MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
NH-12 [Old NH-34], Simhat, Haringhata, Nadia -741249

Department of Information Technology

B.sc in Information Technology (Data Science)

GE Basket 1		GE Basket 2		GE Basket 3	
Mathematics		Humanities and Social Sciences		General Science	
1	Mathematics for Computing	1	Creative Writing	1	Climate Change and Health
2	Probability & Statistics	2	Business English	2	Environmental Law and Policy
3	Bayesian Statistics	3	Leadership	3	Environmental Informatics
4	Operations Research	4	Professional Communication	4	Health Informatics
5	Data Analytics	5	E-Learning	5	Intelligence of Biological Systems
6	Applied Cryptography	6	Model Thinking	6	Simulation and Modelling Natural Processes
7	Inferential Statistics	7	Digital Transformation and Industry 4.0	7	Bioinformatics

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Mathematics for Computing	
Course Code: GE11/ (GE3B-09)	**Semester: I**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance: 5**
Practical:0	**Continuous Assessment: 25**
Credit:6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	To develop formal reasoning.
2.	Create habit of raising questions
3.	Knowledge regarding the use of Mathematics in Computer Science
4.	Ability to communicate knowledge, capabilities and skills related to the computer engineer profession

Objective:Throughout the course, students will be expected to demonstrate their understanding of Mathematics by being able to do each of the following

Sl. No.	
1.	To understand and solve mathematical problems
2.	To impart knowledge regarding relevant topics .
3.	To familiarize students with linear Algebra, differential and integral calculus, numerical methods and statistics.

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B.sc in Information Technology (Data Science)

Pre-Requisite:			
Sl. No.			
1.	**Knowledge of basic algebra, trigonometry and calculus .**		
Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Modern algebra** Set, Relation, Mapping, Binary Operation, Addition Modulo n, Multiplication modulo n, semi group, properties of groups, subgroup.	**3**	**7**
02	**Trigonometry** Radian or circular Measure, Trigonometric Functions, Trigonometric ratios of angle θ when θ is acute, trigonometric ratios of certain standard angles, allied angles, compound angles, multiple and sub- multiple angles.	**6**	**5**
03	**Limits and Continuity** The real number system, The concept of limit, concept of continuity.	**6**	**5**
04	**Differentiation** Differentiation of powers of x, Differentiation of ex and log x, differentiation of trigonometric functions, Rules for finding derivatives, Different types of differentiation, logarithmic differentiation, differentiation by substitution, differentiation of implicit functions, differentiation from parametric equation. Differentiation from first principles.	**6**	**7**
05	**Integrations** Integration of standard Functions, rules of Integration, More formulas in integration, Definite integrals.	**6**	**7**
06	**Differential equations**	**6**	**6**

	First order differential equations, practical approach to Differential equations, first order and first degree differential equations, homogeneous equations. Linear equations, Bernoulli's equation, Exact Differential Equations.		
07	**Complex Numbers** Complex Numbers, Conjugate of a complex number, modulus of a complex Number, geometrical representation of complex number, De Moivre's theorem, n^{th} roots of a complex number.	**5**	**5**
08	**Matrices and Determinants** Definition of a matrix, Operations on matrices, Square Matrix and its inverse, determinants, properties of determinants, the inverse of a matrix, solution of equations using matrices and determinants, solving equations using determinants.	**5**	**8**
09	**Infinite Series** Convergence and divergence, series of positive terms, binomial series, exponential series,logarithmic series.	**5**	**7**
10	**Probability** Concept of probability, sample space and events, three approaches of probability, kolmogorov's axiomatic approach to probability, conditional probability and independence of events, bay's theorem.	**5**	**5**
11	**Introduction to Statistics** Measures of central Tendency, Standard Deviation, Discrete series. Methods, Deviation taken from assumed mean, continuous series, combined standard deviation, coefficient of variation, variance.	**3**	**8**
	Sub Total:	**48**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**52**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

Department of Information Technology

B.sc in Information Technology (Data Science)

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
S. K. Mapa	Higher Algebra		Levant Books
O'Regan, Gerard	Mathematics in Computing		
Chakravorty and Ghosh	Advanced Higher Algebra		U N Dhar Pvt. Ltd

Reference Books:

Das and Mukherjee	Integral Calculus		U N Dhar Pvt. Ltd
Das and Mukherjee	Differential Calculus		U N Dhar Pvt. Ltd

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**5**	**3**	**5**	**60**
C	**1 to 11**			**5**	**3**	**15**	

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Department of Information Technology

B.sc in Information Technology (Data Science)

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

Examination Scheme for end semester examination:

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

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science)		
Subject: Probability & Statistics		
Course Code: GE12/ (GE3B-10)	**Semester: I**	
Duration: 60 Hrs	**Maximum Marks: 100**	
Teaching Scheme	**Examination Scheme**	
Theory: 5	End Semester Exam: 70	
Tutorial:1	Attendance: 5	
Practical:0	Continuous Assessment: 25	
Credit:6	Practical Sessional internal continuous evaluation: NA	
	Practical Sessional external examination: NA	

Aim:	
Sl. No.	
1.	The aim of this course is to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.
2.	The objective of this course is to familiarize the students with statistical techniques.

Objective: Throughout the course, students will be expected to demonstrate their understanding of probability & statistics by being able to learn each of the following	
Sl. No.	
1.	The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2.	The basic ideas of statistics including measures of central tendency, correlation and regression.
3.	The statistical methods of studying data samples.

Pre-Requisite:	
Sl. No.	
1.	Knowledge of basic algebra, calculus.
2.	Ability to learn and solve mathematical model.

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and nonhomogeneous linear partial differential equations of second order by complimentary function and particular integral method. Second-	**18**	**20**

	order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.		
02	Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.	**18**	**25**
03	Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	**20**	**25**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

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

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Erwin Kreyszig	Advanced Engineering Mathematics	9 th Edition	John Wiley & Sons
N. G. Das	Statistical Methods	0070083274, 9780070083271	Tata Mc.Graw Hill
Reference Books:			
P. G. Hoel, S. C. Port and	Introduction to		Universal Book Stall

C. J. Stone	Probability Theory		
W. Feller	An Introduction to Probability Theory and its Applications	3rd Ed.	Wiley

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

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

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject: Bayesian Statistics**			
Course Code: GE13/ (GE3B-11)		**Semester: I**	
Duration: 60 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		**End Semester Exam: 70**	
Tutorial: 1		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 6		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	The aim of this course is to equip students with the skills to perform and interpret Bayesian statistical analyses.		
Objective:			
Sl. No.			
1.	To describing the fundamentals of Bayesian inference by examining some simple Bayesian models.		
2.	To explore more complicated models, including linear regression and hierarchical models in a Bayesian framework		
Pre-Requisite:			
Sl. No.			
1.	Knowledge in mathematics		
Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Statistical Science Scientific Data Gathering Logic, Probability, and Uncertainty Discrete Random Variables	**14**	**15**
02	Bayesian Inference for Discrete Random Variables Continuous Random Variables Bayesian Inference for Binomial Proportion Comparing Bayesian and Frequentist Inferences for Proportion Bayesian Inference for Poisson	**14**	**20**
03	Bayesian Inference for Normal Mean Comparing Bayesian and Frequentist Inferences for Mean Bayesian Inference for Difference Between Means	**14**	**20**
04	Bayesian Inference for Simple Linear Regression Bayesian Inference for Standard Deviation Robust Bayesian Methods	**14**	**15**
	Sub Total:	**56**	**70**

	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
William M. Bolstad	Introduction to Bayesian statistics	2nd ed. ISBN 978-0-470-141 15-1	
Andrew Gelman, John Carlin, Hal Stern, David Dunson, Aki Vehtari, and Donald Rubin.	Bayesian Data Analysis	Third edition	

Reference Books:

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4	10	10				
B	3, 4,			5	3	5	70
C	1,2,3,4			5	3	15	

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

Examination Scheme for end semester examination:

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

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Operations Research	
Course Code: GE14/ (GE3B-12)	**Semester: I**
Duration: 60Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical:0	**Continuous Assessment:25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	To learn how to solve problem in optimized way.
2.	Use various technique like game theory, LPP in real life problem.

Objective:

Sl. No.	
1.	Understand the optimization method
2.	To evaluate the reliability and validity of a measuring
3.	Apply the method to other Real life Problem

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Department of Information Technology

B.sc in Information Technology (Data Science)

Pre-Requisite:	
Sl. No.	
1.	Mathematics
2.	Linear Algebra

Contents		6 Hrs./week	
Chapter	Name of the Topic	Hours	Marks
01	Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation.	8	10
02	Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	12	20
03	Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).	8	5
04	Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	8	10
05	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.	10	15
06	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue).	10	10

	Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.		
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
H. A. Taha	Operations Research		Pearson

Reference Books:

P. M. Karak	Linear Programming and Theory of Games		ABS Publishing House
Ghosh and Chakraborty	Linear Programming and Theory of Games		Central Book Agency

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

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

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

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

Examination Scheme for end semester examination:

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

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject: Data Analytics**	
Course Code: GE15/ (GE3B-13)	**Semester: I**
Duration: 60 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1.	Find a meaningful pattern in data
2.	Graphically interpret data
3.	Implement the analytic algorithms
4.	Handle large scale analytics projects from various domains

Objective:	
Sl. No.	
1.	The process of data analysis uses analytical and logical reasoning to gain information from the data.
2.	To find meaning in data so that the derived knowledge can be used to make informed decisions.
3.	Develop intelligent decision support systems

Pre-Requisite:	
Sl. No.	
1.	A strong mathematical background in Probability and Statistics
2.	Critical thinking and problem solving skills

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Data Definitions and Analysis Techniques** Elements, Variables, and Data categorization Levels of Measurement Data management and indexing	**10**	**14**

02	**Descriptive Statistics** Measures of central tendency Measures of location of dispersions	**10**	**14**
03	**Basic Analysis Techniques** Basic analysis techniques Statistical hypothesis generation and testing Chi-Square test t-Test Analysis of variance Correlation analysis Maximum likelihood test	**12**	**14**
04	**Data analysis techniques** Regression analysis Classification techniques Clustering Association rules analysis	**12**	**14**
05	**Case studies** Understanding business scenarios Feature engineering and visualization	**12**	**14**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Hastie, Trevor, et al.	The elements of statistical learning		Vol. 2. No. 1. New York: springer, 2009.
Montgomery, Douglas C., and George C. Runger	Applied statistics and probability for engineers		John Wiley & Sons, 2010
Reference Books:			

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B.sc in Information Technology (Data Science)

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

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

Examination Scheme for end semester examination:

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

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:Applied Cryptography**	
Course Code: GE16/ (GE3B-14)	**Semester: I**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment:25**
Credit: 6	**Practical & Sessional internal continuous evaluation: NA**
	Practical & Sessional external examination: NA

Aim:

Sl. No.	
1	To learn fundamentals of theoretical and practical areas of cryptography.
2	To learn fundamentals of digital signature and secure data transmission.

Objective:

Sl. No.	
1.	Understand various types of attacks and their characteristics.
2.	Understand the basic concept of encryption and decryption for secure data transmission.
3.	Analyze and compare various cryptography techniques.

4.	Understand the concept of digital signature and its applications.

Contents		**6 Hrs./week**	
Module	**Name of the Topics**	**Hours**	**Marks**
1	Introduction: Need for Security, Security approaches, Principles of Security, Types of Attacks, Plain Text & Cipher Text, Transposition Techniques, Substitution Techniques, Encryption & Decryption, Symmetric Key & Asymmetric Key Cryptography, Key Range & Key Size.	**14**	**18**
2	Introduction to Number Theory, Modular Arithmetic, Prime Numbers, Residue Classes, Euler's Totient Function, Fermat's Theorem and Euler's Generalization, Euclidean Algorithm, Extended Euclidean Algorithm for Multiplicative Inverse, Primitive Roots & Discrete Logarithm, Chinese Remainder Theorem, Gauss Theorem.	**14**	**15**
3	Symmetric Key Cryptography: Overview, Block Cipher, DES Algorithm, Strength of DES, AES Algorithm, Evaluation Criteria for AES, Modes of Operations.	**8**	**10**
4	Asymmetric Key Cryptography: Principles of Public Key Cryptography, RSA Algorithm, Key Management, Man in the Middle Attack, Diffie-Hellman Key Exchange Algorithm.	**10**	**15**
5	Authentication: Authentication Requirement, Functions, Message Digest, Hash Function, Security of Hash Function, Kerberos, Digital Signature Standard, Digital Signature Algorithms – DSA, ElGamal Signature, Authentication Protocols.	**10**	**12**
Sub Total:		**56**	**70**
Internal Assessment Examination & Preparation of Semester Examination		**4**	**30**

Total:						**60**	**100**
List of Books **Text Books:**							
Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**				
William Stallings	Cryptography and Network Security: Principles and Practice	7th edition	PEARSON				
Reference Books:							
AtulKahate	Cryptography and Network Security	3rd edition	McGraw Hill Education (India) Private Limited				
B. Schneier	Applied Cryptography	2nd Edition	J. Wiley and Sons				
End Semester Examination Scheme.			**Maximum Marks-70.**			**Time allotted-3hrs.**	
Group	**Module**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**All**	**12**	**10**				
B	**All**			**5**	**3**	**5**	**70**
C	**All**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the

objective part.

- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	12	10
B	All	5	5	3
C	All	15	3	3

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Inferential Statistics	
Course Code: GE17/ (GE3B-15)	**Semester: I**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical:0	**Continuous Assessment:25**
Credit: 6	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination:NA

Aim:

Sl. No.	
1	To learn how to set up and perform hypothesis tests
2	Use regression analysis to analyze and interpret data collected from ANOVA and ANCOVA designs.

Objective:

Sl. No.	
1.	To enable students to analyze and interpret data
2.	Understand the types of questions that the statistical method addresses

3.	To evaluate the reliability and validity of a measuring
4.	Apply the method to other examples and situations
5.	Use data to make evidence based decisions that are technically sound

Pre-Requisite:

Sl. No.	
1.	Mathematics
2.	Probability Statistics

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE) and Rao-Blackwell theorem with applications. Cramer-Rao inequality and MVB estimators (statement and applications).	**12**	**10**
02	Methods of Estimation: Method of moments, method of maximum likelihood estimation.	**8**	**5**
03	Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test,	**12**	**20**
04	Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test and		**15**

	relevant problems, properties of likelihood ratio tests (without proof).	**12**	
05	Interval estimation - Confidence interval for the parameters of various distributions, Confidence interval for Binomial proportion, Confidence interval for population correlation coefficient for Bivariate Normal distribution, Pivotal quantity method of constructing confidence interval, Large sample confidence intervals.	**12**	**20**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Goon A.M., Gupta M.K.: Das Gupta.B.	Fundamentals of Statistics		World Press

Reference Books:

Rohatgi V. K. and Saleh, A.K. Md. E.	An Introduction to Probability and Statistics	2ndEdn	John Wiley & Sons.
Dudewicz, E. J., and Mishra, S. N.	Modern Mathematical Statistics		John Wiley & Sons.
Bhattacharjee , D. & Das, K. K.	A Treatise on Statistical Inference and Distributions		Asian Books

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Hogg, R.V., Tanis, E.A. and Rao J.M	Probability and Statistical Inference	Seventh Ed	Pearson Education

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

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

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

General Elective Basket-2

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Creative Writing	
Course Code: GE21	**Semester: II**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance: 5**
Practical:0	**Continuous Assessment: 25**
Credit:6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
5.	Revealing insightful ways in which complex socio-historical (or other, such as aesthetic) contexts and assumptions inform the production, distribution, and/or reception of object of study.
6.	Locating and selecting verified, reputable sources to create insightful analysis or synthesis.
7.	Utilizing a language that skillfully communicates with clarity and fluency.
8.	

Objective: The course opens up creative space for students of diverse academic backgrounds: Literary Studies, Science, Technology, Design, Social Studies, Architecture and so on.

Sl. No.	
4.	To apply critical and theoretical approaches to the reading and analysis of literary texts in multiple genres.
5.	Become capable of producing poems or literary non-fictional pieces that are original and

	engaging.		
6.	To articulate an awareness of the relationship between the individual works and conventional literary work.		
7.	To identify, analyze, interpret and describe critical ideas, themes, values that consist of literary texts and perceive the ways to evaluate how ideas, themes and values create an impact on societies, both in the past and present.		
Pre-Requisite:			
Sl. No.			
2.	Introductory Reading and Writing/Composition Courses		
Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Creative Writing** • Imaginative writing vs. technical / academic / other forms of writing • Sensory experience • Language -(Imagery , Figures of speech , Diction) • Sample works of well-known local and foreign writers	**12**	**15**
02	**Reading and Writing Poetry** • Elements of the genre • Essential elements -Theme, Tone • Elements for specific forms -Conventional forms - exemplar: short Tagalog poems like tanaga and diona; haiku; sonnet -rhyme and meter -metaphor • Free verse -the line and line break -enjambments -metaphor • Other experimental texts -typography -genre-crossing texts (e.g. prose poem, performance poetry,	**14**	**15**

	etc.)		
03	**Reading and Writing Fiction** • Elements of the genre -Character -Point of View -1st-person POV (major, minor, or bystander - 2nd-person POV - 3rd-person POV (objective, limited omniscient, omniscient) • Plot (linear, modular/episodic, traditional parts: exposition,rising action, climax, falling action, resolution/denouement) • Irony -verbal -situational - dramatic -moral/lesson -dramatic premise -insight • Techniques and literary devices -Mood/tone -Foreshadowing - Symbolism and motif - Modelling from well-known local and foreign short story writers in arange of modes	**12**	**15**
04	**Reading and Writing Drama (one-act)** • Elements of the genre -Character -Setting -Plot -Dialogue • Techniques and literary devices - Intertextuality - Conceptualization of modality - Modelling from well-known local and foreign playwrights	**12**	**15**
05	The creative work in literary and /or socio political context	**6**	**10**
	Sub Total:	**56**	**70**

	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Dorothea Brande and Dorothea Thompson Brande	Becoming a Writer		Tarcher Perigee
John C Gardner	On Becoming a Novelist		W. W. Norton & Co.
Stephen King	On Writing: A Memoir of the Craft	978-1444723250	

Reference Books:

Betsy Lerner	The Forest for the Trees	978-1594484834	Riverhead Books
Angie Thomas	Find Your Voice		Paperback

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

Group	**Unit**	**Objective Questions** (MCQ only with the	**Subjective Questions**

		correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**5**	**3**	**5**	**60**
C	**1 to 11**			**5**	**3**	**15**	

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Business English	
Course Code: GE22	**Semester: II**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance: 5**
Practical:0	**Continuous Assessment: 25**
Credit:6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	To communicate with others in practical, business oriented situations
2.	To express themselves in English with greater fluency, accuracy and confidence
3.	To handle themselves in English in a variety of business contexts, from negotiating, to using the telephone, to making presentations, to socialising

Objective:

Sl. No.	
1.	To help you read comprehension passages easily using reading techniques.
2.	To help you engage with other members of the business field confidently

3.	To help you write business documents and generate content effectively		
4.	To improve your vocabulary for day-to-day communication in global work spaces.		
Pre-Requisite:			
Sl. No.			
1.	Basic English Communication Skill		
Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introductions** • Course outline and approach • Describing your role and responsibilities • Typical & critical scenarios you use the target language in, key issues	**6**	**5**
02	**Meetings** • Chairing, setting the agenda, controlling the conversation • Participating, turn taking, listening and taking notes • Being diplomatic, agreeing and disagreeing	**9**	**10**
03	**Business Correspondence** • Emails– register, style, standard phrasing • Notes and memos • Business specific language phrases	**8**	**10**
04	**Telephoning** • Checking & clarifying information • Finance specific scenarios • Listening to different accents, intonation	**8**	**10**

05	**Making Presentations** • Introducing a topic effectively • Linking and sequencing ideas • Concluding • Responding to questions	**9**	**15**
06	**Negotiating** • Key negotiating language, framing your argument • Negotiating with suppliers • Negotiating with customers	**8**	**10**
07	**Reports** • Skim reading reports and news feeds • How to report information and ideas • Writing reports– style, register, conventions	**8**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

David Cotton ,David Falvey ,Simon Kent	Market Leader		Financial Times
Rachel Appleby, John Bradley, Brian Brennan and Jane Hudson	Business one:one		Oxford Business English
Mara Pedretti and Rolf Cook	Total Business 1		Workbook
Reference Books:			
Tonya Trappe and Graham Tullis	Intelligent Business		Pearson Longman
Paul Emmerson	Essential Business Grammer Builder		Macmillan Education

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**5**	**3**	**5**	**60**
C	**1 to 11**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.

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- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject: Leadership**	
Course Code: GE23	**Semester: 2**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance: 5**
Practical:0	**Continuous Assessment: 25**
Credit:6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	To Raise one's own self-awareness
2.	To Gain self-confidence for a better leadership
3.	To Develop relational skills, self-knowledge and self-awareness

Objective:Throughout the course, students will be expected to discover a new approach to leadership based on trust and sense.

Sl. No.	
1.	To discover a new approach to leadership based on trust and sense.
2.	To develop greater self-awareness by developing a leadership self-portrait and going through fun activities to increase your empathy and communication.

Pre-Requisite:

Sl. No.	Basic Knowledge of English Communication

Contents	**6 Hrs./week**

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Chapter	Name of the Topic	Hours	Marks
01	Understanding Leadership Defining Leadership; Global Leadership Attributes; Practicing Leadership.	**8**	**10**
02	Recognizing Your Traits Historical Leaders; What Traits Do These Leaders Display? Leadership Studies: What Traits Do Effective Leaders Exhibit?	**6**	**10**
03	Engaging People's Strength Explore how strengths can make one a better leader. Understand the concept of strength; Describe the historical background of strengths-based leadership. Examine how to identify strengths; Review measures used to assess strengths; Examine strengths-based leadership in practice.	**10**	**10**
04	Attending to Tasks and Relationships Task and Relationship Styles Explained; Task and Relationship Styles in Practice	**6**	**6**
05	Developing Leadership Skills Understanding administrative skills and their use in practice. Understanding interpersonal skills and their use in practice. Understanding conceptual skills and their use in practice	**6**	**10**
06	Creating a Vision Understand the characteristics of a vision. Examine the process of vision articulation; Discuss vision implementation; Focus on how to develop a workable vision for different contexts	**6**	**6**
07	Addressing Ethics in Leadership Ethical Leadership is about the following: the Character of the Leader, Action of the Leader, Goals of Leader, Honesty of the Leader, Power of the Leader, Value of Leader	**4**	**9**
08	Overcoming Obstacles	**10**	**9**

	Discuss the concept of obstacles in the workplace. Discuss obstacles in practice. Highlight seven major obstacles derived from path-goal theory of motivation. Describe each obstacle and the various ways leaders can respond to these obstacles		
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
James Kouzes& Barry Posner	**The Leadership Challenge: How to Make Extraordinary Things Happen in Organizations**		
Northouse, P. G	**Introduction to Leadership: Concepts and Practice (3rd ed.)**		

Reference Books:

John Wooden & Steve Jamison	Wooden on Leadership		

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

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Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**5**	**3**	**5**	**60**
C	**1 to 11**			**5**	**3**	**15**	

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Professional Communication	
Course Code: GE24	**Semester: II**
Duration: 60 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial:1	Attendance: 5
Practical:0	Continuous Assessment: 25
Credit:6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
3.	The aim of this course is to communicate more effectively at work
4.	The objective of this course is to to improve your communication skills, and the most successful strategies for using them to your advantage.
Objective: Throughout the course, students will be able to understand what others want, respond strategically to their wants and needs, craft convincing and clear messages, and develop the critical communication skills you need to get ahead in business and in life.	
Sl. No.	
4.	This course helps to how to develop trust, the best method of communication for negotiation, and how to apologize
5.	This course will help to write and speak in English in both social and professional interactions, and learn terminology.
Pre-Requisite:	
Sl. No.	
3.	Basic Knowledge of English Communication

Contents		**6 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Soft Skills– Hard skills & soft skills – employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs	**13**	**14**
02	Self-Introduction-organizing the material – Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice–– presenting the visuals effectively – 5 minute presentation	**13**	**14**

03	Introduction to Group Discussion— Participating in group discussions – understanding group dynamics – brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills	**13**	**14**
04.	Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews	**13**	**14**
05.	Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes	**4**	**14**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

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

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
A. K. Jain and A. M. Sheikh	Professional Communication Skills	Eighth Revised Edition	Schand
Meenakshi Raman and Sangeetha Sharma	Technical Communication: Principles and Practice	2nd Edition, Oxford University Press,	
Reference Books:			
Raman Sharma	Technical Communications		Oxford Publication

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)	**Subjective Questions**

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		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 3**	**10**	**10**				
B	**1 to 3**			**5**	**3**	**5**	**70**
C	**1 to 3**			**5**	**3**	**15**	

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** E-Learning	
Course Code: GE25	**Semester: II**
Duration: 60 Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1	To understand all elements of E-Learning
2	To make students aware of current situation in various E-Learning platform.

Objective:	
Sl. No.	
1	To offer students learn through E-Learning.
2	Understand the drivers and enablers of Industry 4.0
3	Understand the opportunities, challenges brought about by digital media.
4	To understand concepts of digital transformation and its application in education.

Pre-Requisite:	
Sl. No.	
1	Basic knowledge of computer and internet.
2	Should be aware of current situation in various industry vertices.

Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Module 1:** What Is E-Learning?Types of E-Learning, Advantages and Disadvantages of Asynchronous E-Learning, Elements of an E-Learning Course	**9**	**10**
02	**Module 2:** Developing an E-Learning Strategy, The Strategic Plan, Cost-Benefit Analysis, Generating Support	**8**	**10**
03	**Module 3:**	**8**	**10**

	Managing an E-Learning Project, The Project Management Model and the ADDIE Model, Define the Project, Plan the Project,Implement, Monitor, and Adjust the Project, Evaluate the Project, Budgeting, Resources, Timelines and Development Ratios, Working With Vendors		
04	**Module 4:** Tools of the Trade, Authoring Tools, Element Tools, Assessments, Audio and Video	**8**	**10**
05	**Module 5:** The Analysis Phase, Business Analysis, Audience Analysis, Technology Analysis	**6**	**10**
06	**Module 6:** The Design Phase: Broad Strategies, E-Learning and Instructional Design, Developing Objectives, Structuring the Content, Instructional Strategies, Selecting the Best Format, Special E-Learning Considerations: Standards and Compliance, Testing and Assessments Media, Interface and Navigation , The Design Document	**8**	**10**
07	**Module 7:** The Development Phase: Writing the Course, Working With Storyboards, Elements of Storyboards, Storyboard Templates, Organizing Your Content, Converting Existing Content, The Development Phase: Putting the Course Together, Rapid Prototyping, Rapid Development, Paper Review Cycles, Assembling the Course, On-Screen Review Cycles	**5**	**5**
08	**Module 8:** The Implementation Phase, Preparing the Audience,Ongoing Management, The Evaluation Phase Level 1 Evaluation: Learner Reaction, Level 2 Evaluation: Learning, Levels 3–5 Evaluation: Impact, Moving Forward, Find Your PathKeep Learning	**4**	**5**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Diane Elkins&DesiréePinder	E-Learning Fundamentals	ISBN: 9781562869472	ATD Press 2015-06-30

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Reference Books:			
Michael W. Allen	Designing Successful e-Learning	**ISBN 10:** 1118038312 **ISBN 13:** 9781118038314 **Print ISBN:** 9780787982997	Wiley Professional Development (P&T) 5/11/07

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 8	10	10				
B	1 to 8			5	3	5	70
C	1 to 8			5	3	15	

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject: Model Thinking**			
Course Code: GE26		**Semester: II**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	To understand different kind of models		
2	To make students aware of critical thinking		
Objective:			
Sl. No.			
1	To be a clearer thinker		
2	To understand and use of data		
3	To better decide, strategize, and design		
4	To be an intelligent citizen of the world		
Pre-Requisite:			
Sl. No.			
1	Basic knowledge of computer and internet and data.		
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Model & Segregation** Introduction to Different kind of models, data, thinking ability	**9**	**10**
02	**Aggregation & Decision Models**	**8**	**10**
03	**Thinking Electrons: Modelling People & Categorical and Linear Models** Social scientists model. Three different models. The rational actor approach, behavioural models, and rule based models	**8**	**10**
04	**Tipping Points & Economic Growth**	**6**	**10**
05	**Diversity and Innovation & Markov Processes** Rugged landscapes and local optima	**8**	**10**
06	Path Dependence & Networks, Randomness and Random Walks &	**9**	**10**

	Colonel Blotto, Prisoners' Dilemma and Collective Action & Mechanism Design		
07	**Learning Models:** Replicator Dynamics & Prediction and the Many Model Thinker	**8**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Scott E. Page	The Model Thinker:What You Need to Know to Make Data Work for You	ISBN10: 0465094627	Basic Books

Reference Books:

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

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

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

Examination Scheme for end semester examination:

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

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology (Data Science) **Subject:** Digital Transformation and Industry 4.0			
Course Code: GE27		**Semester: II**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	To understand all elements of transformation efforts		
2	To make students aware of current situation in various industry vertices.		
Objective:			
Sl. No.			
1	To offer students an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world.		
2	Understand the drivers and enablers of Industry 4.0		
3	Understand the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits		
4	To understand concepts of digital transformation and its application.		
Pre-Requisite:			
Sl. No.			
1	Basic knowledge of computer and internet.		
2	Should be aware of current situation in various industry vertices.		
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Industry 4.0** The Various Industrial Revolutions , Digitalisation and the Networked Economy , Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 , The Journey so far: Developments in USA, Europe, China and other countries , Comparison of Industry 4.0 Factory and Today's Factory , Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation	**9**	**10**

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02	**Road to Industry 4.0**: Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services , Smart Manufacturing , Smart Devices and Products , Smart Logistics, Smart Cities , Predictive Analytics	**8**	**10**
03	**Related Disciplines, System, Technologies for enabling Industry 4.0:** Cyberphysical Systems , Robotic Automation and Collaborative Robots , Support System for Industry 4.0 , Mobile Computing , Related Disciplines , Cyber Security	**8**	**10**
04	**Role of data, information, knowledge and collaboration in future organizations :** Resource-based view of a firm , Data as a new resource for organizations , Harnessing and sharing knowledge in organizations , Cloud Computing Basics , Cloud Computing and Industry 4.0	**8**	**10**
05	**Business issues in Industry 4.0 :** Opportunities and Challenges , Future of Works and Skills for Workers in the Industry 4.0 Era , Strategies for competing in an Industry 4.0 world	**6**	**10**
06	**Digital Transformation :** Introduction to Digital Transformation, Digital business transformation, Causes of disruption and transformation, Digital transformation myths and realities, Digital Transformation and customer experience, 4 pillars in customer experience transformation, Digital transformation in marketing	**8**	**10**
07	**Digital transformation across various industries :** Retail industry, Government and the public sector, Insurance industry, Healthcare, Banking: Royal Bank of Scotland case study, Fintech: Travelex case study, Public Sector: The MET office case study	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the**

			Publisher
Alp Ustundag and EmreCevikcan	Industry 4.0: Managing The Digital Transformation		Springer
Reference Books:			
Dominik T. Matt, Vladimir Modrak, Helmut Zsifkovits	Industry 4.0 for SMEs: Challenges, Opportunities and Requirements		Springer

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

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

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

Examination Scheme for end semester examination:

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

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Department of Information Technology

B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology **Subject:** Climate Change and Health			
Course Code: GE31		**Semester: III**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	Study the science of climate change and how climate change affects human health.		
2			
Objective:			
Sl. No.			
1	Identify the major global environmental changes and the upstream drivers behind these changes		
2	Identify the health risks of climate variability and change, including the sources of vulnerability and exposure to those risks		
3	Identify highly vulnerable populations domestically and globally		
4	Identify key interventions to promote climate-resilient health systems		
5	Enumerate key issues in implementing, monitoring, evaluating, learning from, and continuously updating, adaptation policies and programs		
6	Identify the health co-benefits of mitigation policies to reduce greenhouse gas emissions		
Pre-Requisite:			
Sl. No.			
1	Basic Environmental science		
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Fundamentals of Climate Change** Global environmental change: an introduction Warming of the climate system is unequivocal The Ice is Melting and the Seas are Rising	**11**	**10**

	Extreme Weather Events are Increasing The Greenhouse Effect Anthropogenic Radiative Forcing of the Climate and Climate Feedback Future Climate Change Health Risks of Biodiversity loss Nitrogen cycle and Health impacts		
02	Stratospheric ozone depletion and Public Health Climate change: where we are and where we are going Assessing and communicating health risks	**8**	**10**
03	Political context for climate science, process for international assessments, and progress toward mitigation goals	**8**	**10**
04	Health exposures: weather, climate variability, climate change, and climate change epidemiology Water-borne Infections Overview Vibrio Infections: Cholera Vibrio Infections: Non-Cholera Vector-borne Diseases: Overview Malaria Lyme Disease	**10**	**15**
05	Extreme weather and climate events and their health impacts Thermoregulation Heat-Related Illness Determinants of Vulnerability To Heat Stress9m Occupational Heat Stress Urban Heat Islands6m Future Exposure to Heat Extremes Adverse Health Effects of Storms and Floods Mortality Surveillance Mental Disorders	**10**	**15**
06	Air quality, including aeroallergens, and health Infectious diseases Food security Mitigation and health co-benefits Climate resilient health systems	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**

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	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Holper, Paul & Torok, Simon	Climate Change. What You Can Do About It At Work At Home At School	1405038780	
George Luber , Jay Lemery	Global Climate Change and Human Health: From Science to Practice	1st Edition	
Reference Books:			

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

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

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology **Subject:** Environmental Law and Policy			
Course Code: GE32		**Semester: III**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	To equip the students with the skills needed for interpreting laws, policies and judicial decisions		
2			
Objective:			
Sl. No.			
1	To explain the role of law, policy and institutions in the conservation and management of natural resources as well as pollution control		
2	To introduce the laws and policies both at the national and international level relating to environment		
3			
4			
Pre-Requisite:			
Sl. No.	Basic Environmental science		
1			
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Basic Concepts in Environmental Law.** An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, PIL–liberalization of the rule of locus standi, Judicial activism. Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Bhopal gas tragedy; Rio	**9**	**10**

	conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts		
02	**Module II–**Forest, Wildlife and Biodiversity related laws Evolution and Jurisprudence of Forest and Wildlife laws; Colonial forest policies; Forest policies after independence 2 Statutory framework on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Modulew leopard.	**8**	**10**
03	**Module III**–Air, Water and Marine Laws National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981; EPA, 1986	**8**	**10**
04	**Module IV**–Environment protection laws and large Projects Legal framework on environment protection-Environment Protection Act as the framework legislation–strength and weaknesses; EIA; National Green tribunal The courts infrastructure projects	**8**	**10**
05	**Module V** Hazardous Substances and Activities Legal framework: EPA and rules made thereunder; PLI Act, 199 Principles of strict and absolute liability	**6**	**10**
06	**Module VI** International Environmental law An introduction to International law; sources of international law; law of treaties; signature.	**8**	**10**
07	**Module VII** Ratification Evolution of international environmental law: Customary principles; Common but differentiated responsibility, Polluter pays	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

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Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Divan S. and Rosencranz A	Environmental Law and Policy in India	2 nd ed.	Oxford
Leelakrishnan P	Environmental Law in India	3rd ed.	Lexis Nexis
Reference Books:			

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

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

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology **Subject:** Environmental Informatics			
Course Code: GE33		**Semester: III**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	The course will focus on the application of information science practices, policies, and knowledge as it relates to the interdisciplinary field of environmental informatics.		
2			
Objective:			
Sl. No.			
1	Understanding of the field of environmental informatics and the challenges that exist		
2	Knowledge of information standards and practices as they are applied to emerging environmental science issues		
3	Ability to develop and implement an environmental science monitoring program with emphasis on the information, computational, and geospatial challenges		
4	Understanding of geospatial standards, concepts, and terminologies		
	Understanding of semantic principles, practices, standards, and applications		
	Application of project management concepts and principles within the field of environmental informatics		
Pre-Requisite:			
Sl. No.			
1			
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Overview of the disciplines involved in Environmental informatics: a. Biological science b. Information science c. Computer science d.	**9**	**10**

	Geospatial science e. Social sciences		
02	Information Life Cycle The Information Life Cycle 1. Science Data Life Cycle emergence 2. Cradle to grave management of scientific data and information 3. Why some organizations succeed and others fail Metadata resistance 1. The scientific model 2. Publish or parish paradigm 3. Incentives and rewards for data sharing 4. Real world examples of its usage and failures	**8**	**10**
03	1. Introduction to the Federal Geographic Data Committee Biological Data Profile 2. Applications of the standards 3. Tools to support metadata development	**8**	**10**
04	Taxonomy - The importance of taxonomy in Environmental informatics 1. Role of taxonomy in Environmental informatics 2. Importance of standardization of scientific names 3. National & Global efforts underway 4. Tools, systems, and technologies available 5. Emerging concepts and trends	**8**	**10**
05	Project Management 1. Concepts, principles, and practices as applied in a scientific domain 2. Tools and applications	**6**	**10**
06	Geospatial Technologies 1. Why is it important 2. Basic concepts and terms 3. Mapping standards 4. Mapping tools	**8**	**10**
07	International Informatics & Data Management activities	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Gunther, Oliver	Environmental Information Systems		Springer
Michener, William	Ecological Data: Design, Management and Processing (Ecological Methods and Concepts)		Published by Wiley-Blackwell

Reference Books:

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End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.							
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 7	10	10				
B	1 to 7			5	3	5	70
C	1 to 7			5	3	15	

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

Examination Scheme for end semester examination:

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

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B.sc in Information Technology (Data Science)

Name of the Course: B.Sc. in Information Technology **Subject:** Health Informatics			
Course Code: GE34		**Semester: III**	
Duration: 60 Hours		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical: 0		Continuous Assessment: 25	
Credit: 6		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1	Student will Understand basic principles of knowledge management systems in biomedicine		
2	Student will develop understanding of various aspects of Health Information Technology standards		
Objective:			
Sl. No.			
1	Become familiar with the basic definitions, key concepts, terminology, and historical context of Health Informatics		
2	Understand fundamental characteristics of data, information, and knowledge in the Health Informatics domain		
3	Become familiar with common algorithms for health applications and IT components in representative clinical processes		
4			
Pre-Requisite:			
Sl. No.			
1	Basic knowledge of health information system.		
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Health Data, Information, and Knowledge	**9**	**10**
02	The National Landscape of Healthcare IT & History of Healthcare Information System	**8**	**10**

03	Medical Algorithms & Medical Decision Making	**8**	**10**
04	Modeling and Simulations & Population Health and Precision Medicine	**8**	**10**
05	Standards in Health Informatics	**6**	**10**
06	Knowledge management system & Organizing Health IT services	**8**	**10**
07	Ethical Issues in Health Informatics,Careers in Health Informatics	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Wager, K. A., Lee, F. W., & Glaser, J. P.	Health care information systems: A practical approach for health care management	4th	
Trotter, F. and Uhlman, D.	Hacking healthcare: A guide to standards, workflows, and meaningful use		O'Reilly Media.
Reference Books:			

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

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

C	1 to 7			5	3	15	

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

Examination Scheme for end semester examination:

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

Name of the Course: B.Sc. in Information Technology **Subject:** Intelligence of Biological Systems		
Course Code: GE35		**Semester: III**
Duration: 60 Hours		**Maximum Marks: 100**
Teaching Scheme		**Examination Scheme**
Theory: 5		End Semester Exam: 70
Tutorial: 1		Attendance : 5
Practical: 0		Continuous Assessment: 25
Credit: 6		Practical Sessional internal continuous evaluation: NA
		Practical Sessional external examination: NA
Aim:		
Sl. No.		
1	To investigate DNA replication.	
2	To investigate the encodings in DNA to maintain various rhythms associated with the body.	
Objective:		
Sl. No.		
1	To introduce the basic concepts in cell biology	
2	To develop an understanding about the basic cellular process	
3	To introduce the basic concepts about the cell intelligence	
4	To introduce state of the art computational algorithms to understand DNA encodings.	
Pre-Requisite:		
Sl. No.		
1		

2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Module I: Systems biology: Self-organization, emergence, modularity and abstraction, feedback, control analysis, Enzyme Kinetics and Thermodynamics: The Law of Mass Action; Reaction Kinetics, Rate Equation, Michaelis-Menten Equation, Hill Equation, Interaction networks overview- Gene Regulatory Network, Protein – Protein Interaction Network, Signaling Pathways, Metabolic pathways; network motifs, Systems Biology tools and standards: Matlab -Systems Biology toolbox; SBML; SBGL (Systems Biology Graphical Language); KEGG; Tools for systems Biology- Cell designer; Cytoscape.	**9**	**10**
02	Module II: Synthetic Biology: Engineering Biology; design and construction of novel biological systems; Abstraction hierarchy- Part, Device, Systems; BioBricks - a standard for (physical) DNA composition, Designing a biological system from Biobricks; iGEM; SBOL, Computational Synthetic biology: Codon optimization; AND gate and OR gate in biology; Operons; Switches and clocks; Repressilator; Applications- Environment, Energy, Pharmaceutical needs, Ethical issues of Synthetic Biology.	**8**	**10**
03	Module III: Niche areas in Genomics: Toxicogenomics, Pharmacogenomics-Pharmacogenetics, SNP, Personalized medicine, Metagenomics, Comparative genomics, Functional genomics, structural genomics, QTL, HGP	**8**	**10**
04	Module IV: Next Generation Sequencing methods, Overview of data compression, Need for compression, Scope of NGS data compression.	**8**	**10**
05	Module V: Advanced topics in CADD: Molecular dynamics simulations, Force fields, Energy minimization, pharmacodynamics & pharmacokinetics, 2D and 3D screening, Identification of targets in silico, GPCRs, Peptides as drugs, introduction to Ayurinformatics	**6**	**10**
06	Module VI: (Flexi module- Only for Internal Assessment. Lecturers may expand and/ or interpret the syllabus to update it or suit the particular cohort in any way)	**8**	**10**

07	Module VII: Metabolomics: Metabolism, metabolomite, metabolome, metabolomic separation and analysis techniques, metabolic profiling, metabolic fingerprinting, Metabolome informatics. Resources/databases of metabolomics, Applications; Epigenetics.	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Ryan Rogers	Cell and Molecular Biology for Environmental Engineers	2018	Momentum Press Engineering
Philip Compeau and PavelPevzener	Finding Hidden Messages in DNA,	2015	Active Learning Publishers
Reference Books:			
Gabi Nindl Waite, Lee R. Waite,	Applied Cell and Molecular Biology for Engineers	2017	McGraw Hill Publishers

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

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

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

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

Name of the Course: B.Sc. in Information Technology **Subject:**Simulation and Modelling Natural Processes	
Course Code: GE36	**Semester: III**
Duration: 60 Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1	Describe the role of important elements of discrete event simulation and modeling paradigm.
2	Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3	Develop skills to apply simulation software to construct and execute goal-driven system models
4	Interpret the model and apply the results to resolve critical issues in a real world environment.
Objective:	
Sl. No.	
1	Define the basics of simulation modeling and replicating the practical situations in organizations
2	Generate random numbers and random variates using different techniques.
3	Develop simulation model using heuristic methods.
4	Analysis of Simulation models using input analyzer, and output analyzer Explain Verification and Validation of simulation model
Pre-Requisite:	

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Department of Information Technology

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Sl. No.			
1			
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Simulation:** Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples	**9**	**10**
02	**General Principles:** Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling.	**8**	**10**
03	**Random Numbers:** Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test	**8**	**10**
04	**Random Variate Generation:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance Rejection Technique Optimisation Via Simulation: Meaning, difficulty, Robust Heuristics, Random Search	**8**	**10**
05	**Analysis of Simulation Data Input Modelling:** Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.	**6**	**10**
06	**Output Analysis** – Types of Simulations with Respect to Output Analysis, Stochastic Nature of output data, Measures of Performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations.	**8**	**10**
07	**Simulation Softwares:** Selection of Simulation Software, Simulation packages, Trend in Simulation Software.	**9**	**10**

	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol	Discrete Event system Simulation,	Asia, 4th Edition, 2007 , ISBN: 81-203-2832-9.	Pearson Education,
Geoffrey Gordon	System Simulation	2nd Edition, 1978, ISBN: 81-203-0140-4	Prentice Hall publication
Reference Books:			
Averill M Law, W David Kelton,	Simulation Modelling & Analysis	4th Edition, ISBN: 0-07-100803-9	McGraw Hill International Editions – Industrial Engineering series
Narsingh Deo	Systems Simulation with Digital Computer	3rd Edition, 2004, ISBN : 0-87692-028-8	PHI Publication (EEE),

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

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

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

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each**	**Question to be**	**Question to be**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
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Department of Information Technology

B.sc in Information Technology (Data Science)

		question	set	answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology **Subject:Bioinformatics**	
Course Code: GE37	**Semester: III**
Duration: 60 Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical: 0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1	The student should be able to understand basic research methods in bioinformatics.
2	The student will choose biological data, submission and retrieval it from databases and design databases to store the information.
3	The students will be able to demonstrate the most important bioinformatics databases, perform text- and sequence-based searches, and analyze the results in light of molecular biological knowledge.
4	The students will be able to demonstrate the most important bioinformatics databases, perform text- and sequence-based searches, and analyze the results in light of molecular biological knowledge.
Objective:	
Sl. No.	
1	**To make students understand the essential features of the interdisciplinary field of science for better understanding biological data**
2	To provide the student with a strong foundation for performing further research in bioinformatics
3	To create students opportunity to interact with algorithms, tools and data in current scenario
4	To make the students look at a biological problem from a computational point of view
5	To find out the methods for analyzing the expression, structure and function of DNA, RNA and proteins, and an understanding of the relationships between species

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Pre-Requisite:			
Sl. No.			
1			
2			
Contents			
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Unit I Introduction to bioinformatics and data generation What is bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software (RASMOL, Ligand Explorer). Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray). Applications of Bioinformatics.	**9**	**10**
02	Unit II Biological Database and its Types Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)	**8**	**10**
03	Unit III Data storage and retrieval and Interoperability Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.	**8**	**10**
04	Unit IV Sequence Alignments and Visualization Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm). Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D,	**8**	**10**

	PyMol), Anatomical visualization		
05	Unit V Gene Expression and and Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes). Genetic variability and connections to clinical data	**6**	**10**
06	Unit VI Concept of molecular modeling, in silico methods of molecular modelling, software for homology modeling, computer and graphic representation of simple molecules and peptides, use of structural databases in molecular modelling.	**8**	**10**
07	Unit VII Concepts of geometry optimization and energy minimization, introduction of molecular dynamic simulation and monte carlo simulation, concepts and applications of macromolecular docking.	**9**	**10**
	Sub Total:	**56**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**60**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Andreas D. Bazavanis and B.F. Francis (Eds.)	Bioinformatics: A Practical Guide to Analysis of Genes and Proteins		Wiley Interscience Publishers.
Lesk, A.M	Introduction to Bioinformatics	Fourth edition	Oxford University Press, UK
Reference Books:			
Scott Markel	Sequence Analysis in a Nutshell – A Guide to Common Tools & Databases	1 edition, ISBN-13: 978-0596004941	O'Reilly

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of	Total	No of	To	Marks per	Total

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		question to be set	Marks	question to be set	answer	question	Marks
A	1 to 7	10	10				
B	1 to 7			5	3	5	70
C	1 to 7			5	3	15	

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

Examination Scheme for end semester examination:

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