

SEMESTER 4

PERIOD: MAY 2021-AUGUST

2022

RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Information Technology, Programme: Artificial Intelligence & Data Science

Vision

To evolve into a centre of excellence in information technology by creation and exchange of knowledge through leading edge research, innovation and services, which will in turn contribute towards solving complex societal problems and thus building a peaceful and prosperous mankind.

Mission

To impart high quality technical education, research training, professionalism and strong ethical values in the young minds for ensuring their productive careers in industry and academia so as to work with a commitment to the betterment of mankind.

Programme Educational Objectives (PEO)

Graduates of Artificial Intelligence & Data Science program shall

PEO 1: Have strong technical foundation for successful professional careers and to evolve as key-players/ entrepreneurs in the field of information technology.

PEO 2: Excel in analyzing, formulating and solving engineering problems to promote life-long learning, to develop applications, resulting in the betterment of the society.

PEO 3: Have leadership skills and awareness on professional ethics and codes.

Programme Outcomes (PO)

Artificial Intelligence & Data Science Program Students will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research

methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

Artificial Intelligence & Data Science Program Students will be able to:

PSO1: Apply the fundamentals of science, engineering and mathematics to understand, analyze and develop solutions in the areas related to artificial intelligence and data science for optimal design of intelligent systems.

PSO2: Design and Implement appropriate techniques and analytic tools for the integration of intelligent systems, with a view to engaging in lifelong learning for the betterment of society.

PSO3: Practice professional ethics in applying scientific method to model and support multidisciplinary facets of engineering and its societal implications.

INDEX		
Sl. No	Content	Page No
1	Assignment Schedule for S4 IT	7
2	INFERENTIAL STATISTICS	8
2.1	Course Information Sheet	
2.2	Course Plan	
2.3	Assignment	
2.4	Tutorial	
3	PROBABILITY STATISTICS AND ADVANCED GRAPH THEORY	26
3.1	Course Information Sheet	
3.2	Course Plan	
3.3	Assignment	
3.4	Tutorial	
4	DATA VISUALIZATION	38
4.1	Course Information Sheet	
4.2	Course Plan	
4.3	Assignment	
4.4	Tutorial	
5	DATABASE MANAGEMENT SYSTEMS	49

5.1	Course Information Sheet	
5.2	Course Plan	
5.3	Assignment	
5.4	Tutorial	
6	PROFESSIONAL ETHICS	62
6.1	Course Information Sheet	
6.2	Course Plan	
6.3	Assignment	
7	CONSTITUTION OF INDIA	71
7.1	Course Information Sheet	
7.2	Course Plan	
7.3	Assignment	
8	DATA VISUALIZATION LAB	82
8.1	Course Information Sheet	
8.2	Course Plan	
8.3	Lab Cycle	
8.4	Open Questions	
8.5	Advanced Questions	
9	DATABASE MANAGEMENT SYSTEMS LAB	96

9.1	Course Information Sheet	
9.2	Course Plan	
9.3	Lab Cycle	
9.4	Open Questions	
9.5	Advanced Questions	

1. Assignment Schedule

SI No	Subject Code & Name	Faculty in-charge	Week
1	100008/MA400A INFERENCE STATISTICS	Ms. Neethu P.R	WEEK 1
2	100902/MA400B PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY	Ms. Anisha Anilkumar	WEEK 2
3	100008/IT400C DATA VISUALIZATION	Dr. Ranju S Kartha	WEEK 3
4	100008/IT400D DATABASE MANAGEMENT SYSTEMS	Dr. Sherly K.K	WEEK 4
5	100908/EN900E PROFESSIONAL ETHICS	Mr. Rajeesh Rajkumar	WEEK 5
6	100908/ES400F CONSTITUTION OF INDIA	Ms. Neethu George	WEEK 6
7	100008/MA400A INFERENCE STATISTICS	Ms. Neethu P.R	WEEK 7
8	100902/MA400B PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY	Ms. Anisha Anilkumar	WEEK 8
9	100008/IT400C DATA VISUALIZATION	Dr. Ranju S Kartha	WEEK 9
10	100008/IT400D DATABASE MANAGEMENT SYSTEMS	Dr. Sherly K.K	WEEK 10
11	100908/EN900E PROFESSIONAL ETHICS	Mr. Rajeesh Rajkumar	WEEK 11
12	100908/ES400F CONSTITUTION OF INDIA	Ms. Neethu George	WEEK 12

INFERENCE STATISTICS

1.1 COURSE INFORMATION SHEET

PROGRAMME: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	DEGREE: BTECH
COURSE: INFERENCE STATISTICS	SEMESTER: IV CREDITS: 4
COURSE CODE: 100008/MA400 B REGULATION: 2020	COURSE TYPE: CORE
COURSE AREA/DOMAIN: MATHEMATICS	CONTACT HOURS: 4+1(Tutorial) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
I	SAMPLING AND ESTIMATION Sampling and Estimation-Sample versus population- Sample techniques (simple, stratified, clustered, random)-Sampling Distributions-Parameter Estimation	9
II	STATISTICAL TESTING- I Unbalanced data treatment-develop an intuition on how to understand the data-attributes-distributions-procedure for statistical testing, etc.- Test of Hypothesis (Concept of Hypothesis testing, Null Hypothesis and Alternative Hypothesis).	9
III	STATISTICAL TESTING- II Cross Tabulations (Contingency table and their use, Chi-Square test, Fisher's exact test),-One Sample t test (Concept, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results)	9

IV	ANOVA Independent Samples t test-Paired Samples t test-One way ANOVA (Post hoc tests: Fisher's LSD, Tukey's HSD)- Z-test and F-test	9
V	REGRESSION AND CORRELATION Linear Regression-Regression basics: Relationship between attributes using Covariance and Correlation	9
TOTAL HOURS		45

TEXT/REFERENCE BOOKS:
1. Text Books

1. B.L.S.Prakasa Rao, *A First Course in Probability and Statistics*, World Scientific/Cambridge University Press India, 2009.
2. R. V. Hogg, J. W. McKean and A. Craig, *Introduction to Mathematical Statistics*, 6th Ed., Pearson Education India, 2006.

2. Reference Books

1. Richard A. Johnson, *Miller and Freund's Probability and Statistics for Engineers*, 8th Ed., Prentice Hall of India, 2015.
2. Rohatgi, Saleh, *An Introduction to Probability and Statistics*, 2nd Ed., Wiley, 2014.
3. S.C.Gupta, V.K.Kapoor, *Fundamentals of Mathematical Statistics*, 11th Ed., S.Chand and Sons, 2002.
4. Spiegel, Schiller, Srinivasan, *Schaum's Outlines in Probability and Statistics*, 4th Ed., McGraw Hill, 2002.
5. Sheldon M.Ross, *Introduction to probability and statistics for engineers and scientists*, 5th Ed., Elsevier, 2014.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	A basic study of statistic in school class.		

COURSE OBJECTIVES:

1	To introduce mathematical notations and concepts in probability that is essential for computing.
2	To train on testing of hypothesis that gives the idea about validity of the sample.
3	To analyse the data relationship between different attributes.

COURSE OUTCOMES:

After the completion of the course the student will be able to

CO 1: Understand sampling distribution and apply the different methods in parameter estimation

CO 2: Apply the testing of hypothesis and understand the different terms null hypothesis and alternate hypothesis.

CO 3: Apply Chi-square test and t-test in different practical cases

CO 4: Understand one way ANOVA test and apply contingency table test

CO 5: Identify the relationship between the attributes through the analysis of correlation

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3														
CO2	3														
CO3	3	2													
CO4	3														
CO5	3														

JUSTIFICATIONS FOR THE MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
C01-PO1	H	Knowledge of sampling distribution and different methods in parameter estimation.
C01-PO2	H	Apply the knowledge of testing of hypothesis and understand null and alternate hypothesis
C01-PO3	H	Knowledge of applying chi square and t- test in different practical cases
C01-PO4	H	Knowledge about ANOVA and how to apply Contingency table test
C01-PO5	H	Relationship between the attributes through analysis correlation can be identified
C03-PO2	M	Chi square and t testing can be formulated and analyzed in different practical cases.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Si NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	LEVEL OF SIGNIFICANCE, CONFIDENCE, LIMITS	READING	1	
2	CRITICAL REGION, CENTRAL LIMIT THEOREM	READING	1	

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Si NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	CUREVE FITTING, FITTING OF STRAIGHT LINES, PARABOLA AND	READING	1	

	EXPONENTIAL CURVES			
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WEB SOURCE REFERENCES:

1	http://pareto.uab.es/statistics/The_Book.pdf
2	http://dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf
3	https://www.youtube.com/watch?v=adx4bFTVa3k

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

<input checked="" type="checkbox"/> CHALK & TALK	<input checked="" type="checkbox"/> STUD. ASSIGNMENT	<input checked="" type="checkbox"/> WEB RESOURCES	
<input checked="" type="checkbox"/> LCD/SMART BOARDS	<input checked="" type="checkbox"/> STUD. SEMINARS	<input type="checkbox"/> ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

<input checked="" type="checkbox"/> ASSIGNMENTS	<input checked="" type="checkbox"/> STUD. SEMINARS	<input checked="" type="checkbox"/> TESTS/MODEL EXAMS	<input checked="" type="checkbox"/> UNIV. EXAMINATION
<input checked="" type="checkbox"/> STUD. LAB PRACTICES	<input checked="" type="checkbox"/> STUD. VIVA	<input type="checkbox"/> MINI/MAJOR PROJECTS	<input type="checkbox"/> CERTIFICATIONS
<input type="checkbox"/> ADD-ON COURSES	<input type="checkbox"/> OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

<input checked="" type="checkbox"/> ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	<input checked="" type="checkbox"/> STUDENT FEEDBACK ON FACULTY (TWICE)
<input type="checkbox"/> ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	<input type="checkbox"/> OTHERS

Prepared by
P R NEETHU

Approved by
HOD

1.2 Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1: Sampling and Estimation (10 hours)	
1.1	Basics of Statistics	1
1.2	Sample Versus Population	1
1.3	Procedure of Statistical Inference	1
1.4	Sampling Techniques	1
1.5	Sampling Distributions	2
1.6	Problems on Sampling	1
1.7	Estimate and its Properties	1
1.8	Point Estimation	1
1.9	Problems on Estimation	1
2	Module 2: Statistical Testing- I(9 hours)	
2.1	Unbalanced data treatment.	1
2.2	Data-attributes	1
2.3	Procedure for statistical testing	1
2.4	Test of Hypothesis -Concept of Hypothesis testing	2
2.5	Null Hypothesis and Alternative Hypothesis.	1
2.6	Problems on Testing of Hypothesis.	3
3	Module 3: Statistical Testing- II(9 hours)	
3.1	Cross Tabulations -Contingency table and their use.	1

3.2	Chi-Square test.	2
3.3	Fisher's exact test.	2
3.4	One Sample t test -Concept, Assumptions	1
3.5	One Sample t test -Verification of assumptions, Performing the test and interpretation of results	1
3.6	Problems	2
4	Module 4: ANOVA(12 hours)	
4.1	Independent Samples t- test	1
4.2	Paired Samples t test.	2
4.3	One way ANOVA	2
4.4	Post hoc tests: Fisher's LSD	2
4.5	Post hoc tests: Tukey's HSD	2
4.6	Z-test	1
4.7	F-test	2
5	Module 5:Regression and Correlation (5Hours)	
5.1	Linear Regression and Problems	2
5.2	Relationship between attributes using Covariance and Correlation	1
5.3	Problems on Correlation and Covariance	2
	Total	45 hours

PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY

2.1 COURSE INFORMATION SHEET

Programme: Artificial Intelligence & data Science	Degree: B. Tech
Semester: 4	Course type: Core
Course area/domain: Mathematics	Contact hours: 4 hours/week
Regulation: 2020	

CODE	COURSE NAME	CATEGORY	L-T-P	CREDIT
100902/MA 400B	PROBABILITY, STATISTICS AND ADVANCED GRAPH THEORY	MATHEMATICS	3-1-0	4

Course objective

- Introduce students to the modern theory of probability, statistics and hypothesis testing and their applications.
- Introduce fundamental concepts in Graph Theory, including properties and characterization of Graph/Trees and Graph-theoretic algorithms.

Textbook

- Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, 8th edition, Cengage, 2012.
- Kenneth H Rosen, *Discrete Mathematics and its applications*, Tata McGrawHill, 8th Edition.

References

- Hossein Pishro-Nik, *Introduction to Probability, Statistics and Random Processes*, Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
- Sheldon M. Ross, *Introduction to probability and statistics for engineers and scientists*, 4th edition, Elsevier, 2009.
- T. Veerarajan, *Probability, Statistics and Random processes*, Tata McGraw-Hill, 2008.
- Ralph P Grimaldi, *Discrete and Combinatorial Mathematics, An applied Introduction*, 4th edition, Pearson.

- C.L.Liu, *Elements of Discrete Mathematics*, Tata McGrawHill, 4th edition, 2017.
- Narasingh Deo, *Graph theory*, PHI, 1979
- John Clark and Holton Derek Allan, *A first look at graph theory*, Allied Publishers, 1995.

Syllabus

Module 1 (Discrete probability distributions): Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Discrete bivariate distributions, marginal distributions, Independent random variables, Expectation -multiple random variables.

Module2 (Continuous probability distributions): Continuous random variables and their probability distributions, Expectation, mean and variance, Uniform, exponential and normal distributions, Continuous bivariate distributions, marginal distributions, Independent random variables, Expectation-multiple random variables, i.i.d random variables and Central limit theorem (without proof).

Module 3 (Statistical inference): Population and samples, Sampling distribution of the mean and proportion (for large samples only), Confidence interval for single mean and single proportions (for large samples only). Test of hypotheses: Large sample test for single mean and single proportion, equality of means and equality of proportions of two populations, small sample *t*-tests for single mean of normal population, equality of means (only pooled *t*-test, for independent samples from two normal populations with equal variance)

Module4 (Advanced Graph theory-I): Introduction-Basic definitions, Directed graphs, pseudo graph, multigraph, Graph models, Graph terminology-vertex degree, simple graph, Complete graphs, cycles, bipartite graph, new graphs from old-union, complement, Representing graph-Adjacency matrix, Incidence Matrix, Isomorphism, Connectivity, path, cut vertices, cut edges, connectedness in directed and undirected graphs, Counting paths between vertices-Euler paths and circuits, Fleury's algorithm (proof of algorithm omitted), Hamiltonian paths and circuits. Ore's theorem, Planar graph, -Euler's formula on planar graphs, Kuratowski's theorem (Proof of theorem omitted)

Module5 (Advanced Graph theory - II): Graph colouring, dual graph, chromatic number, Chromatic number of complete graph K_n , Chromatic number of complete bipartite graph $K_{m,n}$, Chromatic number of cycle C_n , Four color theorem, applications of graph colouring- scheduling and assignments. Trees-rooted trees, Properties of trees-level, height, balanced rooted tree, Spanning tree-basic theorems on spanning-tree(DFS,BFS algorithms and it's applications omitted), Minimum spanning tree, Prim's algorithm and Kruskal's algorithm(proofs of algorithms omitted)

CO-PO Mapping

Course Outcomes: After the completion of the course the student will be able to

CO1	Understand the concept, properties and important models of discrete random variables and, using them, analyse suitable random phenomena.
CO2	Understand the concept, properties and important models of continuous random variables and, using them, analyse suitable random phenomena.
CO3	Perform statistical inferences concerning the characteristics of a population-based. On attributes of samples drawn from the population.
CO4	Understand the basic concept in Graph theory, Understand planar graphs and its properties. Demonstrate the knowledge of fundamental concepts of the matrix representation of graphs, Apply fundamental theorems on Eulerian graphs and Hamiltonian graphs.
CO5	Understand the basic concept in Trees, coloring of graphs. Apply coloring of graphs. Apply the algorithm to find the minimum spanning tree.

Mapping of course outcomes with program outcomes

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	2	2					2		1
CO2	3	2	2	2	2					2		1
CO3	3	2	2	2	2					2		1

C04	3	2	2	2	2					2		1
C05	3	2	2	2	2					2		1

1- Low correlation (Low), 2- Medium correlation (Medium), 3-High correlation (High)

Mapping		1/2/3	Justification
C01	P01	3	Apply the knowledge of discrete random variables to the solution of complex engineering problems.
	P02	2	Identify and analyze complex engineering problems, reaching substantiated conclusions using discrete random variables.
	P03	2	Design solutions for complex engineering problems, using them, analyse suitable random phenomena.
	P04	2	Use research-based knowledge and synthesis of the information to provide valid conclusions.
	P05	2	Create, select, and apply the idea in complex engineering activities with an understanding of the limitations.
	P010	2	Communicate effectively on complex engineering activities with the engineering community and with society .
	P012	1	Recognize the need for, and ability to engage in independent and life-long learning in the broadest context of technological change.
	P01	3	Apply the knowledge of discrete random variables to understand the concept.
	P02	2	Understand the important models of continuous random Variables and analyze complex engineering problems.
	P03	2	Using the properties of continuous random variables, design processes that meet the specified needs with appropriate consideration.

C02	P04	2	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	P05	2	Create probability tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	P010	2	Understand the concept to communicate effectively on complex engineering activities with the engineering community .
	P012	1	Recognize ability to engage in independent and life-long learning in the broadest context of technological change.
C03	P01	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	P02	2	Formulate complex engineering problems reaching substantiated conclusions using engineering sciences.
	P03	2	Design solutions for complex engineering problems by performing statistical inferences based on attributes of samples drawn from the population.
	P04	2	Use research methods including analysis and interpretation of data based on attributes of samples.
	P05	2	Select appropriate techniques and modeling to complex engineering activities with an understanding of the limitations.
	P010	2	Communicate effectively on complex engineering activities with the engineering community to make effective presentations, and give and receive clear instructions.
	P012	1	Recognize the need for, and have the preparation in the broadest context of technological change.
	P01	3	Apply the knowledge of Graph theory, Understand planar graph sandit's properties to the solution of problems.

CO4	P02	2	Demonstrate the knowledge of fundamental concepts of the matrix representation of graphs and analyze complex engineering problems .
	P03	2	Design system components that meet the specified needs with appropriate consideration for the public health and safety.
	P04	2	Using fundamental theorems on Eulerian graphs and Hamiltonian graphs for synthesis of the information to provide valid conclusions.
	P05	2	Demonstrate the knowledge of fundamental concepts of the matrix representation of graphs and modern engineering and IT tools including prediction
	P010	2	Design documentation, make effective presentations, and give and receive clear instructions.
	P012	1	Apply fundamental theorems to engage in independent and life-long learning in the broadest context of technological change.
CO5	P01	3	Understand the basic concept in Trees and engineering specialization to the solution of complex engineering problems
	P02	2	Apply coloring of graphs reaching substantiated conclusions using first principles of mathematics, engineering sciences.
	P03	2	Apply the algorithm to find the minimum spanning tree that meet the specified needs for the cultural, societal, and environmental considerations.
	P04	2	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data.
	P05	2	Understand the basic concept in modeling to complex engineering activities with an understanding of the limitations.
	P010	2	Communicate effectively on complex engineering activities with the engineering community by applying the algorithm.
	P012	1	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning .

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	2	2	
CO2	2	2	
CO3	2	2	
CO4	2	2	
CO5	2	2	

	PSO1	PSO2
CO1	Acquire basic skills in discrete probability which will benefit in future.	Contribute their engineering skills in computing and information engineering domains like network design and administration, data base design and knowledge engineering using basic knowledge on probability.
CO2	Acquire basic skills in continuous probability which will benefit in future.	Contribute their engineering skills in computing and information engineering domains like network design, knowledge engineering using basic knowledge on probability.
CO3	Contribute student's engineering skills in computing and information engineering domains concerning the characteristics of a population	Acquire the skills to understand the concept, properties and important models using hypotheses and apply wherever needed.
CO4	Acquire skills to design, analyse and develop graph algorithms and implement them using high-level programming languages	Contribute their engineering skills in graph theoretical computing in information engineering.

CO5	Acquire skills to design, analyse and develop graph algorithms and implement them using high-level programming languages	Contribute their engineering skills in graph theoretical computing in information engineering.
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GAPS in the syllabus

S.No	Description	Proposed Actions	Relevance with POs and PSO
1	Single and multiple variable calculus	Reading	PO1, PO2
2	Set theory	Reading	PO1, PSO1
3	Matrices	Reading	PO1, PO2, PSO1
4	Iterative methods	Reading	PO1, PO2, PSO1

Topic beyond Syllabus

	Description	Proposed Actions	Relevance with POs and PSO
1	Application of graphs	Assignment	PO1, PO2, PSO1
2	Applications of probability	Assignment	PO1, PO2, PSO1

Websource references

- [Probability, Statistics and Random Processes | Free Textbook | Course \(probabilitycourse.com\)](http://probabilitycourse.com)

- [StatisticsAndProbabilityTutorial|StatisticsAndProbabilityforData Science|Edureka-YouTube](#)
- [BasicProbabilityTheoryandStatistics|byParagRadke|TowardsDataScience](#)
- [GraphTheoryTutorial-Tutorialspoint](#)
- [Mathematics | GraphTheory Basics - Set 1 - GeeksforGeeks](#)
- [NPTEL:: Mathematics - NOC: GraphTheory](#)

Delivery/instructional methodologies:

<input checked="" type="checkbox"/> Chalk & talk	<input checked="" type="checkbox"/> Stud. Assignment	<input checked="" type="checkbox"/> Web resources	<input type="checkbox"/> LCD/smart boards
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Assessment methodologies-direct

<input checked="" type="checkbox"/> Assignments	<input type="checkbox"/> Stud. Seminars	<input checked="" type="checkbox"/> Internal Tests	<input checked="" type="checkbox"/> Univ. Examination
<input type="checkbox"/> Stud. Lab practices	<input type="checkbox"/> Stud.Viva	<input type="checkbox"/> Mini/major projects	<input type="checkbox"/> Certifications
<input type="checkbox"/> Add-on courses	<input type="checkbox"/> Others		

Assessment methodologies-indirect

<input checked="" type="checkbox"/> Assessment of course outcomes (by feedback, once)	<input checked="" type="checkbox"/> Student feedback on faculty (twice)
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Prepared by

Ms. Anisha Anilkumar

Approved by

HoD

2.2 Course Plan

SN o	Module	Topic	No. oflecture s
1	1	Discrete random variables and probability distributions, expected value, mean and variance (discrete)	3
2		Binomial distribution-mean, variance, Poisson distribution-mean, variance, Poisson approximation to binomial	3
3		Discretebivariatedistributions,marginaldistributions,Independence of random variables (discrete), Expected values	3
4	2	Continuous random variables and probability distributions, expected value, mean and variance (continuous)	2
5		Uniform, exponential and normal distributions, mean and variance of these distributions	4
6		Continuous bivariate distributions, marginal distributions, Independent random variables, Expected values, Central limit theorem.	3
7	3	Population and samples, Sampling distribution of single mean and single proportion(large samples)	1
8		Confidence interval for single mean and single proportions (large samples)	2
9		Hypothesis testing basics, large sample test for single mean, single proportion	2
10		Large sample test for equality of means and equality of proportions of two populations.	2
11		t-distribution and small sample t-test for single mean and pooled t-test for equality of means.	2
12		Introduction- Basic definition – Application of graphs Incidence and Degree – Isolated vertex, pendent vertex and Null graph	1

13	4	Theorems connecting vertex degree and edges, bipartite graphs.	1
14		Adjacency matrix, incidence matrix, Isomorphism	1
15		Path, cut set, cut edges, Connectedness of directed and undirected graphs, path isomorphism	2
16		Euler paths and circuits, Fleury's algorithm (proof of algorithm omitted), Hamiltonian paths and circuits. Ore's theorem (proof omitted)	3
17		Planar graph, Euler's theorem on planar graph, applications of Kuratowski's theorem	1
18	5	Graph colouring, dual graph	1
19		Chromatic number, chromatic number of K_m, K_n, C_n	2
20		Four colour theorem, applications of graph colouring-scheduling and assignments,	2
21		Trees-spanning trees-definition and example, minimum spanning tree,	2
22		Prim's algorithm and Kruskal's algorithm (proofs of algorithms omitted)	2

2.3 Assignment Questions

Module 1

1. Let X denote the number that shows up when an unfair die is tossed. Faces 1 to 5 of the die are equally likely, while face 6 is twice as likely as any other. Find the probability distribution, mean and variance of X .
2. Anequipmentconsistsof5components each of which may fail independently with probability 0.15. If the equipment is able to function properly when at least 3 of the components are operational, what is the probability that it functions properly?
3. X is a binomial random variable $B(n, p)$ with $n = 100$ and $p = 0.1$. How would you approximate it by a Poisson random variable?
4. Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 black balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn, find the joint probability distribution of (X, Y)
5. Accidents occur at an intersection at a Poisson rate of 2 per day. What is the probability that there would be no accidents on a given day? What is the probability that in January there are at least 3 days (not necessarily consecutive) without any accidents?

Module 2

6. What can you say about $P(X = a)$ for any real number a when X is a (i) discrete random variable? (ii) continuous random variable?
7. A string, 1 meter long, is cut into two pieces at a random point between its ends. What is the probability that the length of one piece is at least twice the length of the other?
8. A random variable has a normal distribution with standard deviation 10. If the probability that it will take on a value less than 82.5 is 0.82, what is the probability that it will take on a value more than 58.3?
9. X and Y are independent random variables with X following an exponential distribution with parameter μ and Y following an exponential distribution with parameter λ . Find $P(X+Y \leq 1)$
10. If the cumulative distribution of a continuous random variable is given by
$$f(x) = 0, x \leq 1, f(x) = 0.5, 1 \leq x \leq 3, f(x) = 1, 3 \leq x.$$
 Find $P(X \leq 2)$.

Module 3

11. In a random sample of 500 people selected from the population of a city 60

- were found to be left-handed. Find a 95% confidence interval for the proportion of left-handed people in the city population.
12. What are the types of errors involved in statistical hypothesis testing? Explain the level of risks associated with each type of error.
 13. A soft drink maker claims that a majority of adults prefer its leading beverage over that of its main competitor's. To test this claim 500 randomly selected people were given the two beverages in random order to taste. Among them, 270 preferred the soft drink maker's brand, 211 preferred the competitor's brand, and 19 could not make up their minds. Determine whether there is sufficient evidence, at the 5% level of significance, to support the soft drink maker's claim against the default that the population is evenly split in its preference.
 14. A nutritionist is interested in whether two proposed diets, diet A and diet B work equally well in providing weight-loss for customers. In order to assess the difference between the two diets, she puts 50 customers on diet A and 60 other customers on diet B for two weeks. Those on the former had weight losses with an average of 11 pounds and a standard deviation of 3 pounds, while those on the latter lost an average of 8 pounds with a standard deviation of 2 pounds. Do the diets differ in terms of their weight loss?
 15. The 95% confidence interval for the mean mass (in grams) of tablets produced by a machine is $[0.56, 0.57]$, as calculated from a random sample of 50 tablets. What do you understand from this statement?

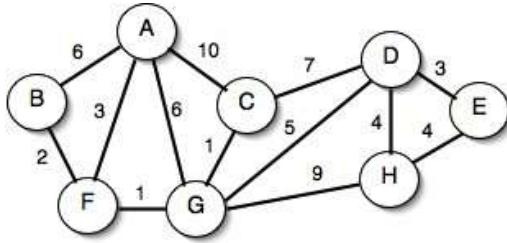
Module 4

16. How many edges are there in a graph with ten vertices each of degree six?
17. Prove that a simple graph with n vertices must be connected, if it has more than $C(n-1, 2)$ edges.
18. Prove that a connected graph G is an Euler graph if all vertices of G are of even degree.
19. Use Kuratowski's theorem to determine whether $K_{4,4}$ is planar.
20. Draw the graph represented by the following adjacency matrix

$$\begin{pmatrix} 1 & 2 & 1 \\ 2 & 0 & 0 \\ 0 & 2 & 2 \end{pmatrix}.$$

Module 5

21. Prove that a tree with n vertices has $n-1$ edges.
22. Find the chromatic number of $K_{m,n}$.
23. Using the graph model, how can the final exam at a university be scheduled so that no student has two exams at the same time?
24. Explain Prim's algorithm and use it to find the minimum spanning tree for the graph given below.



25. Find the value of $\chi_2(K_3)$.

2.4 Tutorial Questions

Module 1

1. Two fair dice are rolled. Let X denote the number on the first die and $Y=0$ or 1 , according as the first die shows an even number or odd number. Find
 - a. the joint probability distribution of X and Y ,
 - b. the marginal distributions.
 - c. Are X and Y independent?
2. Verify that $p(x) = \frac{8}{27} \left(\frac{1}{2}\right)^x$, $x = 1, 2, 3$ is a probability distribution. Find (i) $P(X \leq 2)$
2
(ii) $E[X]$ and (iii) $var(X)$.
3. Suppose X is a Poisson random variable find $P(X=1)=P(X=2)$. Find the mean and variance.
4. The diameter of a circular metallic disc produced by a machine is a random variable with mean 6 cm and variance 2 cm. Find the mean area of the discs.
5. Find the mean and variance of a binomial random variable.

Module 2

6. The random variable X is exponentially distributed with mean 3. Find $P(X > t +$

$3|X > t)$ where t is any positive real number.

7. The IQ of an individual randomly selected from a population is a normal distribution with mean 100 and standard deviation 15. Find the probability that an individual has IQ (i) above 140 (ii) between 120 and 130.
8. A continuous random variable X is uniformly distributed with mean 1 and variance $4/3$. Find $P(X < 0)$.
9. Determine the value of c so that $f(x, y) = cxy$ for $0 < x < 3, 0 < y < 3$ and $f(x, y) = 0$ otherwise satisfies the properties of a joint density function of random variables X and Y . Also find $P(X+Y \leq 1)$. Are X and Y independent? Justify your answer.
10. The life time of a certain type of electric bulb may be considered as an exponential random variable with mean 50 hours. Using central limit theorem, find the approximate probability that 100 of these electric bulbs will provide a total of more than 6000 hours of burning time.

Module 3

11. The mean volume of liquid in bottles of lemonade should be at least 2 litres. A sample of bottles is taken in order to test whether the mean volume has fallen below 2 litres. Give a null and alternate hypothesis for this test and specify whether the test would be one-tailed or two-tailed.
12. The mean blood pressure of 100 randomly selected persons from a target population is 127.3 units. Find a 95% confidence interval for the mean blood pressure of the population.
13. The CEO of a large electric utility claims that 80% of his 1,000,000 customers are very satisfied with the service they receive. To test this claim, the local newspaper surveyed 100 customers, using simple random sampling. Among the sampled customers, 73% say they are very satisfied. Based on these findings, do you think that the CEO is making a false claim of high satisfaction levels among his customers? Use a 0.05 level of significance.
14. Two types of cars are compared for acceleration rate. 40 test runs are recorded for each car and the results for the mean elapsed time recorded below:

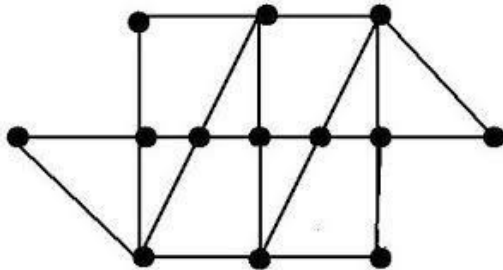
	Sample mean	Sample Standard Deviation
Car A	7.4	1.5
Car B	7.1	1.8

Determine if there is a difference in the mean elapsed times of the two car models at 95% confidence level.

15. A magazine reported the results of a telephone poll of 800 adult citizens of a country. The question posed was: "Should the taxon cigarettes be raised to pay for health care reform?" The results of the survey were: Out of the 800 persons surveyed, 605 were nonsmokers out of which 351 answered "yes" and the rest "no". Out of the remaining 195, who were smokers, 41 answered "yes" and the remaining "no". Is there sufficient evidence, at the 0.05 significance level, to conclude that the two populations smokers and non-smokers differ significantly with respect to their opinions?

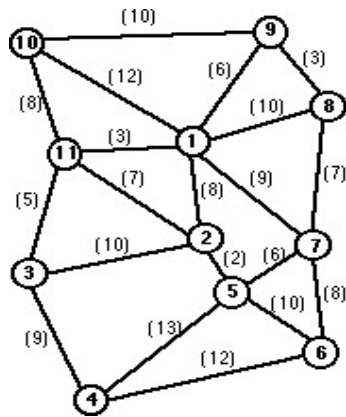
Module 4

16. Give an example of a graph that has a circuit that is (i) Eulerian but not Hamiltonian (ii) Hamiltonian but not Eulerian (iii) neither Eulerian nor Hamiltonian
17. Show that a n edge in a simple graph is a cut edge if and only if this edge is not part of any simple circuit in the graph.
18. Prove that an undirected graph has an even number of odd degree vertices
19. Show that a bipartite graph with an odd number of vertices does not have a Hamiltonian circuit.
20. Use Fleury's algorithm to find an Euler circuit in the following graph



Module 5

21. How many non-isomorphic spanning trees does K_n have? Justify your answer.
22. Prove that a simple graph is a tree if and only if it is connected, but the deletion of any of its edges produces a graph that is not connected.
23. Find the minimal spanning tree for the following graph by Prim's algorithm



24. Show that a connected bipartite graph has a chromatic number of 2.
25. Prove that a full m -ary tree with l leaves has $n = \frac{ml-1}{m-1}$ and $i = \frac{l-1}{m-1}$ internal vertices.

DATA VISUALIZATION

3.1 COURSE INFORMATION SHEET

PROGRAMME: Artificial Intelligence and Data Science	DEGREE: BTECH
COURSE: DATA VISUALIZATION	SEMESTER:S4 CREDITS: 4
COURSE CODE: 100008/IT400C REGULATION: 2020	COURSE TYPE: CORE
COURSE AREA/DOMAIN: Artificial Intelligence	CONTACT HOURS: 4hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): 100008/IT422S	LAB COURSE NAME: DATA VISUALIZATION IN R LAB

SYLLABUS:

UNIT	DETAILS	HOURS
1	Visualisation Workflow : Defining Data Visualisation- The importance of conviction Visualisation Workflow- The importance of process-The process in practice- The Hidden thinking-the first three preparatory stages of the data visualisation design workflow-Formulating Your Brief-Establishing your project's context-establishing your project's vision.	10
2	Working with Data: Data literacy-Data acquisition-Data examination-Data transformation-Data exploration -Managing large data sets-Smoothing and summarizing data- Data transformations-Developing Your Design Solution-Data Representation-Chart types: categorical, hierarchical, relational, temporal, and spatial.	12
3	Data Representation: Influencing factors and considerations: presenting the factors that will influence the suitability of your data representation choices. Understanding and managing options, Data file details, Handling strings, Interacting with gnuplot, Interactivity, The features of interactivity;, Data adjustments: View adjustments: Influencing factors and considerations: Annotation: The features of annotation: Project annotation: Chart annotation: Influencing factors and considerations	14
4	Data Legibility: The features of color-Functional harmony-Influencing factors and considerations-Composition: The features of composition-Project composition-Chart composition-Influencing factors and considerations-Developing Your Capabilities-Visualisation Literacy-Viewing- Creating- The capabilities of the visualizer	12

5	Information Dashboard Design: Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices – visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design- Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency.	12
TOTAL HOURS		60

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Andy Kirk, “Data Visualisation A Handbook for Data Driven Design” SAGE Publications 2016
T	Stephen Few, “Information dashboard design: The effective visual communication of data”, O’Reilly, 2006.
R	Tamara Munzner, Visualization Analysis and Design (VAD), CRC press, 2014.
R	Claus O. Wilke , “Fundamentals of Data Visualization A Primer on Making Informative and Compelling Figures” 2019.
R	Julie Steele, Noah Iliinsky , “Beautiful Visualization Looking at Data through the Eyes of Experts” 2010
R	Nathan Yau, “Data Points: Visualization that means something”, Wiley, 2013.
R	Gert H. N. Laursen and Jesper Thorlund, “Business Analytics for Managers: Taking business intelligence beyond reporting”, Wiley, 2010.
R	Evan Stubbs, “The value of business analytics: Identifying the path to profitability”, Wiley, 2011.

COURSE PRE-REQUISITES:NIL
COURSE OBJECTIVES:

1	To understand the data visualization techniques
2	To understand the core concepts behind data processing and exploratory data analysis
3	To apply visualization tools and design principles
4	To familiarize data analysis using R programming
5	To understand the different practices in dashboard design

COURSE OUTCOMES:
Students will be able to:

SINo.	DESCRIPTION
1	Introduce visual perception and core skills for visual analysis (L2)
2	Understand visualization for time-series analysis, ranking and deviation analysis (L3)
3	Understand the concepts of distribution, correlation and multivariate analysis (L3)
4	Understand visualization for information and dash board design (L2)
5	Understand issues and best practices in dashboard design with CIO and marketing analysis (L2)

CO MAPPING WITH PO, PSO

CO No.	Programme Outcomes (POs)												Programme-Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	1	3	1						1	2	1	2
2	2	1	2	3	3	1						2	2	1	2
3	3	2	3	3	3	1						2	3	2	3
4	3	3	3	3	3	1						3	3	3	3
5	3	3	3	3	3	1						3	3	3	3

JUSTIFICATION FOR CO-PO MAPPING

MAPPING	LEVEL	JUSTIFICATION
CO1-PO1	2	Knowledge of visual perception and core skills for visual analysis can be applied to solve engineering problems.
CO1-PO2	1	Concepts on visual perception and core skills for visual analysis can be applied to identify and analyze complex engineering problems.
CO1-PO3	2	Knowledge on visual perception and core skills for visual analysis can be used to design solution for any complex engineering problems.
CO1-PO4	1	Knowledge on visual perception and core skills for visual analysis can be applied for design of experiments , analysis

		and interpretation of data.
CO1-P05	3	Knowledge on visual perception and core skills for visual analysis can be applied to modern tool usage.
CO1-P06	1	Concepts of visual perception and core skills for visual analysis can be applied for reasoning and best practices for the society.
CO1-P012	1	Concepts of visual perception and core skills for visual analysis has the potential to engage in lifelong learning and adapt to newer technologies.
CO2-P01	2	Knowledge of visualization for time-series analysis, ranking and deviation analysis can be applied to solve engineering problems.
CO2-P02	1	Concepts on time-series analysis, ranking and deviation analysis can be applied to identify and analyze complex engineering problems.
CO2-P03	2	Knowledge on visualization for time-series analysis, ranking and deviation analysis can be used to design solution for any complex engineering problems.
CO2-P04	3	Knowledge on visualization for time-series analysis, ranking and deviation analysis can be applied for design of experiments , analysis and interpretation of data.
CO2-P05	3	Knowledge on visualization for time-series analysis, ranking and deviation analysis can be applied to modern tool usage.
CO2-P06	1	Knowledge on visualization for time-series analysis, ranking and deviation analysis can be applied for reasoning and best practices for the society.
CO2-P012	2	Concepts of visualization for time-series analysis, ranking and deviation analysis has the potential to engage in lifelong learning and adapt to newer technologies.
CO3-P01	3	Knowledge of concepts of distribution, correlation and multivariate analysis can be applied to solve engineering problems.
CO3-P02	2	Theories on concepts of distribution, correlation and multivariate analysis can be applied to identify and analyze complex engineering problems.
CO3-P03	3	Knowledge on concepts of distribution, correlation and multivariate analysis can be used to design solution for any

		complex engineering problems.
C03-P04	3	Knowledge on concepts of distribution, correlation and multivariate analysis can be applied for design of experiments , analysis and interpretation of data.
C03-P05	3	Awareness on concepts of distribution, correlation and multivariate analysis can be applied to modern tool usage.
C03-P06	1	Awareness on concepts of distribution, correlation and multivariate analysis can be applied for reasoning and best practices for the society.
C03-P012	2	Awareness in concepts of distribution, correlation and multivariate analysis has the potential to engage in lifelong learning and adapt to newer technologies.
C04-P01	3	Knowledge of visualization for information and dash board design can be applied to solve engineering problems.
C04-P02	3	Concepts on visualization for information and dashboard design can be applied to identify and analyze data related to complex engineering problems.
C04-P03	3	Knowledge on visualization for information and dashboard design can be used to design solution for any complex engineering problems.
C04-P04	3	Knowledge in visualization for information and dashboard design can be applied for design of experiments , analysis and interpretation of data.
C04-P05	3	Knowledge on visualization for information and dashboard design can be applied to modern tool usage.
C04-P06	1	Concepts of visualization for information and dash board design can be applied for reasoning and best practices for the society.
C04-P012	3	Awareness of visualization for information and dash board design has the potential to engage in lifelong learning and adapt to newer technologies.
C05-P01	3	Knowledge of issues and best practices in dashboard design with CIO and marketing analysis can be applied to solve engineering problems.
C05-P02	3	Awareness of issues and best practices in dashboard design with CIO and marketing analysis can be applied to identify and analyze complex engineering problems.

C05-PO3	3	Knowledge on issues and best practices in dashboard design with CIO and marketing analysis can be used to design solution for any complex engineering problems.
C05-PO4	3	Awareness on issues and best practices in dashboard design with CIO and marketing analysis can be applied for design of experiments, analysis and interpretation of data.
C05-PO5	3	Knowledge on issues and best practices in dashboard design with CIO and marketing analysis can be applied to modern tool usage.
C05-PO6	1	Knowledge on issues and best practices in dashboard design with CIO and marketing analysis can be applied for reasoning and best practices for the society.
C05-PO12	3	Awareness of issues and best practices in dashboard design with CIO and marketing analysis has the potential to engage in lifelong learning and adapt to newer technologies.

JUSTIFICATION FOR CO-PSO MAPPING

MAPPING	LEVEL	JUSTIFICATION
C01-PSO1	2	Knowledge on visual perception and core skills for visual analysis can be used in implementing high level programming languages.
C01-PSO2	1	Knowledge on visual perception and core skills for visual analysis can be applied to knowledge in computing and information engineering
C01-PSO3	2	Knowledge on visual perception and core skills for visual analysis can be applied to provide IT solutions in different domains
C02-PSO1	2	Awareness on visualization for time-series analysis can be used to implement high level programming languages
C02-PSO2	1	Awareness on visualization for time-series analysis can be applied to knowledge in computing and information engineering
C02-PSO3	2	Knowledge on visualization for time-series analysis can be used to provide IT solutions in different domains
C03-PSO1	3	Awareness on concepts of distribution, correlation and multivariate analysis can be used to implement high level programming languages

C03-PS02	2	Concepts of distribution, correlation and multivariate analysis can be applied to knowledge in computing and information engineering
C03-PS03	3	Awareness on concepts of distribution, correlation and multivariate analysis can be used to provide IT solutions in different domains
C04-PS01	3	Concepts of visualization for information and dash board design can be applied to implement high level programming languages.
C04-PS02	3	Concepts of visualization for information and dash board design can be applied to knowledge in computing and information engineering
C04-PS03	3	Concepts of visualization for information and dash board design can be applied to provide IT solutions in different domains
C05-PS01	3	Concepts of issues and best practices in dashboard design with CIO and marketing analysis can be used to implement high level programming languages
C05-PS02	3	Concepts of issues and best practices in dashboard design with CIO and marketing analysis can be applied to knowledge in computing and information engineering
C05-PS03	3	Knowledge on issues and best practices in dashboard design with CIO and marketing analysis can be applied to provide IT solutions in different domains

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Familiarization with tree maps	Practice sessions in lab	1, 2, 3, 4, 5, 6
2	Glyphs	Share materials and conduct familiarization during labs	1, 2, 3, 4, 5, 6

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURE/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

S No:	DESCRIPTION	PO MAPPING
1	Graph Visualization	1, 2, 3, 4, 5, 6
2	SVG	1, 2, 3, 4, 5, 6

WEB SOURCE REFERENCES:

1.	https://www.youtube.com/watch?v=UjYzNhBVlvYn - NPTEL course link
2.	https://www.youtube.com/watch?v=eFByJkA3ti4

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

<input checked="" type="checkbox"/> CHALK & TALK	<input checked="" type="checkbox"/> STUD. ASSIGNMENT	<input type="checkbox"/> WEB RESOURCES	<input type="checkbox"/> STUD. LAB PRACTICES
<input checked="" type="checkbox"/> LCD/SMART BOARDS	<input type="checkbox"/> STUD. SEMINARS	<input checked="" type="checkbox"/> ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

<input checked="" type="checkbox"/> ASSIGNMENTS	<input checked="" type="checkbox"/> STUD. SEMINARS	<input checked="" type="checkbox"/> TESTS/MODEL EXAMS	<input type="checkbox"/> UNIV. EXAMINATION
<input type="checkbox"/> STUD. LAB PRACTICES	<input type="checkbox"/> STUD. VIVA	<input type="checkbox"/> MINI/MAJOR PROJECTS	<input type="checkbox"/> CERTIFICATIONS
<input type="checkbox"/> ADD-ON COURSES	<input type="checkbox"/> OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

<input checked="" type="checkbox"/> ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	<input checked="" type="checkbox"/> STUDENT FEEDBACK ON FACULTY (TWICE)
<input type="checkbox"/> ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	<input type="checkbox"/> OTHERS

Prepared by
Ms. Sreeja M. U.
 (Faculty in Charge)

Approved by
Dr. Neeba E.A
 (HoD)

3.2 Course Plan

No	Topic	No. of Lectures
1	VISUALISATION WORK FLOW	
1.1	Defining Data Visualisation	1 Hour
1.2	The importance of conviction Visualisation Workflow	1 Hour
1.3	The importance of process	1 Hour
1.4	The processing practice	1 Hour
1.5	The Hidden thinking	1 Hour
1.6	The first three preparatory stages of the data visualization design workflow	2 Hour
1.7	Formulating Your Brief	1 Hour
1.8	Establishing your project's context	1 Hour
1.9	Establishing your project's vision.	1 Hour
2	WORKING WITH DATA	
2.1	Data literacy	1 Hour
2.2	Data acquisition	1 Hour
2.3	Data examination	1 Hour
2.4	Data transformation	1 Hour
2.5	Data exploration	1 Hour
2.6	Managing large datasets-Smoothing and summarizing data	2 Hour
2.7	Data transformations	1 Hour
2.8	Developing Your Design Solution-Data Representation	1 Hour
2.9	Chart types: categorical, hierarchical, relational, temporal, and spatial.	3 Hours
3	DATA REPRESENTATION	
3.1	Influencing factors and considerations:	1 Hour
3.2	Presenting the factors that will influence the suitability of your Data representation choices	2 Hours
3.3	Understanding and managing options	1 Hour
3.4	Data file details	1 Hour
3.5	Handling strings	1 Hour
3.6	Interacting with gnu plot, Interactivity	1 Hour
3.7	The features of interactivity:, Data adjustments: View adjustments: Influencing factors and considerations:	3 Hours

3.8	Annotation: The features of annotation: Project annotation:	1 Hour
3.9	Chart annotation: Influencing factors and considerations	3 Hours
4	DATA LEGIBILITY	
4.1	The features of color	2 Hours
4.2	Functional harmony	1 Hour
4.3	Influencing factors and considerations-Composition:	1 Hour
4.4	The features of composition	1 Hour
4.5	Project composition	1 Hour
4.6	Chart composition	1 Hour
4.7	Influencing factors and considerations	1 Hour
4.8	DevelopingYourCapabilities-VisualisationLiteracy-Viewing- Creating	3 Hours
4.9	The capabilities of the visualizer	1 Hour
5	INFORMATION DASHBOARD DESIGN	
5.1	Information dashboard	1 Hour
5.2	Categorizing dashboards	1 Hour
5.3	Typical dashboard data	1 Hour
5.4	Dashboard design issues and best practices	1 Hour
5.5	Visual perception	1 Hour
5.6	Limits of short-term memory-visually encoding data- Gestalt principles	2 Hours
5.7	principles of visual perception for dashboard design-Characteristics of dashboards	2 Hours
5.8	Key goals in visual design process- dashboard display media	1 Hour
5.9	Designing dashboards for usability-meaningful organization-Maintaining consistency.	2 Hours

3.3 Assignment Questions

Assignment 1

1. For the state of California, make time series plots showing rates for all diseases. Include only years with 10 or more weeks reporting. Use a different color for each disease.
2. Explain the preparatory stages of the data visualisation design workflow.

Assignment 2

1. Discuss the characteristics of dashboard. Apply the principles of dashboard design for visualizing purpose in any one application.

DATABASE MANAGEMENT SYSTEMS

4.1 COURSE INFORMATION SHEET

PROGRAMME: ARTIFICIAL INTELLIGENCE & DATA SCIENCE	DEGREE: B.TECH	YEAR: 2022
COURSE: Database Management Systems	SEMESTER: IV	CREDITS: 4
COURSE CODE : 100008/IT400D REGULATION: 2020	COURSE TYPE: CORE	
COURSE AREA/DOMAIN: DATABASE	CONTACT HOURS: 3 + 1 (Tutorial) hours/Week	
CORRESPONDING LAB COURSE CODE (IF ANY): 100008/IT422T	LAB COURSE NAME: Database Management Systems Lab	

SYLLABUS:

UNIT	DETAILS	HOURS
I	<p>INTRODUCTION TO E-R MODEL</p> <p>Introduction: Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. (Reading: Elmasri Navathe, Ch. 1 and 2. Additional Reading: Silbershatz, Korth, Ch. 1) Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity Relationship Diagram, Weak Entity Sets, Relationships of degree greater than 2 (Reading: Elmasri Navathe, Ch.7.1-7.8)</p>	9
II	<p>RELATIONAL MODEL, DATABASE LANGUAGES & SQL</p> <p>Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema (Reading: Elmasri Navathe, Ch. 3 and 8.1, Additional Reading: Silbershatz, Korth, Ch. 2.1-2.4) Database Languages: Concept of DDL and DML relational algebra (Reading: Silbershatz, Korth, Ch 2.5-2.6 and 6.1-6.2, Elmasri Navathe, Ch. 6.1-6.5). Structured Query Language (SQL): Basic SQL Structure, examples, Set operations, Aggregate Functions, nested sub-queries (Reading: Elmasri Navathe, Ch. 4 and 5.1) Views, assertions and triggers (Reading: Elmasri Navathe, Ch. 5.2-5.3, Optional reading: Silbershatz, Korth Ch.5.3).</p>	8

III	RELATIONAL DATABASE DESIGN Relational Database Design: Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover (proofs not required). Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions (Reading: Elmasri and Navathe, Ch. 14.1-14.5, 15.1-15.2. Additional Reading: Silberschatz, Korth Ch. 8.1-8.5)	11
IV	PYSICAL DATA ORGANIZATION AND QUERY OPTIMIZATION Physical Data Organization: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+-Trees (basic structure only, algorithms not needed), (Reading Elmasri and Navathe, Ch. 17.1-17.4) Query Optimization: heuristics-based query optimization, (Reading Elmasri and Navathe, Ch. 18.1, 18.7)	7
V	TRANSACTION PROCESSING CONCEPTS Transaction Processing Concepts: overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability. Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, (Reading Elmasri and Navathe, Ch. 20.1-20.5 (except 20.5.4-20.5.5) , Silberschatz, Korth Ch. 15.1 (except 15.1.4-15.1.5), Ch. 16.1 – 16.5) Recent topics (preliminary ideas only): Semantic Web and RDF(Reading: Powers Ch.1, 2), GIS, biological databases (Reading: Elmasri and Navathe Ch. 23.3- 23.4) Big Data (Reading: Plunkett and Macdonald, Ch. 1, 2)	10
TOTAL HOURS		45

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Elmasri R. and S. Navathe, <i>Database Systems: Models, Languages, Design and Application Programming</i> , Pearson Education, 2013.
T	Silberschatz A., H. F. Korth and S. Sudarshan, <i>Database System Concepts</i> , 6/e, McGraw Hill, 2011.
R	Powers S., <i>Practical RDF</i> , O'Reilly Media, 2003.
R	Plunkett T., B. Macdonald, et al., <i>Oracle Big Data Hand Book</i> , Oracle Press,

	2013.
R	Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015
R	Olivier Pivert, NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018.
R	Web Resource: https://www.w3resource.com/redis/
R	web Resource: https://www.w3schools.in/category/mongodb/
R	Web Resource: https://www.tutorialspoint.com/cassandra/cassandra_introduction.htm
R	Web Resource : https://www.tutorialspoint.com/arangodb/index.htm

Preamble: Database Management Systems course is intended to deliver students the elementary concepts of a database management system and equips them to design and implement a database application built over those concepts. It also introduces to them advanced level areas like transaction processing, concurrency control and recovery management. The current trend, unstructured data - NoSQL is unveiled too.

Prerequisite: NIL

Course Objectives:

1	To impart the basic understanding of the theory and applications of database management systems.
2	To give basic level understanding of internals of database systems.
3	To expose to some of the recent trends in databases.

Course Outcomes:

CO No.	CO	Bloom's Category
CO1	Define, explain and illustrate the fundamental concepts of databases.	Understand
CO2	Model real word scenarios given as informal descriptions, using Entity Relationship diagrams.	Apply
CO3	Model and design solutions for efficiently representing and querying data using relational model.	Apply
CO4	Demonstrate the features of indexing and hashing in database applications.	Apply
CO5	Discuss and compare the aspects of Concurrency Control and Recovery in Database systems.	Understand

C06	Discuss the latest trends in databases.	Understand
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CO-PO Mapping

	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
C01	1	1	3	-	-	-	-	-	-	-	-	-	1	3	-
C02	2	2	3	-	-	-	-	-	-	-	-	-	1	3	-
C03	1	1	2	2	3	-	-	-	-	-	-	2	1	3	-
C04	2	2	3	2	-	-	-	-	-	-	-	-	1	-	-
C05	2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
C06	3	1	2												

JUSTIFICATIONS FOR CO-PO-PSO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
ITT206.1-PO1	L	Students could apply fundamental engineering knowledge for describing data models.
ITT206.1-PO2	L	Students could identify functionalities of DBMS.
ITT206.1-PO3	H	Knowledge in architecture of DBMS help students to clearly understand the functionalities of DBMS.
ITT206.1-PS01	L	Students will be able to select data models for a given problem.
ITT206.1-PS02	H	Students will be able to design database for solving complex problems.
ITT206.2-PO1	M	Students gain knowledge in E-R modeling.
ITT206.2-PO2	M	Students acquire competency in building E-R models of database.
ITT206.2-PO3	H	Students will be able to develop relational schema from ER models.
ITT206.2-PS01	L	Students can solve database design problems with knowledge in ER modeling.
ITT206.2-PS02	H	Students will acquire skills in developing ER diagrams.
ITT206.3-PO1	L	Students will be able to classify different SQL queries.

ITT206.3-PO2	L	Students will be able to understand the formulation and working of SQL queries.
ITT206.3-PO3	M	Students gain competency in PL/SQL programming.
ITT206.3-PO4	M	Understanding of the working of different SQL queries is required in interacting with database.
ITT206.3-PO5	H	Students acquire competency in developing SQL queries to interact with database.
ITT206.3-PO12	M	Students will be able to identify formal query languages in database.
ITT206.3-PSO1	L	Students will be able to solve complex engineering tasks with skills in database languages.
ITT206.3-PSO2	H	Students will be able to develop user friendly application with efficient use of database usage.
ITT206.4-PO1	M	Students will be able to identify different normalization procedures used in database design.
ITT206.4-PO2	M	Students will gain knowledge in classifying different normal forms
ITT206.4-PO3	H	Students gain competency in designing database following normal form standards.
ITT206.4-PO4	M	Students will be to apply proper normalization for developing well tuned database.
ITT206.4-PSO1	L	Understanding of the normalization schemes for database design in developing normalized database.
ITT206.5-PO1	M	Students will be able to describe transaction processing and related issues.
ITT206.5-PO2	M	Students will be able to classify different concurrency control techniques.
ITT206.5-PO3	H	Students gain competency in understanding different scheduling process.
ITT206.5-PSO2	H	Students acquire knowledge in transaction processing and related issues, concurrency control.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Sl. No.	Description	Relevance to PO, PSO
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1	Query optimization	POs – 1, 2, 3, 4; PSOs – 1, 2
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PROPOSED ACTIONS: ASSIGNMENT/ NPTEL

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl. No.	Topics	Relevance to PO, PSO
1	Spatial databases	POs – 2, 3, 4; PSOs – 1, 2
2	Temporal databases	POs – 1, 2, 3, 4; PSOs – 1, 2

WEB SOURCE REFERENCES:

1	NPTEL link - https://youtu.be/SkT7jhPAQOE
2	https://www.tutorialspoint.com/dbms/index.htm

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

<input checked="" type="checkbox"/> CHALK & TALK	<input checked="" type="checkbox"/> STUD. ASSIGNMENT	<input checked="" type="checkbox"/> WEB RESOURCES
<input type="checkbox"/> LCD/SMART BOARDS	<input checked="" type="checkbox"/> STUD. SEMINARS	<input type="checkbox"/> ADD-ON COURSES

ASSESSMENT METHODOLOGIES - DIRECT

<input checked="" type="checkbox"/> ASSIGNMENTS	<input checked="" type="checkbox"/> STUD. SEMINARS	<input checked="" type="checkbox"/> TESTS/MODEL EXAMS	<input checked="" type="checkbox"/> UNIV. EXAMINATION
<input checked="" type="checkbox"/> STUD. LAB PRACTICES	<input checked="" type="checkbox"/> STUD. VIVA	<input type="checkbox"/> MINI/MAJOR PROJECTS	<input type="checkbox"/> CERTIFICATIONS
<input type="checkbox"/> ADD-ON COURSES		<input type="checkbox"/> OTHERS	

ASSESSMENT METHODOLOGIES - INDIRECT

<input checked="" type="checkbox"/> ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	<input type="checkbox"/> STUDENT FEEDBACK ON FACULTY (ONCE)
<input type="checkbox"/> ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	<input type="checkbox"/> OTHERS

Prepared by

Dr. Sherly K.K

Approved by

(HOD)

4.2 Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	INTRODUCTION TO E-R MODEL	
1.1	Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users	3 hours
1.2	Three Schema architecture of DBMS. Database architectures and classification.	2 Hours
1.3	Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity Relationship Diagram, Weak Entity Sets, Relationships of degree greater than 2	4 Hours
2	RELATIONAL MODEL, DATABASE LANGUAGES & SQL	
2.1	Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema	2 Hours
2.2	Database Languages: Concept of DDL and DML relational algebra	2 Hours
2.3	Structured Query Language (SQL): Basic SQL Structure, examples, Set operations, Aggregate Functions, nested sub-queries	3 Hours
2.4	Views, assertions and triggers	2 Hours
3	RELATIONAL DATABASE DESIGN	
3.1	Different anomalies in designing a database, Normalization	1 Hours
3.2	Functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover	4 Hours
3.3	Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions	6 Hours
4	PYSICAL DATA ORGANIZATION AND QUERY OPTIMIZATION	
4.1	Physical Data Organization: index structures, primary, secondary and clustering indices	3 Hours
4.2	Single level and Multi-level indexing, B+-Trees	2 Hours
4.3	Query Optimization: heuristics-based query optimization	2 Hours
5	TRANSACTION PROCESSING CONCEPTS	
5.1	Overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability.	3 Hours
5.2	Two-phase locking, failure classification	2 Hours
5.3	Storage structure, stable storage, log based recovery, deferred database modification, check-pointing	2 Hours
5.4	Semantic Web and RDF	2 Hours
5.5	GIS, biological databases	1 Hours
5.6	Big Data	1 Hours

4.3 Assignment Questions

Assignment 1

Question 1: Construct an ER diagram for the following:

- a) A book publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors, who not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book requires some items for publications. These items supplied by suppliers. One supplier can supply many items. Shop owner buy books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by Bookid.

Question 2: Construct an ER diagram for a college database given the following statements:

- A college contains many departments
- Each department can offer any number of courses
- Many instructors can work in a department
- An instructor can work only in one department
- For each department there is a Head
- An instructor can be head of only one department
- Each instructor can take any number of courses
- A course can be taken by only one instructor
- A student can enroll for any number of courses
- Each course can have any number of students

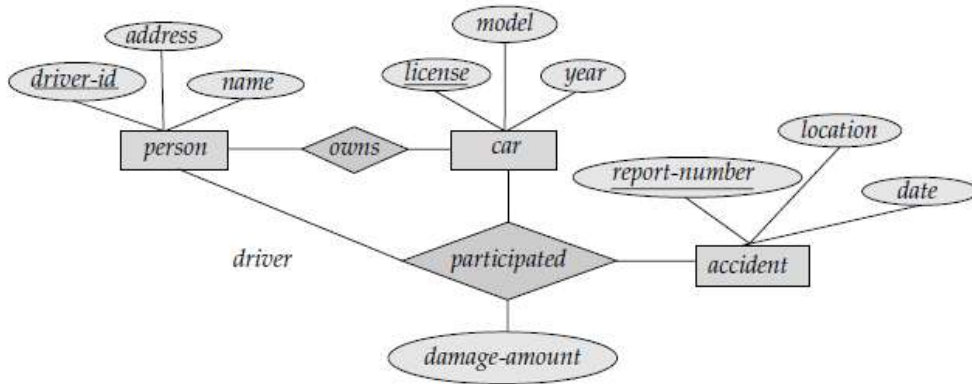
Question 3: Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):

- The NHL has many teams,
- Each team has a name, a city, a coach, a captain, and a set of players,
- Each player belongs to only one team,
- Each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
- A team captain is also a player,

- A game is played between two teams (referred to as *host_team* and *guest_team*) and has a date (such as May 11th, 1999) and a score (such as 4 to 2).

Construct a clean and concise ER diagram for the NHL database.

1. Design a relational database corresponding to the E-R diagram given below:



2. Consider the following relational database schema:

employee (*person-name*, *street*, *city*)

works (*person-name*, *company-name*, *salary*)

company (*company-name*, *city*)

manages (*person-name*, *manager-name*)

Give an expression in the relational algebra to express each of the following queries:

- Find the names of all employees who work for First Bank Corporation.
- Find the names and cities of residence of all employees who work for First Bank Corporation.
- Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000 per annum.
- Find the names of all employees in this database who live in the same city as the company for which they work.
- Find the names of all employees who live in the same city and on the same street as do their managers.

- f. Find the names of all employees in this database who do not work for First Bank Corporation.
- g. Find the names of all employees who earn more than every employee of Small Bank Corporation.
- h. Assume the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.

Assignment 2

1. Find the minimal cover of the set of functional dependencies given; $\{A \rightarrow C, AB \rightarrow C, C \rightarrow DI, CD \rightarrow I, EC \rightarrow AB, EI \rightarrow C\}$

2. Consider the schema given below.

person (driver-id, name, address)

car (reg-no, model, year, driver-id)

accident (report-number, date, location)

participated (driver-id, reg-no, report-number, damage-amount)

Write SQL queries for the following:

- a. Find the name of driver, who is drives the car with reg-no='AABB2000'.
- b. Find the total number of people who were involved in car accidents in 01-01-1989.
- c. Find the number of accidents in which the cars belonging to "John Smith" were involved.
- d. Update the damage amount for the car with reg-no "AABB2000" in the accident with report number "AR2197" to \$3000.

3. Compute the closure of the following set F of functional dependencies for relation schema R = (A, B, C, D, E).

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

List the candidate keys for R.

4. Define 3NF and BCNF. Let R (A, B, C, D, E) be a relational schema in which the following functional dependencies are known to hold: $AB \rightarrow C$, $C \rightarrow E$ and $E \rightarrow D$. Identify the highest normal form

4.4 Tutorial Questions

Tutorial 1

Consider the following relations:

Student(*snum*: integer, *sname*: string, *major*: string, *level*: string, *age*: integer)

Class(*name*: string, *meets at*: time, *room*: string, *_d*: integer)

Enrolled(*snum*: integer, *cname*: string)

Faculty(*fid*: integer, *fname*: string, *deptid*: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.

Write the following queries in SQL. No duplicates should be printed in any of the answers.

1. Find the names of all Juniors (Level = JR) who are enrolled in a class taught by I. Teach.
2. Find the age of the oldest student who is either a History major or is enrolled in a course taught by I. Teach.
3. Find the names of all classes that either meet in room R128 or have five or more students enrolled.
4. Find the names of all students who are enrolled in two classes that meet at the same time.
5. Find the names of faculty members who teach in every room in which some class is taught.
6. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

7. Print the Level and the average age of students for that Level, for each Level.
8. Print the Level and the average age of students for that Level, for all Levels except JR.
9. Find the names of students who are enrolled in the maximum number of classes.
10. Find the names of students who are not enrolled in any class.
11. For each age value that appears in Students, find the level value that appears most often. For example, if there are more FR level students aged 18 than SR, JR, or SO students aged 18, you should print the pair (18, FR).

Tutorial 2

1. Examine the table shown below:

<i>branchNo</i>	<i>branchAddress</i>	<i>telNos</i>
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

- a. Why is this table not in 1NF?
 - b. Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).
 - c. Identify the primary, alternate and foreign keys in your 3NF relations.
2. $R = (A, B, C, D, E)$. We decompose it into $R_1 = (A, B, C)$, $R_2 = (C, D, E)$. The set of functional dependencies is: $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$. Check whether this decomposition is a lossless join decomposition or not.

PROFESSIONAL ETHICS

5.1 COURSE INFORMATION SHEET

PROGRAMME: All Programmes	DEGREE: B.TECH
COURSE: PROFESSIONAL ETHICS	SEMESTER: III & IV CREDITS: 2
COURSE CODE: 100908/EN900E REGULATION: 2019	COURSE TYPE: Mandatory Credited Course
COURSE AREA/DOMAIN: HUMANITIES	CONTACT HOURS: 2 hours/week – 2 L

SYLLABUS:

UNIT	DETAILS
I	Understanding Ethics and Values: Morals, Values, and Ethics-Integrity- Academic Integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others-Living Peacefully-Caring and Sharing- Honesty- Courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations
II	Scope and Aim of Engineering Ethics: Senses of Engineering Ethics - Variety of moral issues- Types of inquiry; Moral dilemmas –Moral Autonomy – Kohlberg’s theory- Gilligan’s theory- Consensus and Controversy; Profession and Professionalism- Models of professional roles; Theories about right action –Self-Interest-Customs and Religion- Uses of Ethical Theories
III	Engineering as Social Experimentation: Engineers as responsible Experimenters-Codes of Ethics- Plagiarism- A balanced outlook on law - Challenger case study- Bhopal gas tragedy
IV	Professional Responsibilities: Collegiality and loyalty–Managing Conflict-Respect for authority-Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime Professional Rights: Employee rights- IPR-Discrimination
V	Global Issues: Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development Engineers as Managers, Consultants and Leaders: Engineers as Managers- Consulting Engineers-Engineers as Expert witnesses and advisors-Moral leadership

TEXT/REFERENCE BOOKS:

T/ R	BOOK TITLE/AUTHORS/PUBLICATION
T	M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
T	R S Naagarazan, A textbook on professional ethics and human values, New age international (P) limited, New Delhi,2006
R	http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics .
R	Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and Cases, Wadsworth Thompson Learning, United States,2005.
R	Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
R	Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
R	P Arne Vesilind, Alastair S. Gunn, Engineering Ethics and the Environment, Cambridge University Press, 1998

COURSE PREREQUISITES:

NIL

COURSE OBJECTIVES:

1	Brief students on the core values that are required by any professional.
2	Help students identify the ethical thought process in a professional environment.
3	Explain the implementation of values and morals in a workspace at a personal level.
4	Enable students to effectively solve problems within a given moral and ethical framework through examples, case studies and thought experiments.
5	Encourage students to implement the same pattern of thought process for real world issues.

COURSE OUTCOMES:

NO	DESCRIPTION
C01	Understand the core values that shape the ethical behaviour of a professional.
C02	Adopt a good character and follow an ethical life.
C03	Explain the role and responsibility in technical development by keeping personal ethics and legal ethics.
C04	Solve moral and ethical problems through exploration and assessment by established experiments.

C05	Apply the knowledge of human values and social values to contemporary ethical dilemmas and global issues.
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TOPICS BEYOND SYLLABUS:

	TOPICS	PROPOSED ACTION
1	Three types of ethics or morality – common, personal and professional	Lecture
2	Preventive and Aspirational Ethics	Lecture
3	Social and value dimensions of technology	Lecture
4	Environmental Ethics in Engineering	Lecture/Activity
5	Organizational culture and types	Lecture/Activity
6	Functions of engineers and managers	Lecture/Activity
7	Corporate Social Responsibility (CSR)	Lecture/Activity
8	Social Sensitivity and Gender Sensitivity	Lecture/Activity

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

√ CHALK & TALK	√ STUD. ASSIGNMENT	√ WEB RESOURCES	ADD-ON COURSES
LCD/SMART BOARDS	STUD. SEMINARS		

ASSESSMENT METHODOLOGIES-DIRECT:

√ ASSIGNMENTS	STUD. SEMINARS	√ TESTS/MODEL EXAMS	√ UNIV. EXAMINATION
STUD. LAB PRACTICES	STUD. VIVA	MINI/MAJOR PROJECTS	CERTIFICATIONS
ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT:

√ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	√STUDENT FEEDBACK ON FACULTY (TWICE)
ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	OTHERS

Prepared by

Dr Sonia Paul

Mr Rajeesh Rajkumar

Mr Vinay Menon

Approved by

Dr Sonia Paul

HoD, BSH

RSET

5.2 COURSE PLAN

No	Module	Topic
1	I (3)	Introduction to the course, background & familiarization with assignments and requirements
2		Morals, Values, Virtues, Ethics; Integrity – academic & workplace; Work ethics _ Honesty, Courage, Cooperation, Commitment
3		Civic Virtue – Respect for others, Living peacefully, Caring and Sharing, Empathy; Service Learning; Social Expectations; Self Confidence
4	II (5)	Engineering ethics – senses, moral issues, types of enquiry; Moral Dilemma, Moral Autonomy; Consensus and Controversy
5		Profession & Professionalism; Models of Professional Roles
6		Kohlberg’s & Gilligan’s theories of Moral Development
7		Moral Reasoning & Ethical theories – theories about right action
8		Self-interest, Custom and Religion; Use of ethical theories
9	III (5)	Engineering as Experimentation
10		Engineers as Responsible Experimenters
11		Code of Ethics; Plagiarism; Balanced Outlook on Law
12		Challenger Case
13		Safety and Risk; Bhopal Gas Tragedy
14	IV (5)	Collegiality, Loyalty, Respect for Authority, Collective Bargaining
15		Confidentiality, Conflicts of Interest, Managing Conflict, Occupational Crime
16		Professional Rights
17		Employee Rights
18		IPR
19	V (6)	Multinational corporations & Business Ethics
20		Environmental Ethics
21		Computer Ethics, Weapons Development
22		Engineers as Managers & Consultants

23	Engineers as Expert Witnesses & Advisors
24	Moral Leadership

5.3 SAMPLE ASSIGNMENT QUESTIONS

- (1) Talk to two practicing engineers. Ask each of them to describe a moral problem they have confronted in their work. Present the moral problems they have shared with you briefly, and answer the questions that are given below for each of them:
- (a) Is the moral problem a moral dilemma? What are the conflicting moral obligations, duties, rights, ideals or principles involved in the case?
 - (b) How would you resolve the problem were you in the position of the engineer confronting the problem?
- (2) We have already seen that moral issues in engineering can be either micro issues, i.e. pertaining to the individual or the organization level decisions, or macro issues, which have a global impact. From a survey of the newspapers, magazines or other channels, identify two micro issues and two macro issues in any sphere of engineering which have been in the news recently.
- Briefly explain the issues.
- As an engineer in training, what do you think should be done to address these issues?
- (3) You have been introduced to three main ethical theories viz. Teleological (Utilitarian), Deontological (Duty), and Virtue Ethics.
- (a) Give one example each from your own life where you have applied the underlying ideas in these three schools of ethical thought.
 - (b) Which of these do you most often adopt in your own life and why?
- (4) Suppose that those who are happy with their jobs also perform well in them because they are personally suited for the role. Now think of the career you have considered for yourself (engineering or otherwise). What character traits would a person need to excel in that job or field?
- (5) Comment on the following passage: "A code only sets the limits beyond which behavior will be condemned, and the moral level is not high when all or most of those who live under it always act within a hairline of those limits. Codes, in fact,

are for criminals and competitors, not for professions that want to be known as dedicated.”

- (6) Respond to the following claim: “Even if substantial agreement could be reached on ethical principles and they could be set out in a code, the attempt to impose such principles on others in the guise of ethics contradicts the notion of ethics itself, which presumes that persons are autonomous moral agents.” Is the idea of an officially prescribed, authoritative code of ethics somehow incompatible with an appreciation of the importance of moral autonomy in individuals?
- (7) Carry out a short research and prepare a brief report on a real-life case of whistle blowing in the engineering industry. Clearly mention the consequences both for the agent and the case.

Based on your understanding of whistle blowing, judge whether the case you reported is morally justified. Give reasons for your answer.

- (8) Clothing and hairstyles have remained a controversial topic in the workplace. While employees believe they can choose the clothing and hairstyles they wear to work, legal rulings state that employers have the right to set reasonable standards, specifically in instances where corporate image and job function are affected. Discuss this issue, defending your own view by referring to utilitarian, duty-based or rights based ethical theories.

CONSTITUTION OF INDIA

6.1 COURSE INFORMATION SHEET

PROGRAMME: B. TECH ALL BRANCHES	DEGREE: B.TECH
COURSE: CONSTITUTION OF INDIA	SEMESTER: 4
COURSE CODE: MCN202 REGULATION: 2019	COURSE TYPE: CORE
COURSE AREA/DOMAIN: SOCIAL SCIENCE	CONTACT HOURS: 2-0-0
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: NA

SYLLABUS:

No	Topic	No. of Lectures
1	Module 1	
1.1	Definition of constitution, historical back ground, salient features of the constitution.	1
1.2	Preamble of the constitution, union and its territory.	1
1.3	Meaning of citizenship, types, termination of citizenship.	2
2	Module 2	
2.1	Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation	2
2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.	2
2.3	Directive principles of state policy, classification of directives, fundamental duties.	2
FIRST INTERNAL EXAM		
3	Module 3	
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.	2
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.	2
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.	1
4	Module 4	
4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.	2
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.	2
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.	1
SECOND INTERNAL EXAM		
5	Module 5	
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance	1

	commission.	
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.	2
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	2
TOTAL HOURS		24

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHOR/PUBLICATION
T	Das Basu Durga, <i>Introduction to The Constitution of India</i> , Lexix Nexis Publication, RELX India Pvt. Ltd. 24 th Edition, 2020
T	PM Bhakshi, <i>The constitution of India</i> , Universal Law, 14e, 2017
R	Ministry of law and justice, <i>The constitution of India</i> , Govt of India, New Delhi, 2019
R	JN Pandey, <i>The constitutional law of India</i> , Central Law agency, Allahabad, 51e, 2019
R	MV Pylee, <i>India's Constitution</i> , S Chand and company, New Delhi, 16e, 2016

COURSE OBJECTIVES:

SL./NO.	COURSE OBJECTIVES
1.	To enable the students to understand the importance of the Indian Constitution
2.	To create awareness among the students about the Indian Judiciary and its functions.
3.	To make the students aware about their fundamental rights and duties

COURSE OUTCOME:

CO 1 KNOWLEDGE	Explain the background of the present constitution of India and features
CO 2 COMPREHENSION	Utilize the fundamental rights and duties
CO 3 APPLICATION	Understand the working of the union executive, parliament and judiciary
CO 4 ANALYSIS	Understand the working of the state executive, legislature and judiciary
CO 5 SYNTHESIS	Utilize the special provisions and statutory institutions

CO 6 EVALUATION	Show national and patriotic spirit as responsible citizens of the country
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MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						3						
CO 2						3		3				
CO 3										3		
CO 4										3		
CO 5							3					
CO 6						3						3

JUSTIFICATION FOR COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING					
CO / PO	PO 6	PO 7	PO 8	PO 10	PO 12
CO 1	To conceptualize the cause effect relationship between professional practices upon society within the constitutional framework.				
CO 2	To design and plan any activity that so that it does not result in breaching the rights and privileges enjoyed by the society and it abide by the constitutional provisions.		To regulate any arbitrary action by the individual against any entity and helps to work in an ethical manner.		
CO 3				Understands the procedure and law abiding by the Centre, State and the Judiciary conduct the engineering practices in accordance with the same.	
CO 4				Understands the procedure and law abiding by the Centre, State and the Judiciary conduct the engineering practices in	

				accordance with the same	
CO 5		To be aware that not all places in a country are treated alike and some places have its own uniqueness w.r.t language, tribes, environmentally fragility, historical importance etc. and to plan actions by considering the special provisions granted to these places by the constitution.			
CO 6	Reminds every student about his/her duties as citizen of India as an ordinary citizen as well as an professional engineer.				Reminds every student about his/her duties as citizen of India as an ordinary citizen as well as an professional engineer

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS

Sl.No.	Description	Proposed Actions
1.	Environmental Protection Act	NPTEL
2.	Pollution Control Laws: Administrative process	NPTEL
3.	Cyber Laws: Administrative Process	Assignment
4.	Intellectual Property Law & Rights	NPTEL
5.	Human Rights	Webinar
6.	Contract Laws and Tort Laws	Webinar

Proposed Actions: Topics beyond Syllabus/Assignment/Industry Visit/Guest Lecture/NPTEL Etc

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl.No.	Topic
1.	Challenges to Indian Political System
2.	India's External Relations
3.	Working of Election Commission
4.	Environmental Impact Assessment and Administrative Process

WEB SOURCE REFERENCES:

Sl. No.	Web Sources
1.	E – PG pathshaala – Law
2.	https://indiankanoon.org/
3.	https://www.sci.gov.in/
4.	https://cag.gov.in/en
5.	www.india.gov.in
6.	https://www.epw.in/
7.	https://www.barandbench.com/
8.	https://www.lawweb.in/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ Chalk & Talk	✓ Student Assignment	✓ Web Resources	LCD/Smart Boards
✓ Student Seminars	Add-On Courses	✓ ICT Enabled Classes	

ASSESSMENT METHODOLOGIES-DIRECT

✓ Assignments	✓ Student Seminars	✓ Tests/Model Exams	✓ Univ. Examination
Stud. Lab Practices	Stud. Viva	Mini/Major Projects	Certifications
Add-On Courses	Others	✓ Group Discussion	

ASSESSMENT METHODOLOGIES-INDIRECT

✓ Assessment of Course Outcomes (By Feedback, Once)	✓ Student Feedback On Faculty (Twice)
Assessment Of Mini/Major Projects By External Experts	✓ Others

Prepared by:

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Approved by:

Dr. Sonia Paul
HoD
DSH, RSET

6.2 COURSE PLAN		
DAYS	MODULE	GENERALCOURSEPLAN
DAY1	I	Definition of constitution, salient features of the constitution.
DAY2	I	Historical background
DAY3	I	Preamble of the constitution, union and territory.
DAY4	I	Meaning of citizenship, types, termination of citizenship.
DAY5	II	Definition of state, fundamental rights, general nature, classification.
DAY6	II	Right to equality, right to freedom, right against exploitation
DAY7	II	Right to freedom of religion, cultural and educational rights, Right to constitutional remedies
DAY8	II	Protection in respect of conviction for offences.
DAY9	II	Directive principles of state policy, classification of directives, Fundamental duties
DAY10	III	The Union executive, the President, the vice President, the Council of ministers
DAY11	III	The Prime minister, Attorney-General, functions.
DAY12	III	The parliament, composition, Rajyasabha, Lok Sabha
DAY13	III	Qualification and disqualification of membership, functions of parliament.
DAY14	III	Union judiciary, the supreme court, jurisdiction, appeal by Special leave
DAY15	IV	The State executive, the Governor, the council of ministers
DAY16	IV	The Chief minister, advocate general, union Territories
DAY17	IV	The State Legislature, composition, qualification and disqualification of membership, functions.
DAY18	IV	The state judiciary, the high court, jurisdiction, writs jurisdiction.
DAY19	V	Relations between the Union and the States
DAY20	V	Union and States-legislative relation, administrative relation
DAY21	V	Union and States -, financial Relations, Inter State council, finance commission.
DAY22	V	Emergency provision, freedom of trade commerce and intercourse

DAY23	V	Auditor general of India, public Services, Public service commission, administrative Tribunals.
DAY24	V	Official language
DAY25	V	Elections
DAY26	V	Special provisions relating to certain classes
DAY27	V	Amendment of the Constitution
DAY28	V	Amendment of the Constitution

6.3 ASSIGNMENT QUESTIONS

ASSIGNMENT1-C05

1. Federal Constitutions as a rule are rigid as most of them have extremely difficult and even complicated procedures of amendment. It should be understood that a constitution being a dynamic document should grow with a growing nation and should suit the changing needs and circumstances of a growing and changing people. Amending a federal constitution of many countries is the most difficult process in contrast, the Constitution of India presents a must simpler picture.

Prepare a write up on Constitutional amendments made in India.

[Hint: Procedure of amendment, any 20 amendments with reason] [Content clarity-

3marks + presentation style-1mark + submission on time-1mark = 5marks]

ASSIGNMENT2-C05

2 a. What were the situations to declare National Emergencies in India-Elucidate with case study?

b. National Emergency (1975-77)-The darkest hours of Indian Democracy-Why?

[Content clarity -3 marks + presentation style-1mark + submission on time-1mark = 5marks]

ASSIGNMENT3-GROUPACTIVITY-C01

3. Analyse the features of any three different constitutions. How Indian Constitution is unique?
[Content clarity-3marks + presentation style-1mark + Presentation on time-1mark = 5marks]

DATA VISUALIZATION LAB

7.1 COURSE INFORMATION SHEET

PROGRAMME: ARTIFICIAL INTELLIGENCE & DATA SCIENCE	DEGREE: BTECH
COURSE: DATA VISUALIZATION IN R LAB	SEMESTER: IV CREDITS: 2
COURSE CODE: 100002/AD422S REGULATION: 2020	COURSE TYPE: CORE
COURSE AREA/DOMAIN: PROGRAMMING, ARTIFICIAL INTELLIGENCE	CONTACT HOURS: 3 Lab hours/Week
CORRESPONDING LAB COURSE CODE (IF ANY): NA	LAB COURSE NAME:NA

SYLLABUS:

1. Draw a simple Bar Chart for the data given.
2. Draw a Bar Chart with Multiple Response Questions for the data given*
3. Draw a Column Chart with two-line labeling for the data given*
4. Draw a Column chart with 45o labeling for the data given
5. Draw a Profile Plot for the data given*
6. Draw a Dot Chart for 3 variables for the data given
7. Draw a Pie Chart and Radial Diagram for the data given*
8. Draw a Chart Tables for the data given*
9. Draw a Histogram overlay for the data given*
10. Draw a Box Plots for group for the data given*
11. Draw a Pyramids with multiple colors for the data given
12. Draw a Pyramid: emphasison the outer and inner area for the data given*
13. Draw a Pyramid with added line for the data given
14. Draw a Aggregated Pyramids for the data given*
15. Draw a Simple Lorenz curve for the data given*
16. Draw a Shot Time Series for the data given*
17. Draw a Areas underneath and between time series for the data given*
18. Draw a presentation of daily values for the data given *
19. Draw a presentation of weekly and monthly values for the data given*
20. Draw a Exceptions and Special cases in Time series for the data given
21. Draw a Scatter Plot for Four Quadrants differentiated by colors for the data given*

22. Draw a Scatter Plot for Outliers Highlighted for the data given*
 23. Draw a Scatter Plot for Areas Highlighted for the data given*
 24. Draw a Exceptions and Special cases in Scatter Plot for the data given
- (* indicates mandatory experiments.)

TEXT/REFERENCEBOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Data Visualization with R100 Examples by Thomas Rahlf, Springer
T2	Using R for Introductory Statistics, By John Verzani, CRC Press
R1	Davis, Pecar–Business Statistics using Excel, Oxford
R2	KenBlack–BusinessStatistics,5thed.,WileyIndia
R3	Chandrasekaran & Uma parvathi-Statistics for Managers, 1 st edition, PHILearning
R4	Big Data Visualization, James D. Miller, Packt Publishing Ltd.

COURSE OUTCOMES:

After the completion of the course the student will be able to

CO 1	To understand the basic concept of data visualization with R. (Cognitive Knowledge Level: Knowledge)
CO 2	To understand the implementation of descriptive statistics in R (Cognitive Knowledge Level: Knowledge)
CO 3	To apply R functions to visualize categorical data in the form of Bars and Charts (Cognitive Knowledge Level: Apply)
CO 4	To understand the representation of Histogram, Pyramids, and Box plot in R. (Cognitive Knowledge Level: Analyze)
CO 5	To understand the visualization of time series and scatterplot. (Cognitive Knowledge Level: Analyze)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	2	1	-	-	-	-	-	3
CO2	3	2	3	1	2	1	-	-	-	-	-	3

C03	3	2	3	1	2	1	-	-	-	-	-	3
C04	3	2	3	1	2	1	-	-	-	-	-	3
C05	1	2	1	1	2	1	-	-	-	-	-	3
C06	1	2	3	1	2	1	-	-	-	-	-	3

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LEVEL	JUSTIFICATION
C01-P01	2	Basic concept of data visualization with R can be applied to solve engineering problems.
C01-P02	1	Concepts of data visualization with R can be applied to identify and analyze complex engineering problems.
C01-P03	2	Knowledge on concepts of data visualization with R and core skills for visual analysis can be used to design solution for any complex engineering problems.
C01-P04	1	Concepts of data visualization with R can be applied for design of experiments, analysis and interpretation of data.
C01-P05	3	Knowledge on concepts of data visualization with R can be applied to modern tool usage.
C01-P06	1	Concepts of data visualization with R can be applied for reasoning and best practices for the society.
C01-P012	1	Concepts of data visualization with R has the potential to engage in lifelong learning and adapt to newer technologies.
C02-P01	2	Knowledge on the implementation of descriptive statistics in R can be applied to solve engineering problems.
C02-P02	1	Concepts on the implementation of descriptive statistics in R can be applied to identify and analyze complex engineering problems.
C02-P03	2	Knowledge on the implementation of descriptive statistics in R can be used to design solution for any complex engineering problems.
C02-P04	3	Knowledge on the implementation of descriptive statistics in

		R can be applied for design of experiments , analysis and interpretation of data.
C02-P05	3	Knowledge in the implementation of descriptive statistics in R can be applied to modern tool usage.
C02-P06	1	Knowledge on the implementation of descriptive statistics in R can be applied for reasoning and best practices for the society.
C02-P012	2	Concepts on the implementation of descriptive statistics in R has the potential to engage in lifelong learning and adapt to newer technologies.
C03-P01	3	Knowledge on applying R functions to visualize categorical data in the form of Bars and Charts can be applied to solve engineering problems.
C03-P02	2	Theories on concepts on applying R functions to visualize categorical data in the form of Bars and Charts can be applied to identify and analyze complex engineering problems.
C03-P03	3	Knowledge on concepts on applying R functions to visualize categorical data in the form of Bars and Charts can be used to design solution for any complex engineering problems.
C03-P04	3	Knowledge on applying R functions to visualize categorical data in the form of Bars and Charts can be applied for design of experiments , analysis and interpretation of data.
C03-P05	3	Awareness on applying R functions to visualize categorical data in the form of Bars and Charts can be applied to modern tool usage.
C03-P06	1	Awareness on applying R functions to visualize categorical data in the form of Bars and Charts can be applied for reasoning and best practices for the society.
C03-P012	2	Awareness on applying R functions to visualize categorical data in the form of Bars and Charts has the potential to engage in lifelong learning and adapt to newer technologies.
C04-P01	3	Knowledge on representation of Histogram, Pyramids, and Box plot in R can be applied to solve engineering problems.
C04-P02	3	Concepts on representation of Histogram, Pyramids, and Box

		plot in R can be applied to identify and analyze data related to complex engineering problems.
CO4-P03	3	Knowledge on visualization for information and dashboard design can be used to design solution for any complex engineering problems.
CO4-P04	3	Knowledge in representation of Histogram, Pyramids, and Boxplot in R can be applied for design of experiments , analysis and interpretation of data.
CO4-P05	3	Knowledge on representation of Histogram, Pyramids, and Boxplot in R can be applied to modern tool usage.
CO4-P06	1	Concepts of representation of Histogram, Pyramids, and Boxplot in R can be applied for reasoning and best practices for the society.
CO4-P012	3	Awareness of representation of Histogram, Pyramids, and Boxplot in R has the potential to engage in lifelong learning and adapt to newer technologies.
CO5-P01	3	Understanding the visualization of time series and scatter plot can be applied to solve engineering problems.
CO5-P02	3	Awareness of visualization of time series and scatter plot can be applied to identify and analyze complex engineering problems.
CO5-P03	3	Knowledge on visualization of time series and scatter plot can be used to design solution for any complex engineering problems.
CO5-P04	3	Awareness on visualization of time series and scatter plot can be applied for design of experiments , analysis and interpretation of data.
CO5-P05	3	Knowledge on visualization of time series and scatter plot can be applied to modern tool usage.
CO5-P06	1	Knowledge on visualization of time series and scatter plot can be applied for reasoning and best practices for the society.
CO5-P012	3	Awareness of visualization of time series and scatter plot has the potential to engage in lifelong learning and adapt to newer technologies.

JUSTIFICATION FOR CO-PSO MAPPING

MAPPING	LEVEL	JUSTIFICATION
CO1-PSO1	2	Basic concept of data visualization with R can be used in implementing high level programming languages.
CO1-PSO2	1	Knowledge on basic concept of data visualization with R can be applied to knowledge in computing and information engineering
CO1-PSO3	2	Basic concept of data visualization with R can be applied to provide IT solutions in different domains
CO2-PSO1	2	Knowledge in the implementation of descriptive statistics in R can be used to implement high level programming languages
CO2-PSO2	1	Knowledge in the implementation of descriptive statistics in R can be applied to knowledge in computing and information engineering
CO2-PSO3	2	Knowledge in the implementation of descriptive statistics in R can be used to provide IT solutions in different domains
CO3-PSO1	3	Awareness on applying R functions to visualize categorical data in the form of Bars and Charts can be used to implement high level programming languages
CO3-PSO2	2	Knowledge on applying R functions to visualize categorical data in the form of Bars and Charts can be applied to knowledge in computing and information engineering
CO3-PSO3	3	Concepts on applying R functions to visualize categorical data in the form of Bars and Charts can be used to provide IT solutions in different domains
CO4-PSO1	3	Knowledge in representation of Histogram, Pyramids, and Boxplot in R can be applied to implement high level programming languages.
CO4-PSO2	3	Knowledge in representation of Histogram, Pyramids, and Boxplot in R can be applied to knowledge in computing and information engineering.

CO4-PSO3	3	Knowledge in representation of Histogram, Pyramids, and Boxplot in R can be applied to provide IT solutions in different domains.
CO5-PSO1	3	Knowledge on visualization of time series and scatter plot can be used to implement high level programming languages.
CO5-PSO2	3	Knowledge on visualization of time series and scatter plot can be applied to knowledge in computing and information engineering.
CO5-PSO3	3	Knowledge on visualization of time series and scatter plot can be applied to provide IT solutions in different domains.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS: NIL

SNO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Familiarization with tree maps	Practice sessions in lab	1, 2, 3, 4, 5, 6
2	Glyphs	Share materials and conduct familiarization during labs	1, 2, 3, 4, 5, 6

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SN	DESCRIPTION	PO
1	Graph Visualization	1, 2, 3, 4, 5, 6
2	SVG	1, 2, 3, 4, 5, 6

WEB SOURCE REFERENCES:

1	https://www.youtube.com/watch?v=UjYzNhBVlvYn- NPTEL course link
2	https://www.youtube.com/watch?v=eFByJkA3ti4

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

CHALK & TALK	STUD. ASSIGNMENT	WEB RESOURCES
LCD/SMART BOARDS	STUD. SEMINARS	ADD-ON COURSES

ASSESSMENT METHODOLOGIES-DIRECT

ASSIGNMENTS	STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
✓ STUD. LABPRACTICES	✓ STUD.VIVA	MINI/MAJOR PROJECTS	CERTIFICATIONS
ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES(BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	OTHERS

Prepared by
Ms. Sreeja M U.

Approved by
(H.O.D)

7.2 Lab Cycle and Schedule

Cycle	Name of Experiment
I	Draw a simple Bar Chart for the data given. Draw a Bar Chart with Multiple Response Questions for the data given Draw a Column Chart with two-line labelling for the data given Draw a Column chart with 45° labelling for the data given
II	Draw a Profile Plot for the data given Draw a Dot Chart for 3 variables for the data given Draw a Pie Chart and Radial Diagram for the data given
III	Draw a Chart Tables for the data given Draw a Histogram overlay for the data given Draw a Box Plots for group for the data given
IV	Draw a Pyramids with multiple colors for the data given Draw a Pyramid: emphasis on the outer and inner area for the data given Draw a Pyramid with added line for the data given Draw a Aggregated Pyramids for the data given
V	Draw a Simple Lorenz curve for the data given Draw a Shot Time Series for the data given Draw a Areas underneath and between time series for the data given
VI	Draw a presentation of daily values for the data given Draw a presentation of weekly and monthly values for the data given Draw a Exceptions and Special cases in Time series for the data given
VII	Draw a Scatter Plot for Outliers Highlighted for the data given Draw a Scatter Plot for Areas Highlighted for the data given Draw a Exceptions and Special cases in Scatter Plot for the data given

Internal Examination

Continuous Internal Evaluation Pattern:

Attendance : 15 marks

Continuous Assessment : 30 marks

Internal Test (Immediately before the second series test): 30 marks

End Semester Examination Pattern:

The following guidelines should be followed regarding award of marks

- (a) Preliminary work : 15Marks
- (b) Implementing the work/Conducting the experiment : 10Marks
- (c) Performance, result and inference (usage of equipments and trouble shooting) : 25Marks
- (d) Viva voce : 20marks
- (e) Record : 5Marks

Lab in Charge: Ms. Sreeja M. U.

7.3 Open Questions

- I. Load the mtcars dataset using the commands below and perform the following.

```
#To load datasets package  
library("datasets")  
#To load iris dataset  
data(mtcars)  
#To analyze the structure of the dataset  
str(mtcars)
```

1. To draw a scatter plot of cyl(Number of Cylinders) and vs(Engine Type(0 = V-shaped, 1 = straight)),
2. Avoid overplotting in the above plot
3. To draw a scatter plot of cyl(Number of Cylinders) and vs(Engine Type(0 = V-shaped, 1 = straight)) according to **am** Transmission (0 = automatic, 1 = manual)
4. To draw a bar plot of cyl(Number of Cylinders) according to the Transmission type using geom_bar() and fill()
5. To facet the following plot according to gear(Number of Gears(3,4,5)), we use facet_grid() function.

7.4 Advanced Questions

Read the nc.csv file and do the following.

```
nc <- read.csv("/cloud/project/nc.csv")
```

1. Using a data visualization, visually assess the average of the difference in age between mother and father of each child?
2. Determine the proportion of births in this sample where the father is older than the mother?
3. Make a graph showing weeks again on the x axis and the variable gained on the y axis (the amount of weight a mother gained during pregnancy). Include axis labels with measurement

- units, and a title.
4. Inspect the histogram of the weeks variable. Answer each of the following with text.
 5. The y axis is labeled count. What is specifically being counted in this case? Hint: think about what each case is in this data set.
 6. What appears to be roughly the average length of pregnancies in weeks?
 7. If we changed the bin width to 10, how many bins would there be? Roughly how many cases would be in each bin?
 8. Load the data set called *data03* and create a simple scatterplot showing the Variable1 on the x-axis and Variable2 on the y-axis.

```
data03 <- base::readRDS(url("https://slcladal.github.io/data/d03.rda", "rb"))
```

DATABASE MANAGEMENT SYSTEMS LAB

8.1 COURSE INFORMATION SHEET

PROGRAMME: B.TECH- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	DEGREE: B.TECH
COURSE: Database Management Systems Lab	SEMESTER: IV CREDITS: 2
COURSE CODE: 100008/IT422T REGULATION: 2020	COURSE TYPE: LAB
COURSE AREA/DOMAIN: DATABASE MANagementsYSTEMS	CONTACT HOURS: 3 Practical hours/Week

Preamble:

Database Management Systems Lab course is intended to provide students

- A hands on experience in database management concepts.
- A strong formal foundation in database concepts, technology and practice to the students.
- An exposure to design and develop applications to present SQL and procedural interfaces to SQL comprehensively.
- To declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.

Prerequisite: Nil

SYLLABUS:

1. Design a database schema for an application with ER diagram from a problem description**.
2. Creation, modification, configuration, and deletion of databases using UI and SQL Commands **.
3. Creation of database schema - DDL (create tables, set constraints, enforce relationships, create indices, delete and modify tables). Export ER diagram from the database and verify relationships** (with the ER diagram designed in step 1).
4. Database initialization - Data insert, Data import to a database (bulk import using UI and SQL Commands)**.
5. Practice SQL commands for DML (insertion, updating, altering, deletion of data, and Viewing /querying records based on condition in databases)**.

6. Implementation of built-in functions in RDBMS**.
7. Implementation of various aggregate functions in SQL**.
8. Implementation of Order By, Group By & Having clause **.
9. Implementation of set operators nested queries, and join queries **.
10. Implementation of queries using temp tables.
11. Practice of SQL TCL commands like Rollback, Commit, Savepoint **.
12. Practice of SQL DCL commands for granting and revoking user privileges **.
13. Practice of SQL commands for creation of views and assertions ** .
14. Implementation of various control structures like IF-THEN, IF-THEN-ELSE, IFTHENELSIF, CASE, WHILE using PL/SQL **.
15. Creation of Procedures, Triggers and Functions**.
16. Creation of Packages **.
17. Creation of Cursors **.
18. Creation of PL/SQL blocks for exception handling **.
19. Database backup and restore using commands.
20. Query analysis using Query Plan/Show Plan.
21. Familiarization of NoSQL Databases and CRUD operations**.
22. Design a database application using any front end tool for any problem selected. The application constructed should have five or more tables**.
** mandatory

Text Books

1. Elmasri R. and S. Navathe, *Database Systems: Models, Languages, Design and Application Programming*, Pearson Education, 2013.
2. Silberschatz A., H. F. Korth and S. Sudarshan, *Database System Concepts*, 6/e, McGraw Hill, 2011

Reference

1. C. J. Date, A. Kannan and S. Swamynathan, *An Introduction to Database Systems*, Eighth Edition, Pearson Education, 2009.
2. Patrick O'Neil and Elizabeth O'Neil, *Database Principles, Programming and Performance*, First Edition, Harcourt Asia Pte. Ltd., 2001.

3. Peter Rob and Carlos Coronel, *Database Systems Design, Implementation and Management*, Seventh Edition, Thomson Learning-Course Technology, 2007.
4. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems* (7th Edition), Pearson Education Ltd.
5. Shio Kumar Singh, *Database Systems Concepts, Designs and Application*, Second Edition, Pearson Education, 2011.

COURSE OUTCOMES:

After the completion of the course the student will be able to

SNO	DESCRIPTION	Blooms' Taxonomy Level
100008/I T422T.1	Design and implement a database for a given problem using database design principles.	Create (Level 6)
100008/I T422T.2	Apply stored programming concepts (PL-SQL) using Cursors and Triggers.	Apply (Level 3)
100008/I T422T.3	Use graphical user interface, Event Handling and Database connectivity to develop and deploy applications and applets.	Apply (Level 3)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
100008 /IT422 T.1	1	2	3	2	-	-	-	-	-	-	-	-	1	-	-
100008 /IT422 T.2	1	2	3	2	-	-	-	-	-	-	-	-	2	2	-
100008 /IT422 T.3	1	2	3	2	-	-	-	-	-	-	-	-	2	-	-

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW /MEDIUM /HIGH	Justification
100008/IT42 2T.1-PO1	L	Understanding the database management system concepts and basic commands helps to find out solutions to complex engineering problems.
100008/IT42 2T.1-PO2	M	Knowledge on database design and database models helps to identify, formulate and analyze complex engineering problems reaching substantiated conclusions.
100008/IT42 2T.1-PO3	H	This basic knowledge prepares the students for professional careers, with a strong technical foundation.
100008/IT42 2T.1-PO4	M	Understanding the database design and management concepts help to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
100008/IT42 2T.1-PSO1	L	Students acquire skills to design and develop databases.
100008/IT42 2T.2-PO1	L	Knowledge on SQL and PL/SQL helps to find out the solution of complex engineering problems.
100008/IT42 2T.2-PO2	M	Understanding of DDL, DML commands in SQL and knowledge of PL/SQL helps to identify, formulate and analyze complex engineering problems reaching substantiated conclusions.
100008/IT42 2T.2-PO3	H	Basic knowledge of Cursors and Triggers can be used to design solutions for complex engineering problems and design system components or processes that meet the specified needs.
100008/IT42 2T.2-PO4	M	This basic understanding helps to use research-based knowledge and research methods including design, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
100008/IT42	M	Knowledge about query languages prepares the students for professional careers, with a strong technical

2T.2-PSO1		foundation.
100008/IT42 2T.2-PSO2	M	Database designing and manipulation using Oracle and PL/SQL prepare students to excel in analysing, formulating and solving engineering problems.
100008/IT42 2T.3-PO1	L	They understand the basic concepts of graphical user interface, Event Handling and Database connectivity, which helps find out the solution of complex engineering problems.
100008/IT42 2T.3-PO2	H	Knowledge on modern databases helps to identify, formulate, review research literature, and analyze complex engineering problems.
100008/IT42 2T.3-PO3	H	Data manipulation in recent databases with the knowledge about concepts like graphical user interface, Event Handling and Database connectivity to design solutions for complex engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations..
100008/IT42 2T.3-PO4	M	Understanding of basic concepts to develop and deploy applications and applets on modern databases, help to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
100008/IT42 2T.3-PSO1	M	Understanding of graphical user interface and Database connectivity to develop and deploy applications and applets, prepares the students for professional careers, with a strong technical foundation in database manipulation.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Sl.No.	Description	Proposed Action	Relevance to PO and PSO
1	Oracle database – Storage Organization	Assignment	PO – 2, 3, 4

			PSO – 1, 2
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PROPOSED ACTIONS: ASSIGNMENT

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl.No.	Topics	Proposed Action	Relevance to PO and PSO
1	MySQL - Introduction	Assignment	PO – 2, 3, 4 PSO – 1, 2
2	Case Study - Microsoft Access	Assignment	PO – 2, 3, 4 PSO – 1, 2

WEB SOURCE REFERENCES:

1	www.w3schools.com
2	www.sqlcourse.com
3	www.beginner-sql-tutorial.com
4	www.plsql-tutorial.com
5	www.tutorialspoint.com
6	www.cs.rutgers.edu

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

<input checked="" type="checkbox"/> CHALK & TALK	<input checked="" type="checkbox"/> STUD. ASSIGNMENT	<input checked="" type="checkbox"/> WEB RESOURCES	
<input type="checkbox"/> LCD/SMART BOARDS	<input type="checkbox"/> STUD. SEMINARS	<input type="checkbox"/> ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

<input checked="" type="checkbox"/> ASSIGNMENTS	<input type="checkbox"/> STUD. SEMINARS	<input checked="" type="checkbox"/> TESTS/MODEL EXAMS	<input checked="" type="checkbox"/> UNIV. EXAMINATION
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<input checked="" type="checkbox"/> STUD. LAB PRACTICES	<input checked="" type="checkbox"/> STUD. VIVA	<input type="checkbox"/> MINI/MAJOR PROJECTS	<input type="checkbox"/> CERTIFICATIONS
<input type="checkbox"/> ADD-ON COURSES	<input type="checkbox"/> OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

<input type="checkbox"/> ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	<input checked="" type="checkbox"/> STUDENT FEEDBACK ON FACULTY (TWICE)
<input type="checkbox"/> ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	<input type="checkbox"/> OTHERS

Prepared by

**Dr. Sherly K.K
(Faculty)**

Approved by

**Dr. Neeba E.A
(HOD)**

8.2 COURSE PLAN

No	Topic	Days
1	DDL Commands	Day 1
2	DCL Commands	Day 2
3	DML Commands	Day 3
4	Implementation of various Aggregate functions and grouping in SQL	Day 4
5	Implementation of Nested Queries and Join Queries	Day 5
6	Creation of Views	Day 6
7	Simple PL/SQL programs	Day 7
8	Creation of Cursor	Day 8
9	Exception handling in PL/SQL	Day 9
10	Creation of Procedure	Day 10
11	Creation of Function	Day 11
12	Creation of Trigger	Day 12

8.3 LAB CYCLE

INSTRUCTIONS TO STUDENTS

Students should be regular and come prepared for the lab practice.

1. In case a student misses a class, it is his/her responsibility to complete that missed experiment(s) before he or she comes for the second lab after the missed class.
2. Students should maintain a lab record with cycle stuck. Prescribed textbook and class notes can be kept ready for reference if required.
3. Once the experiment(s) get executed, they should show the results to the instructors and copy the same in their observation book.

PROCEDURE FOR EVALUATION

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern:

The following guidelines should be followed regarding award of marks

- (a) Preliminary work : 15 Marks
- (b) Implementing the work/Conducting the experiment : 10 Marks
- (c) Performance, result and inference : 25 Marks
- (d) Viva voce : 20 marks
- (e) Record : 5 Marks

Exercise 1: DDL Commands

a. Create a database of your choice and create the following tables in it.

i. Table Name: Students

Column name	Constraint	Type of data
Id	Not null	Integer value
Name		Text
Email		Text
Phoneno		Numeric value
DOB		Date
Address		Text
Height_in_cm		Float
DeptNo	Not null	Numeric value

ii. Table Name: Dept

Column Name	Data Type	Constraint
DeptNo	Number(5)	Primary key
DeptName	Varchar2(20)	
Location	Varchar2(20)	

- b. Modify student table to add a column called date_of_joining with data type date.
- c. Modify student table to add a column called stipend with not null constraint.
- d. Add a check constraint to the student table to verify that the stipend is always greater than 0.
- e. Modify student table to change id to a primary key constraint.
- f. Modify student table by adding a referential integrity constraint (foreign key) on deptno to department table.
- g. Remove the column date_of_joining, adress from student table.
- h. Modify the column width of dname of department table to 50.
- i. Drop the unique constraint on dname of department table.
- j. Rename the column name Name to SName in Students table.
- k. Delete the table Dept.
- l. Display your name and age using DUAL table.
- m. Display the current system date.
- n. Perform the following operations: $15+10-5*2/5$
- o. Display all the tables currently available to the user.

Exercise 2: DML Commands

Performing DML commands like Insertion, Deletion, Modifying, Altering, and Updating records based on conditions.

a. Insert the following values in Students table.

Id	Name	Email	Phoneno	DOB	Address	Height_in_cm	DeptNo
S0001	Abey	U2007002@rajagiri.edu.in	9645765552	15/12/2001	RSET-AID	160	D004
S0002	Jesto	U2007068@rajagiri.edu.in	9446907495	24/04/2001	RSET-IT	165	D002
S0003	Adarsh	U2007003@rajagiri.edu.in	9446168018	10/01/2003	RSET-AID	180	D004
S0004	Kevin	U2007004@rajagiri.edu.in	9048779636	10/10/2002	RSET-IT	175	D002
S0005	Bony	U2007005@rajagiri.edu.in	8848647102	11/04/2001	RSET-CSE	168	D001
S0006	Manu	U2007006@rajagiri.edu.in	9447026251	19/06/2003	RSET-CSBS	190	D003

b. Create and insert the following values in Department table.

DeptNo	DeptName	Location
D001	DIT	A block
D002	DCS	B block
D003	DEC	C block
D004	DEE	D block

c. Create a table as shown below and insert the values:

Table Name: Client

Name	Data type
Cno	Varchar2(6)
Name	Varchar2(20)
Address	Varchar2(30)
City	Varchar2(15)
PinCode	Number(8)
State	Varchar2(15)

Baldue	Number(10,2)
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d. Insert the following values into the Client table

CNO	Name	City	Pincode	State	Baldue
C001	Nimmy	Cochin	680324	Kerala	14000
C002	Susan	Cochin	680324	Kerala	0
C003	Anjana	Salem	680345	TamilNadu	5000
C004	Sneha	Pune	680223	Maharashtra	500
C005	Annet	Gandipuram	680321	Karnataka	7600
C006	Ann	Bombay	682111	Maharashtra	2055

- e. Display the entire contents of the tables.
- f. Insert a new student with Id=S0007.
- g. Display the first 4 rows of the Client table.
- h. Retrieve the names, Email and Phoneno of all students.
- i. List all Students whose name starts with 'A' or 'K'.
- j. Display the distinct cities to which the clients belong.
- k. List all students whose name falls in the alphabetical range 'E to L'.
- l. Change the city of Client No: C003 from 'Salem' to 'Delhi'.
- m. Change the balance due of client 'Susan' to 600.
- n.** List details of students who belong to dept D002 or D004.
- o. Display the column name 'Baldue' of Client table as "Due Balance"
- p. List all clients who are not from 'Kerala'.
- q. Write SQL query to find the total number of students in department DEE.
- r. List the entire departments who have no students.
- s. List the name and department of students whose date of birth is in between February 20, 2001 and July1, 2003. Order the query in ascending order of DOB.

Exercise 3: Design a database schema for an application with ER diagram

Design a database schema for the following application with ER diagram:

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course.

Exercise 4: Constraints

1. Creating relationship between the databases.

Create a database of your choice and create the following tables in it.

i. Table Name: Employee

Column Name	Data Type	Constraint
EmpId	Number(5)	Primary Key
EmpName	Varchar2(20)	
Job	Varchar2(10)	
Manager	Number(5)	
DeptNo	Number(5)	
HireDate	Date	
Sal	Number(7,3)	

ii. Insert the following values in Employee table.

EmpId	EmpName	Job	Manager	DeptNo	HireDate	Comm	Salary
E0001	Abey	Tester	E0004	D004	15/12/12	500	30000
E0002	Jesto	Analyst	E0001	D002	24/04/11	650	25000

E0003	Adarsh	Clerk	E0004	D004	10/01/13	500	15000
E0004	Kevin	Admin	E0005	D002	10/10/13	1750	20000
E0005	Bony	Manager		D001	11/04/11	1000	50000
E0006	Manu	Supplier	E0001	D003	19/06/13	450	5000

iii. Table Name: Department

Column name	Constraint	Type of data
Deptno	Not null	Integer value
Dname	Unique	Text
Loc		Text

iv. Insert the following values in Department table

DeptNo	Dname	Loc
D001	Accounting	New York
D002	Research	Dallas
D003	Sales	Chicago
D004	Operations	Boston

- a. Alter the client table to add Primary key constraint on CNO Column.
- b. Create foreign key constraint on Manager and Dept. No column of Employee table.
- c. Insert a new employee with DeptNo as D006.

2. Creating a database to set various constraints.

- a. Add a constraint to make the Job column unique.
 - b. Add constraint to the Employee table to check if Salary > 20000.
-

- c. Set Salary value by default as 25000, otherwise as the user enters.
- d. Remove the constraint from the column Job.
- e. Display all the constraints on the Employee table.

Exercise 5: Views & Built-in Functions

- 1. Creation of Views and Assertions (study syntax only) *
 - a. Create a view CUST_VW of the Employee table with the following columns:

EmpId
EmpName
Job
Manager

- b. Update CUST_VW by changing the Job='Clerk' to 'Senior Clerk'
 - c. Delete from CUST_VW the Employee-Kevin.
 - d. Delete the view created.
- 2. Implementation of Built in functions in RDBMS *
 - a. Find the value of 21^5
 - b. Find the length of the string "Administration"
 - c. What is the last date of the current month?
 - d. Convert the given number "xxxxx" to "\$xxxxx". Use format mask.
 - e. Display the current system date and time with fractional seconds with time zone.
 - f. Display the year of the hiring of all the employees from the Employee table.
 - g. Calculate the number of months the employees have been working in the Company.
 - h. Find the number of departments available.
 - i. Display the hire date of all employees in the following format: Friday, 11th August, 2017
 - j. Display the ASCII value of a given letter
 - k. Converting to upper and lower cases

Exercise 6: Aggregate Functions

Implementation of various aggregate functions in SQL *

1. Calculate the total of Balance from Client table.
2. Count the total records in Employee table.
3. Find the minimum and maximum Balance due from Client table.
4. Find the average salary in Employee table.
5. Display the client names in ascending order.
6. Determine the maximum salary in each department.
7. Display the minimum salary of all departments except D001.

Exercise 7: Nested Queries and Join Queries

Implementation of set operators, nested queries and Join queries *

- a. Display all the DeptNo available with the dept and employee tables.
- b. Display all the DeptNo available in employee and not in department tables.
- c. Write a nested query to select the employees who have got more salary than Adarsh.
- d. Write a nested query to select the employees who have less salary than any employees working in dept D004.
- e. Display all employee names and salary whose salary is greater than minimum salary of the company and job title starts with A.
- f. Display the employee details, departments that the departments are same in both the employee and department.
- g. Display the employee details, departments that the departments are not same in both the employee and department.
- h. Create the following tables
 1. Table Name: Faculty

FID	FName	DeptNo
1	Neethu	D002
2	Ricky	D003
3	Jimmy	D005
4	Tom	D008
5	Harry	D003

2. Table Name: Dept

DeptNo	Dname
D001	IT
D002	CSE
D003	EEE
D004	ECE

- i. Display the Faculty ID, Faculty name, Department Name by implementing a left outer join.
- j. Display the Faculty ID, Faculty name, Department Name by implementing a right outer join.
- k. Display the Faculty ID, Faculty name, Department Name by implementing a full outer join.

Exercise 8: TCL Commands

1. Practice of SQL TCL commands like Rollback, Commit and Savepoint
 - a. Delete all clients whose Baldue is 0 or below.
 - b. Write a query to undo the above delete query.
2. Practice of SQL DCL commands for granting and revoking user privileges.
 - a) Write a query to grant all privileges of client table to nearby user.
 - b) Write a query to grant some privileges of Employee table to nearby user.
 - c) Write a query to revoke all privileges of client table from the user.

- d) Write a query to revoke some privileges of employees table from the user.

Exercise 9: Simple PL/SQL Programs

1. Write a PL/SQL code block to find factorial of a number.
2. Write a pl/sql program to check whether a given 3-digit number is Armstrong or not.
3. Write a pl/sql program to display the reverse of a string.
4. Write a pl/sql program to check whether a given number is palindrome or not.
5. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 10 to 20. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius & area.
6. Create a sequence starting with 10 to 50 displaying the even numbers only. Insert the sequence into an empty table named "EvenNo".
7. Write a pl/sql block to accept the marks for three subjects from a student and classify according to the grade and insert into tables named gradea, gradeb and graded.
(Hint: the student table contains rollno, name, m1, m2,m3 and tot_marks. If the total marks >75% insert into gradea table, between 60 and 75% insert into gradeb table and <60% graded table. Grade table has the following fields : rollno, name, %marks)

Exercise 10: Cursors

1. Write a program in PL/SQL to create an implicit cursor with for loop to display the details of an employee.
2. Write a program in PL/SQL to create an explicit cursor with for loop to display the details of an employee.
3. Write a program in PL/SQL to create a cursor displays the name and salary of each employee in the EMPLOYEES table whose salary is less than that specified by a passed-in parameter value.
4. A bank has an 'ACCMASTER' table where it holds the current status of a client's bank account. Another table called 'ACCTTRAN' holds each transaction as it occurs at bank (ie, Deposits/withdrawals of clients). The 'ACCTTRAN' table must hold a flag indicating whether the

transaction was credit or debit. Write SQL procedure to update the 'ACCMASTER' table and sets the balance depending upon whether the account is debited or credited. The updation should be done only for those records that are not processed.

ACCMASTER	ACCTRAN
Accno(PK)	Accno(FK)
Name	TransactionDate
Balance	Deb_cred Debit/Credit
	Amount
	Processed Yes/No flag

Exercise 11: Procedures

1. Create an Employee table with attributes - empid, ename, salary, dept, edate. Write a procedure to accept two arguments: empid and sal_incr (the amount by which to increase the employee's salary), to update salary with increase if employee exists, record the effective date and display the current basic.
2. Create a procedure which increases the Commission of the given employee of the Employee table by 5%.

EMPID	EMPNAME	JOB	MANAGER	DEPTNO	HIREDATE	SALARY	COMMISSION
E0001	ABEY	TESTER	E0004	D004	15-DEC-12	30000	525
E0002	JESTO	ANALYST	E0001	D002	24-MAR-11	25000	683
E0003	ADARSH	SENIOR CLERK	E0004	D004	10-JAN-13	15000	525
E0005	BONY	MANAGER	E0002	D001	11-APR-11	50000	1050
E0006	MANU	SUPPLIER	E0001	D003	19-JUN-13	50000	473

3. Write SQL procedure for a banking application which accepts the account number and amount withdraw. If the balance after withdrawal is less than 1000, give an error message using user defined exception. Else update the table with new balance.

4. Write a PL/SQL procedure that takes three numbers as parameters and displays the LCM and GCD of the three numbers.
5. Create table Student(RegNo, name, marks).
 - a) Write a procedure to display average mark of the students from the Student table.
 - b) Write a procedure to display mark of a student with the given student register number.

Exercise 12: Functions

1. Create a function which returns the manager name of an employee, given the EmpId.
2. Sales of two different products in 1 week is recorded
Product (product_id, product_name, grade)
Sales (product_id, sales, sales_date, sales_day)
Do the following:
 - i. Write a function that retrieves the product name and grade of a product with the given product_id.
 - ii. Whenever the sum of the sales of a particular product becomes greater than a target value it is given an A grade. If there is no sale for a product, an exception is to be raised and no more sales for that product should be allowed. Sales are not allowed on Sundays.
3. Consider a database that contains the following tables:
Candidate (cand-id, cand-name, party)
Voters (voter-id, voter-name)
Voted (cand-id, party, voter-id)
 - a) Write a program to ensure that only valid voters are permitted to vote.
 - b) Write a function which calculates the total number of votes of a particular candidate.
 - c) Write a procedure which count the votes and declare the winner.

Exercise 13: Trigger

1. Create a trigger that can be used to keep track of all the transactions performed on the employee table. If any employee is deleted, a new row containing the details of this employee is stored in a table called xemployee. Similarly, if a new employee is inserted, a new row is created in another table called nemployee, and so on. If employee table is updated, then updated rows have to be inserted into another table called cemployee.
2. Create a trigger that limits the DML actions to the employee table to weekdays from 8.30am to 6.30pm. If a user tries to insert/update/delete a row in the EMPLOYEE table, a warning message will be prompted.
3. Create the following tables:

BookRec (BookName, Author, TotalCopies, AvailableCopies

MembershipRec(MemberID, Name)

BookDetails(BookID, BookName, MemberID)

CirculationRec(BookID, MemberID, IssueDate, ReturnDate)

- a) Write a PL/SQL program to add a new book into the library

Hint: Read Book Name, Author and total copies from the keyboard

- b) Autogenerate the BookID field in the BookDetails table
- c) The entry into the BookDetails table should be done using Trigger

4. Create the following tables:
BookRec (BookName, Author, TotalCopies, AvailableCopies
MembershipRec(MemberID, Name)
BookDetails(BookID, BookName, MemberID)
CirculationRec(BookID, MemberID, IssueDate, ReturnDate)

Write a function to issue a book to a member. If book is available the function should return the returnDate of the book otherwise display a message

Hint:1. Read Book name and MemberID from the keyboard

2. If sufficient copies of the book are available

- a. Make necessary updations to BookRec and BookDetails table
- b. Insert a new row into the CirculationRec table
- c. Return date should be 30 days after the issue date

Exercise 14: Develop an online train ticket reservation system

PROCEDURE

1. A home page in which user can register and the details are entered to the database
2. Registered user can login to the homepage by unique username and password
3. User can book tickets, cancel tickets and enquire PNR status
4. User can view train schedule, booked ticket history and details of cancelled tickets
5. User can also track train status
6. User can update account details, add/delete favorite journey list

8.4 Open Questions

1. Create the following tables:

Customer (CName ,CAddress)

CustAcct (CName ,AcctNo)

Account (AcctNo, Balance, Branch_name)

Branch (Branch_name, Branch_city)

- Create a trigger to ensure that a customer should not have more than 3 accounts.
- Write a procedure 'Branch_List' that produces for each branch a list of customers and total amount of money held in the accounts of that branch.
- Display the branch name and customer name of account with the highest balance in the city 'Cochin'.

2. Consider the following database:

Employee(emp-id, job, oldsal, newsal, lowsal, highsals)

Salary hike is given for all employees other than president [use trigger]

See that the following conditions are not violated[Use exceptions]

- lowsal \geq newsal \leq highsal
- newsal $>$ oldsal
- newsal is only 1.1% greater than the oldsal

3. Create the following tables:

GUEST (Name, Address , Room No, check_in_date,check_out_date)

BILL (Name, Billamount)

ROOM (RoomNo, Charge/day)

HISTORY(Name, Room No, check_out_date)

- Write a program to print the names of 5 highest billed customers.
- Write a procedure to generate the bill and store in the BILL table.
- Write a function to return the maximum bill amount.
- Create a trigger that inserts values to the table history when a person checks out.

4. Create the following tables:

SalesDetails (Salesman_id (primary key & should start with 'S'),

Salesman_name, Quantity, Rate, Date)

SalesCommission (Salesman_id, Commission)

a.) Create a trigger called 'give_commission'. Every time when the quantity column is updated then the trigger checks to see if the total amount of a Salesman is over Rs.1000/-. If so give a commission of Rs.200/-

b.) Write a function to retrieve the quantity sold by a Salesman. If it is below 50 raise an exception.

c.) Display the Salesman name getting the highest commission.

5. Consider the following relations

Salaried_Emp (emp_id, dept, salary)

Retirement (emp_id, service_period, ret_date)

Emp_Details(emp_id, name, dob, street, city, phone)

Do the following operations on these tables:

Calculate the tax for the salaried employees under the following condition.

Salary	Tax
0-5000	no tax
<=8000	5%
<=10,000	10%
Above	15%

Update the salary field after reducing the tax amount from the salary of each employee. Whenever a salaried employee retires(age=55) his details should be recorded in a pension table. His pension amount is half of his salary.

Pension (emp_id, pension_amount, street, city, phone)

6. Write a program to compute the commission. The salesman table records the salesman no., name, commission along with the minimum sales for which the commission is given. If the sales made are greater than the target, he is to be commissioned. The commission amount along with salesman number is to be recorded in commission payable table.

7. Create a transparent audit system for the table 'ClientMaster'. The system must keep track of records that are being deleted or modified. Table 'ClientMaster' contains fields: client_no, name, balance_due, address. 'AuditClient' contains client_no, name, balance_due, operation, operation_date.

8. Write a PL/SQL program to list the five highest paid employees.

Employee(emp_no, emp_name, salary)

9. Write a PL/SQL program to input a dept number and display the number of employees working in a department and also the average salary needed by that department.

Employee(emp_no, emp_name, salary, dept_no)

8.5 Advanced Questions

1. Implement Payroll System
2. Implement Airline Reservation System
3. Implement Train Ticket Booking System
4. Implement Hospital Management System
5. Implement Library Management System