM.Sc.-I:**1300**

Coursestructure

M.Sc.PartI

Semester– I		
CourseCode	**CourseTitle**	**Credits**
CC-101	ResearchinComputing	4
CC-102	Advance Web Technology	4
CC-103	CloudComputing	4
CC-104	i) Machine Learning Processing ii) Advanced Database Management System iii) SoftComputingTechniques	4
CCPR-105	ResearchinComputingLab	2
CCPR-106	Advance Web Technology Lab	2
CCPR-107	CloudComputingLab	2
CCPR-108	Elective Lab-I	2
AEC-109	Communicative English-I	
	TotalCredits	**24**
Semester– II		
CourseCode	**CourseTitle**	**Credits**
CC-201	Data Science	4
CC-202	Advanced Java Programming	4
CC-203	Big Data Analytics	4
CC-204	i) Modern Networking ii) Natural Language Processing iii) Deep Learning	4
CCPR-205	Data Science Lab	2
CCPR-206	Advanced Java Programming Lab	2
CCPR-207	Big Data Analytics Lab	2
CCPR-208	Elective Lab-II	2
CCPR-209	Minor Project	4
	TotalCredits	**28**

TheoryLectures:60MinutesEach	TotalCreditsforM.Sc.-I(SemesterI&II):52
CC-CoreCourse	
OE–OpenElective	
CCPR-CoreCoursePractical	
SWM-SWAYAMUGConlineCourses	
CE–CoreElective(Withindepartment):Coreelectivepapersshallbeminimum2or more	
PracticalExaminationisSemesterwise.	
SeparatepassingismandatoryforTheory,Internal,Practicaland Project	

M.Sc-ISemester-I(Information Technology)

Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

M.Sc (InformationTechnology)		**Semester–I**	
CourseName:ResearchinComputing		**CourseCode: CC101**	
Periodsperweek **1Period is60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Tobeabletoconductbusinessresearchwithanunderstandingofallthelatestheories. • To develop the ability to explore research techniques used for solvinganyreal world orinnovateproblem.

Prerequisites	Basicknowledgeofstatisticalmethods.Analyticalandlogicalthinking.

Unit	**Details**	**Lectures**
I	**Introduction:** Role of Business Research, Information Systems andKnowledge Management, Theory Building, Organization ethics andIssues	**12**
II	**Beginning Stages of Research Process:** Problem definition,Qualitativeresearch tools, Secondary dataresearch	**12**
III	**ResearchMethodsandDataCollection:**Surveyresearch,communicating with respondents, Observation methods, Experimentalresearch	**12**
IV	**Measurement Concepts, Sampling and Field work:** Levels of Scalemeasurement, attitude measurement, questionnaire design, samplingdesignsandprocedures,determination of samplesize	**12**

V	**Data Analysis and Presentation:** Editing and Coding, Basic DataAnalysis,UnivariateStatisticalAnalysisandBivariateStatisticalanalysis and differences between two variables. Multivariate StatisticalAnalysis.	**12**

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	BusinessResearchMethods	William G.Zikmund, B.JBabin,J.C.Carr,	Cengage	8e	2016
2.	Business Analytics	Albright Winston	Cengage	5e	2015
3.	ResearchMethods for Business Students FifthEdition	MarkSaunders			2011
4.	MultivariateDataAnalysis	Hair	Pearson	7e	2014

M.Sc(InformationTechnology)		**Semester–I**	
CourseName:Advanced Web Technology		**CourseCode:CC102**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	Students will be able to develop application using MVC. Students will be able to understand Entity Framework. Students will be able to understand Web API.

Prerequisites	Basicunderstandingofstatistics

Unit	Details	Lectures
I	**Introduction to MVC**, Benefits of using ASP.NET MVC, Role of Model, View, and Controller, ASP.NET MVC Works, Naming conventions, Creating views, Defining controllers, Defining a data model, Creating strongly-typed views, Creating strongly-typed views	12
II	**Razor View Engine:** Razor Basics, Razor design goals, Implementation of Razor view, Razor syntax, Accessing Model Data in Razor views **Using Entity Framework:**Crud Operations, Crud Operation Using BO Class, Crud Operations Using Generic BO Class.	12
III	Working with URLs and Routing:Understanding the Routing Mechanism,Adding a Route Entry, Using Parameters, Using Defaults, Using Constraints ASP.NET Web API with MVC:Overview of the ASP.NET Web API, Building servers and clients,Content negotiation, Validation, Dependency Injection	12
IV	**MVC State Management:** Using hidden fields, Session and Application State, Custom model bindings Azure Services: Cloud Computing, Cloud Characteristics, Cloud Computing Service Models, Introduction to Azure, Benefits of Azure, Azure Hosting Models, Azure Services, Azure Portals	12
V	**Introduction to Bootstrap:** History of Bootstrap, Advantages of Bootstrap Framework,Responsive webpage,Bootstrap Grid,Container, Offset Column, Reordering Columns, Bootstrap Typography, Bootstrap Tables, Bootstrap Form Layout, Bootstrap Components, Glyphicons Component	12

Booksand References:

Sr.No.	Title	Author/s	Publisher	Edition	Year
1.	Professional ASP.NET MVC 5	by Jon Galloway, Brad Wilson, K. Scott Allen, David Matson			
2.	ASP.NET MVC 4 and the Web AP	Jamie Kurtz			

M.Sc (InformationTechnology)		Semester–I	
CourseName:CloudComputing		**CourseCode:CC103**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	□ To learn how to use Cloud □ Services.ToimplementVirtualizatio □ n. □ To implement Task Scheduling □ algorithms.ApplyMap- □ Reduceconcepttoapplications.To build PrivateCloud.

Unit	Details	Lectures
I	**IntroductiontoCloudComputing:**Introduction,Historicaldevelopments,BuildingCloudComputingEnvironments,**PrinciplesofParallelandDistributedComputing:**ErasofComputing,Parallelv/sdistributed computing, Elements of Parallel Computing, Elements ofdistributedcomputing,Technologiesfordistributedcomputing.**Virtualization:**Introduction,Characteristicsofvirtualizedenvironments, Taxonomy of virtualization techniques, Virtualizationandcloudcomputing,Prosandconsof virtualization,Technologyexamples.LogicalNetworkPerimeter,Virtual Server,CloudStorage Device, Cloud usage monitor, Resource replication, Ready-madeenvironment.	**12**
II	**CloudComputingArchitecture:**Introduction,Fundamentalconceptsandmodels,Rolesandboundaries,CloudCharacteristics,CloudDeliverymodels,CloudDeploymentmodels,Economicsofthecloud,Openchallenges.**FundamentalCloudSecurity:**Basics,Threatagents,Cloudsecuritythreats,additionalconsiderations.**IndustrialPlatforms and New Developments:** Amazon Web Services,GoogleAppEngine, MicrosoftAzure.	**12**

III	**Specialized Cloud Mechanisms:** Automated Scaling listener, LoadBalancer, SLA monitor, Pay-per-use monitor, Audit monitor, fail oversystem,Hypervisor,ResourceCentre,Multidevicebroker,StateManagement Database. **Cloud Management Mechanisms:** Remoteadministrationsystem,ResourceManagementSystem,SLAManagement System, Billing Management System, **Cloud SecurityMechanisms:**Encryption,Hashing,DigitalSignature,PublicKeyInfrastructure(PKI),IdentityandAccessManagement(IAM),Single	**12**
	Sign-On(SSO),Cloud-BasedSecurityGroups,HardenedVirtualServerImages	
IV	**FundamentalCloudArchitectures:**WorkloadDistributionArchitecture, ResourcePoolingArchitecture,DynamicScalabilityArchitecture, Elastic Resource Capacity Architecture, Service LoadBalancingArchitecture,CloudBurstingArchitecture,ElasticDiskProvisioningArchitecture,RedundantStorageArchitecture.**AdvancedCloudArchitectures:**HypervisorClusteringArchitecture,LoadBalancedVirtualServerInstancesArchitecture,Non-DisruptiveService Relocation Architecture, Zero Downtime Architecture, CloudBalancing Architecture, Resource Reservation Architecture, DynamicFailureDetectionandRecoveryArchitecture,Bare-MetalProvisioning Architecture,RapidProvisioningArchitecture,StorageWorkloadManagementArchitecture	**12**
V	**CloudDeliveryModel Considerations:**CloudDeliveryModels:TheCloudProviderPerspective,CloudDeliveryModels:TheCloudConsumerPerspective,**CostMetricsandPricingModels**:BusinessCost Metrics, Cloud Usage Cost Metrics, Cost ManagementConsiderations,**ServiceQualityMetricsandSLAs:**ServiceQualityMetrics,SLA Guidelines	**12**

Booksand References:

Sr.No.	Title	Author/s	Publisher	Edition	Year
1.	MasteringCloudComputing FoundationsandApplicationsProgramming	RajkumarBuyya, ChristianVecchiola,S. ThamaraiSelvi	Elsevier	-	2013
2.	Cloud ComputingConcepts,Technology&Architecture	Thomas Erl,Zaigham Mahmood, and RicardoPuttini	Prentice Hall	-	2013
3.	Distributed and CloudComputing,FromParallel ProcessingtotheInternetofThings	Kai Hwang, JackDongarra, GeoffreyFox	MK Publishers	--	2012

M.Sc (InformationTechnology)		Semester–I	
CourseName:Machine Learning		CourseCode: CC104-01	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
EvaluationSystem	TheoryExamination	3	80
	TheoryInternal	--	20

Objectives	• 1. Develop an appreciation for what is involved in learning models from data. • 2. Understand a wide variety of learning algorithms. • 3. Understand how to evaluate models generated from data.

Prerequisites	Basicknowledgeofstatisticalmethods.Analyticalandlogicalthinking.

Unit	Details	Lectures
I	Introduction to Machine Learning • Introduction • Evolution of machine learning • Difference between AI and Machine learning • Developments in machine learning • Introduction to K-nearest neighbor method, different phases of predicative modeling	12
II	Aspects of Machine Learning • Definition of learning System • Goals and applications of machine learning • Aspects of developing a learning system: training data, concept representation, function approximation	12
III	Machine Learning Modelling • ML Modeling flow, How to treat Data in ML • Types of machine learning, performance measures • Bias-Variancde Trade-Off • Overfitting & Underfitting, Bootstrap Sampling, Bagging Aggregation 12 4 Basic Probability and	12
IV	Handling Test Data • Reading test data from excel file • Writing data to excel file • Reading test configuration data from text file • Test logging • Machine Learning Grid Overview	12
V	Building Automation Frameworks Using Machine Learning • What is a Framework • Types of Frameworks • Modular framework • Data Driven framework	12

	• Keyword driven framework • Hybrid framework • Use of Framework • Develop a framework using TestNG/WebDriver	

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	EthemAlpaydin, Introduction to Machine Learning, Second Edition	EthemAlpaydin, Introduction to Machine Learning, Second Edition			
2.	DAN.W. Patterson, Introducti on to A.I and Expert Systems				2007
3.	Rich & Knight, Artificial Intelligence	Tata McGraw Hill,		2nd edition,	1991.

M.Sc (InformationTechnology)		**Semester–I**	
CourseName:Advanced Database Management System		**CourseCode: CC104-02**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Tocoveradvancedtopicsofdatabasestobecomemoreproficient. • To Expand Students, view and introduce advanced topics and BusinessIntelligence.

Prerequisites	Basicknowledgeofstatisticalmethods.Analyticalandlogicalthinking.

Unit	Details	Lectures
I	**EnhancedDatabaseModels:-** Object–OrientedDatabases:NeedofObject-orienteddatabases,ComplexDataTypes,StructuredTypesandInheritance, Object-Identity and Reference, ODL and OQL, Implementing O-R Features,Persistent Programming Languages, Object-Oriented versus Object-Relational, Example of Object oriented and object relational databaseimplementation,comparisonofRDBMS,OODBMS,ORDBMS XMLDatabases:StructuredSemistructureandunstructureddata,XML hierarchical tree data model, Documents DTD and XML schema,XML Documents & Database, XML query and transformation, Storageof XML data, Xpath. XQuery, Join and Nesting Queries, XMLdatabaseapplications.	12
II	**SpatialDatabases:-**Typesofspatialdata,GeographicalInformation Systems (GIS), Conceptual Data Models for spatial databases,Logicaldatamodelsforspatialdatabases:Rasteran dvectormodel.Physicaldatamodelsforspatialdatabases:Clusteringmetho ds(spacefillingcurves),Storagemethods(R-tree).Queryprocessing. TemporalDatabases:Timeontology,structure,andgranularity,Temporal data models,Temporalrelational algebra	12
III	**CooperativeTransactionModel:-** ParallelandDistributedDatabases:Architectureofparalleldatabases,Parall elqueryevaluation,Parallelizingindividualoperations,SortingJoins DistributedDatabases:Concepts,Datafragmentation,Replicationandalloc ationtechniquesfordistributeddatabasedesign,Queryprocessing, Architecture and Design: Centralised versus non centralizedDatabases,HomogeneousandHeterogeneous DDBMS,FunctionsandArchitecture,Distributeddatabasedesign,querypr ocessinginDDBMS, Distributed concurrency management, deadlockmanagement, Distributed Commit Protocols: 2 PC and 3 PC,Conceptsofreplicationservers. Mobile Database: Overview, Features, Advantages andDisadvantages,Mobile databasesinAndroid System	12
IV	**LearningtheNoSQLBasics:-** IntroductiontoNoSQL:CharacteristicsofNoSQL,NoSQLStoragetypes, Advantagesand Drawbacks,NoSQL Products InterfacingandinteractingwithNoSQL:StoringDataInandAccessingData fromMongoDB,Redis,HBaseandApacheCassandra,Language Bindingsfor NoSQL DataStores	12

	Understanding the storage architecture: Working Oriented Databases, HBase Distributed Storage PerformingCRUDoperations:CreatingRecords,AccessingData,UpdatingandDeletingData	
V	**GainingProficiencyWithNoSQL:** QueryingNoSQLStores:SimilaritiesBetweenSQLandMongoDBQuery Features,AccessingData fromColumn-OrientedDatabasesLikeHBase,Querying RedisDataStores IndexingAndOrderingDataSets:EssentialConceptsBehindaDatabase Index, Indexing and Ordering in MongoDB, ouchDB andApacheCassandra ManagingTransactionsAndDataIntegrity:RDBMSandACID,DistributedACIDSystems,UpholdingCAP,ConsistencyImplementations Using NoSQL in The Cloud: Google App Engine Data Store, AmazonSimpleDB	**12**

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	DatabaseManagementSystems	RaghuRamakrishnanandJohannes	Gehrke,McGrawHill	3rdEdition	2014
2.	ProfessionalNoSQL	ShashankTiwari,Wrox-JohnWiley&Sons,Inc			2011.

M.Sc (InformationTechnology)		**Semester–I**	
CourseName:SoftComputingTechniques		**CourseCode:**CC104-03	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Softcomputingconceptslikefuzzylogic,neuralnetworksandgeneticalgorithm,where Artificial Intelligence is motherbranch ofall. • AllthesetechniqueswillbemoreeffectivetosolvetheefficientlyproblemAllthesetechniqueswillbemoreeffectivetosolvetheefficientlyproblem

Prerequisites	BasicconceptsofArtificialIntelligence.KnowledgeofAlgorithms

Unit	Details	Lectures
I	Introduction of soft computing, soft computing vs. hard computing,various types of soft computing techniques, Fuzzy Computing, NeuralComputing,GeneticAlgorithms,AssociativeMemory,AdaptiveResonanceTheory,Classification,Clustering,BayesianNetworks,Probabilisticreasoning,applicationsofsoft computing.	**12**
II	Artificial Neural Network: Fundamental concept, Evolution of NeuralNetworks, Basic Models, McCulloh-Pitts Neuron, Linear Separability,HebbNetwork. Supervised Learning Network: Perceptron Networks, Adaptive LinearNeuron, Multiple Adaptive Linear Neurons, Backpropagation Network,RadialBasisFunction,TimeDelayNetwork,FunctionalLinkNetworks,TreeNeuralNetwork. AssociativeMemoryNetworks:TrainingalgorithmforpatternAssociation, Autoassociativememorynetwork,hetroassociativememorynetwork,bi-directionalassociativememory,Hopfieldnetworks,iterativeautoassociativememorynetworks,temporalassociativememory networks.	**12**
III	UnSupervisedLearningNetworks:Fixedweightcompetitivenets,Kohonen self-organizing feature maps, learning vectors quantization,counterpropogationnetworks, adaptiveresonancetheory networks. Special Networks: Simulated annealing, Boltzman machine, GaussianMachine, Cauchy Machine, Probabilistic neural net, cascade correlationnetwork,cognitionnetwork,neo-cognitionnetwork,cellularneuralnetwork,optical neural network ThirdGeneration NeuralNetworks: Spiking Neural networks, convolutional neural networks, deep learningneuralnetworks, extreme learning machine model.	**12**
IV	Introduction to Fuzzy Logic, Classical Sets and Fuzzy sets:Classicalsets, Fuzzy sets. ClassicalRelations andFuzzy Relations: CartesianProductofrelation,classicalrelation,fuzzyrelations,tolerranceandequivalencerelations,non-iterativefuzzysets. Membership Function: features of the membership functions,fuzzification,methods of membershipvalueassignments. Defuzzification:Lambda-cutsforfuzzysets,Lambda-cutsforfuzzyrelations,Defuzzification methods. FuzzyArithmeticandFuzzymeasures:fuzzyarithmetic,fuzzymeasures, measures of fuzziness,fuzzy integrals.	**12**

V	FuzzyRulebase andApproximate reasoning: Fuzzyproportion,formationofrules,decompositionofrules,aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems,Fuzzy logic control systems, control system design, architecture andoperation of FLC system, FLC system models and applications of FLCSystem. Genetic Algorithm: Biological Background, Traditional optimizationandsearchtechniques,geneticalgorithmandsearchspace,geneticalgorithm vs. traditional algorithms, basic terminologies, simple geneticalgorithm, general genetic algorithm, operators in genetic algorithm,stopping condition for genetic algorithm flow, constraints in geneticalgorithm,problemsolvingusinggeneticalgorithm,theschematheorem, classification of genetic algorithm, Holland classifier systems,genetic programming, advantages and limitations and applications ofgeneticalgorithm. Differential Evolution Algorithm, Hybrid soft computing techniques – neuro–fuzzyhybrid,geneticneuro-hybridsystems,geneticfuzzy hybridandfuzzy genetichybridsystems.	**12**

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Artificial Intelligence andSoftComputing	Anandita Das Battacharya	SPD	3rd	2018
2.	PrinciplesofSoftcomputing	S.N.Sivanandam S.N.Deepa	Wiley	3rd	2019
3.	Neuro-Fuzzy and SoftComputing	J.S.R.Jang, C.T.Sun andE.Mizutani	Prentice Hallof India		2004
4.	Neural Networks, FuzzyLogicand Genetic Algorithms: Synthesis &Applications	S.Rajasekaran, G. A.Vijayalakshami	Prentice Hall ofIndia		2004
5.	Fuzzy Logic withEngineeringApplications	TimothyJ.Ross	McGraw-Hill		1997
6.	GeneticAlgorithms:Search, Optimization and MachineLearning	DavisE.Goldberg	Addison Wesley		1989
7.	Introduction to AI andExpertSystem	Dan W.Patterson	Prentice Hall ofIndia		2009

M.Sc (InformationTechnology)		Semester–I	
CourseName:Research inComputing Practical		CourseCode: CCPR-105	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
EvaluationSystem	PracticalExamination	2	50

PracticalNo	Details
1 - 10	10Practicalbased onabove syllabus, coveringentiresyllabus

CourseOutcome	Alearner will beable to: solve real world problems with scientific approach.developanalyticalskillsbyapplyingscientificmethods. recognize,understandandapplythelanguage,theoryandmodelsofthefield ofbusinessanalytics foster an abilityto critically analyze, synthesizeand solvecomplexunstructuredbusinessproblems understandandcriticallyapplytheconceptsandmethodsofbusinessanalytics identify,modelandsolvedecisionproblems indifferentsettingsinterpret results/solutions and identify appropriate courses ofaction for a given managerial situation whether a problem or anopportunity createviablesolutionstodecisionmakingproblems

M.Sc (InformationTechnology)		Semester–I	
CourseName:Advanced Web Technology Lab		**CourseCode:**CCPR-106	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbased onabove syllabus,coveringentire syllabus

CourseOutcome	• Understandtheadvanced concepts in web technologyanditsassociatedapplicationsinvarious fields. • createviablesolutionstodecisionmakingproblems

M.Sc (InformationTechnology)		Semester–I	
CourseName:CloudComputingPractical		**CourseCode:**CCPR-107	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Analyze the Cloud computing setup with its vulnerabilities andapplicationsusing differentarchitectures. • Design different workflows according to requirements and applymapreduce programmingmodel. • Apply and design suitable Virtualization concept, Cloud ResourceManagementand designscheduling algorithms. • Create combinatorial auctions for cloud resources and designschedulingalgorithms for computingclouds • Assess cloud Storage systems and Cloud security, the risksinvolved,itsimpact anddevelop cloudapplication

M.Sc (InformationTechnology)		Semester–I	
CourseName:Machine Learning Processing Lab		**CourseCode:**CCPR108-01	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Identifyandlearning Machine techniquesandtheirroles inbuildingintelligentmachines • RecognizethefeasibilityofapplyingaMachine techniquesmethods fora particularproblem

M.Sc (InformationTechnology)		Semester–I	
CourseName:Advanced Database Management System		**CourseCode:**CCPR108-02	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Identifyanddescribeemerging trends andtechniquesandtheirroles inbuildingintelligent database. • Recognizethefeasibilityofapplyingan advanced database techniques.

M.Sc (InformationTechnology)		Semester–I	
CourseName:SoftComputingTechniques Lab		**CourseCode:**CCPR108-03	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Identifyanddescribesoftcomputingtechniquesandtheirroles inbuildingintelligentmachines • Recognizethefeasibilityofapplyingasoftcomputingmethodologyfora particularproblem • Apply fuzzy logic and reasoning to handle uncertainty and solveengineeringproblems • Applygeneticalgorithmstocombinatorialoptimizationproblems • Applyneuralnetworksforclassificationandregressionproblems • Effectivelyuseexistingsoftwaretoolstosolverealproblems usingasoft computingapproach • Evaluateandcomparesolutionsbyvarioussoftcomputingapp roachesfor a given problem.

Semester–II

M.Sc(InformationTechnology)		Semester–I	
CourseName:DataScience		**CourseCode:CC201**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Developindepthunderstandingofthekeytechnologiesindatascienceand business analytics: data mining, machine learning, visualizationtechniques,predictive modeling, andstatistics. • Practiceproblemanalysisanddecision-making. • Gainpractical,hands-onexperiencewithstatisticsprogramminglanguages and big data tools through coursework and applied researchexperiences.

Prerequisites	Basicunderstandingofstatistics

Unit	Details	Lectures
I	**DataScienceTechnologyStack:**RapidInformationFactoryEcosystem, Data Science Storage Tools, Data Lake, Data Vault, DataWarehouse Bus Matrix, Data Science Processing Tools ,Spark, Mesos,Akka,Cassandra,Kafka,ElasticSearch,R,Scala,Python,MQTT,TheFuture **Layered Framework:** Definition of Data Science Framework, Cross-IndustryStandardProcessforDataMining(CRISP-DM),HomogeneousOntologyforRecursiveUniformSchema,TheTopLayers of a Layered Framework, Layered Framework for High-LevelDataScience and Engineering **Business Layer:** Business Layer, Engineering a Practical BusinessLayer **Utility Layer:** Basic Utility Design, Engineering a Practical UtilityLayer	**12**
II	**ThreeManagementLayers:**OperationalManagementLayer,Processing-Stream Definition and Management, Audit, Balance, andControl Layer, Balance, Control, Yoke Solution, Cause-and-Effect,AnalysisSystem, Functional Layer,Data Science Process **Retrieve Superstep :** Data Lakes, Data Swamps, Training the TrainerModel,UnderstandingtheBusinessDynamicsoftheDataLake,ActionableBusinessKnowledgefromDataLakes,EngineeringaPracticalRetrieve Superstep, Connectingto Other DataSources,	**12**
III	**Assess Superstep:** Assess Superstep, Errors, Analysis of Data,PracticalActions, Engineeringa Practical AssessSuperstep,	**12**

IV	**Process Superstep :** Data Vault, Time-Person-Object-Location-EventDataVault,Data Science Process, Data Science, **TransformSuperstep:**TransformSuperstep,BuildingaDataWarehouse, TransformingwithDataScience,HypothesisTesting,Overfittingand Underfitting,Precision-Recall, Cross-ValidationTest.	**12**
V	**TransformSuperstep:**UnivariateAnalysis,BivariateAnalysis,MultivariateAnalysis,LinearRegression,LogisticRegression,ClusteringTechniques,ANOVA,PrincipalComponentAnalysis(PCA), Decision Trees, Support Vector Machines, Networks, Clusters,andGrids,DataMining,PatternRecognition,MachineLearning, BaggingData,RandomForests,ComputerVision(CV),NaturalLanguage Processing(NLP), NeuralNetworks, TensorFlow. **OrganizeandReportSupersteps:**OrganizeSuperstep,ReportSuperstep, Graphics, Pictures, Showing the Difference	**12**

Booksand References:

Sr.No.	Title	Author/s	Publisher	Edition	Year
1.	PracticalDataScience	Andreas FrançoisVermeulen	APress		2018
2.	PrinciplesofData Science	SinanOzdemir	PACKT		2016
3.	DataScience fromScratch	JoelGrus	O'Reilly		2015
4.	Data Science from ScratchfirstPrinciplein python	JoelGrus	ShroffPublishers		2017
5.	Experimental Design inDatasciencewithLeast Resources	NCDas	ShroffPublishers		2018

M.Sc (InformationTechnology)		Semester–II	
CourseName:Advance Java Programming		CourseCode: CC202	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
EvaluationSystem	TheoryExamination	12	80
	TheoryInternal	--	20

Objeives	• To present the mathematical, statistical and computational challenges of building neural networks • To study the concepts of deep learning • To enable the students to know deep learning techniques to support real-

Prerequisites	Basicknowledgeofstatisticalmethods.Analyticalandlogicalthinking.

Course Objectives:

1) The student will be able to develop distributed business applications, develop web pages using advanced server-side programming through servlets and Java server pages
2) Demonstrate approaches for performance and effective coding
3) Develop Java client/server applications
4) . Develop distributed applications using RMI
5) Develop component-based Java software using JavaBeans
6) Develop server side programs in the form of servlet
7) Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB) ,use Struts frameworks, which gives the opportunity to reuse the codes for quick development and map Java classes and object associations to relational database tables with Hibernate mapping files

Unit	Details	Lectures
I	**Servlets, JSPs & MVC** HTML • History of web application & need of dynamic web sites • Servlet • Servlet History • Basic resources of JSDK • Life Cycle Servlet • Executing Servlet on Tomcat web server • Carrying values in servlets • Session tracking techniques • JSP (Java Server Pages) • Need of JSP • Executing JSP • Carrying values in JSP • 9 implicit objects of JSP • Directives • Actions • Custom tags • Filters • JDBC • JDBC through servlets & JSP • Prepared Statements • Callable Statements • Scrollable ResultSet • Batch Updates • ResultSet Metadata • MVC Architecture • CRUD Application using MVC	12
II	**HIBERNATE**-Introduction to Hibernate • Types, Need of Persistence • Why ORM • Basics of ORM • Understanding of Hibernate as an ORM • Need of Hibernate • Architecture of Hibernate • Understanding JPA • Annotations • Need & Features JPA • JPA Architecture • Significance of EntityManagerFactory, EntityManager, Entity • Different ways to Integrate Spring with JPA • Create Application Spring + Hibernate +JPA and MySQL	12

	as Database Server	
III	**SPRING** Define the Spring Framework • Goals & Features of Spring Framework • What IOC is? • Various ways of Injecting Dependencies • Benefits of IOC • Spring Container working • Simple Sprig Based Application • MVC Design Pattern • Front Controller Pattern • Spring MVC • Spring Annotations • Spring AOP	**12**
IV	**Ajax-** ntroduction to Ajax • The purpose of Ajax • Traditional web application • Ajax with JQuery • An AJAX web application • Ajax advantages and disadvantages	**12**
V	**JSON** Introduction to jQuery • jQuery and JavaScript • jQuery and Ajax • Obtaining / Accessing the jQuery library • Binding event handlers • Removing event handlers • Getting objects by ID, Class, Tag • Modifying object and attributes on-the-fly • Changing an object's Inner Text • Styles and CSS Classes • Handling Events with jQuery • Using the ajax() API • Loading data with GET & POST • Working with JSON data • Serialising your form handling with serialize() • Handling a completed Ajax request	**12**

References:- 1. Java 2 Complete Reference - 2. Java server pages

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Java 2 Complete Reference	(Tata McGraw Hill)			
2.	. Java 2EE –	Ivan Bayross (PHI)			

M.Sc (InformationTechnology)		**Semester–II**	
CourseName:BigData Analytics		**CourseCode:CC203**	
Periodsperweek **1Period is60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Toprovideanoverviewofanexcitinggrowingfieldofbigdataanalytics. • Tointroduce thetoolsrequired to manageand analyzebig datalikeHadoop,NoSql MapReduce. • To teach the fundamental techniques and principles in achieving big dataanalyticswithscalabilityandstreamingcapability. • To enable students to have skills that will help them to solve complex real-worldproblemsin fordecisionsupport.

Unit	Details	Lectures
I	IntroductiontoBigData,CharacteristicsofData,andBigDataEvolution of Big Data, Definition of Big Data, Challenges with bigdata,WhyBigdata?DataWarehouseenvironment,TraditionalBusiness Intelligence versus Big Data. State of Practice in Analytics,KeyrolesforNewBigDataEcosystems,ExamplesofbigDataAnalytics. Big Data Analytics, Introduction to big data analytics, Classification ofAnalytics, Challenges of Big Data, Importance of Big Data, Big DataTechnologies,DataScience,Responsibilities,Softstateeventualconsistency.Data Analytics Life Cycle	12
II	AnalyticalTheoryandMethods:ClusteringandAssociatedAlgorithms, Association Rules, Apriori Algorithm, Candidate Rules,ApplicationsofAssociationRules,ValidationandTesting, Diagnostics, Regression, Linear Regression, Logistic Regression,AdditionalRegression Models.	12
III	AnalyticalTheoryandMethods:Classification,DecisionTrees,NaïveBayes,DiagnosticsofClassifiers,AdditionalClassificationMethods,TimeSeriesAnalysis,BoxJenkinsmethodology,ARIMAModel,Additionalmethods.TextAnalysis,Steps,TextAnalysisExample,Collecting Raw Text, Representing Text, Term Frequency-InverseDocumentFrequency(TFIDF),CategorizingDocumentsbyTopics,DeterminingSentiments	12
IV	Data Product, Building Data Products at Scale with Hadoop, DataScience Pipeline and Hadoop Ecosystem, Operating System for BigData, Concepts, Hadoop Architecture, Working with Distributed filesystem,WorkingwithDistributedComputation,FrameworkforPython andHadoopStreaming, HadoopStreaming,MapReduce withPython,	12

	Advanced MapReduce. In-Memory Computing with Spark, SparkBasics,InteractiveSparkwithPySpark,WritingSparkApplications,	
V	DistributedAnalysisandPatterns,ComputingwithKeys,DesignPatterns, Last-MileAnalytics,DataMiningandWarehousing,StructuredDataQueries withHive,HBase,DataIngestion,Importing RelationaldatawithSqoop,Injestingstreamdatawithflume.Analyticswith higher levelAPIs, Pig, Spark'shigher levelAPIs.	**12**

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Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	BigData andAnalytics	Subhashini ChellappanSeemaAcharya	Wiley	First	
2.	DataAnalyticswith Hadoop *An Introduction for DataScientists*	*BenjaminBengfortand JennyKim*	O'Reilly		2016
3.	BigData and Hadoop	V.KJain	KhannaPublishing	First	2018

M.Sc (InformationTechnology)		**Semester–I**	
CourseName:ModernNetworking		**CourseCode:CC204-01**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	• Tounderstandthestate-of-the-artinnetworkprotocols,architecturesandapplications. • Analyzeexistingnetworkprotocolsandnetworks. • Developnewprotocolsinnetworking • Tounderstandhownetworkingresearchisdone • To investigatenovelideasintheareaofNetworkingviaterm-longresearchprojects.

Prerequisites	FundamentalsofNetworking

Unit	Details	Lectures
I	ModernNetworking ElementsofModernNetworking The Networking Ecosystem ,Example Network Architectures,GlobalNetworkArchitecture,ATypicalNetworkHierarchy EthernetApplicationsofEthernetStandardsEthernetDataRatesWi-FiApplicationsofWi-Fi,StandardsWi-FiDataRates4G/5GCellularFirstGeneration Second Generation, Third Generation Fourth GenerationFifth Generation, Cloud Computing Cloud Computing Concepts TheBenefitsofCloudComputingCloudNetworkingCloudStorage.	**12**
II	Software-DefinedNetworks SDN: Background and Motivation, Evolving Network RequirementsDemand Is Increasing,Supply Is IncreasingTraffic Patterns Are MoreComplexTraditionalNetworkArchitecturesareInadequate,TheSDN ApproachRequirementsSDNArchitectureCharacteristicsofSoftware-Defined Networking, SDN- and NFV-Related Standards Standards-DevelopingOrganizationsIndustryConsortiaOpenDevelopmentInitiatives, SDN Data Plane and OpenFlow SDN Data Plane, DataPlaneFunctionsDataPlaneProtocolsOpenFlowLogicalNetworkDeviceFlowTableStructureFlowTablePipeline,TheUseofMultipleTablesGroup Table OpenFlow Protocol, SDN ControlPlane.	**12**
III	Virtualization, Network Functions Virtualization: Concepts andArchitecture, Background and Motivation for NFV, Virtual MachinesThe Virtual Machine Monitor, Architectural Approaches ContainerVirtualization, NFV Concepts Simple Example of the Use of NFV,NFV Principles High-Level NFV Framework, NFV Benefits andRequirementsNFVBenefits,NFVRequirements, NFV ReferenceArchitecture NFV Management and Orchestration, Reference PointsImplementation, NFV Functionality, NFV Infrastructure,ContainerInterface.	**12**

IV	Defining and Supporting User Needs, Quality of Service, Background,QoSArchitecturalFramework,DataPlane,ControlPlane,ManagementPlane,Integrated Services Architecture, ISAApproach ISA Components, ISA Services, Queuing Discipline, DifferentiatedServices,Services,DiffServField,DiffServConfigurationandOperation, Per-Hop Behavior, Default Forwarding PHB, Service LevelAgreements, IP Performance Metrics, OpenFlow QoS Support, QueueStructures,Meters,QoE:UserQualityofExperience,WhyQoE?,OnlineVideoContentDelivery,ServiceFailuresDuetoInadequate QoE Considerations QoE-Related Standardization Projects,Definition of Quality of Experience, Definition of Quality, Definitionof Experience Quality Formation Process, Definition of Quality ofExperience, QoE Strategies in Practice.	12
V	Modern Network Architecture: Clouds and Fog, Cloud Computing,Basic Concepts, Cloud Services, Software as a Service, Platform as aService,InfrastructureasaService,OtherCloudServices,XaaS,CloudDeployment Models, Public Cloud Private Cloud Community Cloud,Hybrid Cloud, Cloud Architecture, NIST Cloud Computing ReferenceArchitecture,ITU-T Cloud Computing Reference Architecture, SDN andNFV,ServiceProviderPerspectivePrivateCloudPerspective,ITU-TCloudComputingFunctionalReferenceArchitecture.	**12**

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Foundationsof Modern Networking:SDN,NFV, QoE,IoT, and Cloud	William Stallings	Addison-WesleyProfessional		October 2015

2.	SDNandNFVSimplifiedA Visual Guide toUnderstanding SoftwareDefinedNetworks and Network FunctionVirtualization	**JimDoherty**	PearsonEducation,Inc		

M.Sc (InformationTechnology)		Semester–II	
CourseName:Natural Language Processing		**CourseCode:CCPR 204-02**	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
EvaluationSystem	**TheoryExamination**	**3**	**80**
	TheoryInternal	**--**	**20**

Objectives	**To learn how to use Natural Language Processing** **ToimplementNLP.** **The ultimate aim of NLP is to read, understand, and decode human words in a valuable manner.**

Unit	Details	Lectures
I	**Introduction:-** NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.	**12**
II	**N-gram Language Models:-** The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. **Part Of Speech Tagging and Sequence Labeling:-** Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training).	**12**

III	**Syntactic parsing:-** Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs	**12**
IV	**Semantic Analysis:-** Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Sematic Parsing.	**12**
V	**Machine Translation (MT):-** Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.	**12**

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Natural Language Processing	James Allen	Elsevier	II	1995
2.	Computational Linguistics and Natural Language Processing	Alexandar Clark,Chris Fox and Shallom Lappin	Willey-Blackwell	Kindle	

M.Sc (InformationTechnology)		Semester–II	
CourseName:Deep Learning		CourseCode: CCPR204-03	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
EvaluationSystem	TheoryExamination	12	80
	TheoryInternal	--	20

Objectives	• To present the mathematical, statistical and computational challenges of building neural networks • To study the concepts of deep learning • To enable the students to know deep learning techniques to support real-

Prerequisites	Basicknowledgeofstatisticalmethods.Analyticalandlogicalthinking.

Unit	Details	Lectures
I	**Applied Math and Machine Learning Basics:** Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identity and Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors, eigen decompositions. Numerical Computation: Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization	12
II	**Deep Networks:** Deep feedforward network , regularization for deep learning , Optimization for Training deep models	12
III	Convolutional Networks, Sequence Modelling, Applications	12
IV	Deep Learning Research: Linear Factor Models, Autoencoders, representation learning	12
V	Approximate Inference, Deep Generative Models	12

Booksand References:					
Sr.No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courvile	An MIT Press book	1st	2016
2.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	1st	2017
3.	Deep Learnin CookBok	Douwe Osinga	O'Reilly	1st	2017
4.	Deep Learning: Methods and Applications	Deng & Yu	Now Publishers	1st	2013

M.Sc (InformationTechnology)		**Semester–I**	
CourseName:DataScienceLab		**CourseCode:** CCPR-205	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

CourseOutcome	• Applyquantitativemodelinganddataanalysistechniquestothesolution of real world business problems, communicate findings, andeffectivelypresentresults using datavisualizationtechniques.

M.Sc(InformationTechnology)		Semester–II	
CourseName:Advanced Java Programming Lab		CourseCode:CCPR-206	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
EvaluationSystem	PracticalExamination	2	50

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	Developweb applicationsusing JSP, Spring and hibernate CreateMVCModelsandwritecodethatimplementsbusinesslogicwithinModel methods, properties,andevents.

M.Sc (InformationTechnology)		Semester–II	
CourseName:BigDataAnalyticsLab		CourseCode:CCPR-207	
Periodsperweek 1Period is60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
EvaluationSystem	PracticalExamination	2	50

PracticalNo	Details
1 - 10	10Practicalbased onabove syllabus,coveringentire syllabus

CourseOutcome	• Understandthekeyissuesinbigdatamanagementanditsassociatedapplicationsinintelligentbusinessandscientificcomputing. • Acquirefundamentalenablingtechniquesandscalablealgorithms like Hadoop, Map Reduce and NO SQL in big dataanalytics. • Interpret business models and scientific computing paradigms,andapply software tools for big dataanalytics. • Achieve adequate perspectives of big data analytics in variousapplicationslikerecommendersystems,socialmedia • . .

M.Sc (InformationTechnology)		Semester–II	
CourseName:ModernNetworkingPractical		**CourseCode:**CCPR208-01	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Demonstrate in-depthknowledgein theareaof ComputerNetworking. • To demonstrate scholarship of knowledge through performing in a grouptoidentify,formulate andsolvea problemrelated toComputerNetworks • PrepareatechnicaldocumentfortheidentifiedNetworkingSystemConductingexperimentstoanalyzetheidentifiedresearchworkinbuildingComputerNetworks

M.Sc (InformationTechnology)		Semester–II	
CourseName:Natural Language Processing Lab		**CourseCode:**CCPR208-02	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Demonstrate in-depthknowledgein theareaof NLP. • To demonstrate NLP Programs.

M.Sc (InformationTechnology)		Semester–II	
CourseName:Deep Learning Lab		**CourseCode:**CCPR208-03	
Periodsperweek 1Period is60 minutes	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
EvaluationSystem	**PracticalExamination**	**2**	**50**

PracticalNo	Details
1 - 10	10Practicalbasedonabove syllabus,coveringentiresyllabus

CourseOutcome	• Demonstrate in-depthknowledgein theareaof Deep Learning • To demonstrate Deep Learning Programs.