EVALUATION SCHEME

B.TECH (COMPUTER SCIENCE & ENGINEERING/ COMPUTER SCIENCE) CURRICULUM STRUCTURE

SEMESTER- V													
Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KCS501	Database Management System	3	1	0	30	20	50		100		150	4
2	KCS502	Compiler Design	3	1	0	30	20	50		100		150	4
3	KCS503	Design and Analysis of Algorithm	3	1	0	30	20	50		100		150	4
4	Deptt. Elective-I	Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	Deptt. Elective-II	Departmental Elective-II	3	0	0	30	20	50		100		150	3
6	KCS551	Database Management System Lab	0	0	2				25		25	50	1
7	KCS552	Compiler Design Lab	0	0	2				25		25	50	1
8	KCS553	Design and Analysis of Algorithm Lab	0	0	2				25		25	50	1
9	KCS554	Mini Project or Internship Assessment*	0	0	2				50			50	1
10	NC+	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**8**							**950**	**22**
*The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.													

Departmental Elective-I

1. KCS-051 Data Analytics
2. KCS-052 Web Designing
3. KCS-053 Computer Graphics
4. KCS-054 Object Oriented System Design

Departmental Elective-II

1. KCS-055 Machine Learning Techniques
2. KCS-056 Application of Soft Computing
3. KCS-057 Augmented & Virtual Reality
4. KCS-058 Human Computer Interface

ACADEMIC HANDBOOK

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

VISION

Engineering the future of the nation by transforming the students to be skilled technocrats, innovative leaders and environmentally receptive citizens. The Vision of the department is to carve the youth as dynamic, competent, valued and knowledgeable professionals who shall lead the Nation to a better future.

MISSION

- To flourish the SRMS as the World Leader in Computer Science & Engineering through continuous research & development directed towards the betterment of the society.
- To establish the cooperative learning environment for facilitating the quality academics, state-of-the art research and remarkable development activities.
- To establish World Class resources especially Research & Development Laboratories, Value Addition courses etc. for the in-house up gradation & community services.
- To groom the students into Industry – Ready Professionals through a rigorous training in a self-disciplined environment.
- To groom the learned pool of faculty in accordance with the recent advancements in the field of Computer Science & Engineering.

PROGRAM EDUCATIONAL OBJECTIVES

- To encourage students to use their practical, computer and analytical skills to build industry ready engineers to solve multi-disciplinary sustainable projects.
- To keep abreast the students with the use of modern tools, equipments and software and inculcating the habit of lifelong learning.
- To foster team work and professional ethics among students towards devising feasible solutions to problems and project work.
- To augment the existing facilities: Library, Labs and efforts excel classroom teaching, thereby arousing curiosity, ultimately resulting in innovative ideas.
- To enhance technical skills of laboratory staff, provision to train the lab staff, encouraging staff to improve qualifications offering incentives.

PROGRAM SPECIFIC OUTCOMES

- Foundation of mathematical concepts: To use mathematical concepts to solve problem using suitable mathematical analysis, data structure and suitable algorithm.
- Foundation of Computer System: the ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.
- Foundations of Software development: the ability to grasp the software development lifecycle and methodologies of software systems. Possess competent skills and knowledge of software design process. Familiarity and practical proficiency with a broad area of programming concepts and provide new ideas and innovations towards research.

KCS-501: DATABASE MANAGEMENT SYSTEM

DETAILED SYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	08
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQl Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	08
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	08
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	08
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	08

Text books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
2. Date C J, "An Introduction to Database Systems", Addision Wesley
3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
4. O'Neil, Databases, Elsevier Pub.
5. RAMAKRISHNAN"Database Management Systems",McGraw Hill
6. Leon & Leon,"Database Management Systems", Vikas Publishing House
7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
8. Majumdar & Bhattacharya, "Database Management System", TMH

References:-

(A)Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
(B)Date C J, " An Introduction to Database Systems", Addision Wesley
(C)Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley

KCS-502: COMPILER DESIGN

DETAILED SYLLABUS		3-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	**08**
II	**Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	**08**
III	**Syntax-directed Translation:** Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	**08**
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	**08**
V	**Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	**08**

REFRENCES:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
2. V Raghvan, " Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education
5. .K. Muneeswaran,Compiler Design,First Edition,Oxford University Press.
6. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill,2003.
7. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001

KCS- 503 DESIGN AND ANALYSIS OF ALGORITHMS

UNIT I:
Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Sorting and order Statistics - Shell sort, Quick sort, Merge sort, Heap sort, Comparison of sorting algorithms, Sorting in linear time.

UNIT II:
Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps, tries, skip list.

UNIT III: Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching.**Greedy methods** with examples such as Optimal Reliability Allocation, Knapsack, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.

UNIT IV: Dynamic programming with examples such as Knapsack. All pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.

UNIT V: Selected Topics: Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.

TEXT BOOKS:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008.

REFERENCES:

1. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
2. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997
4. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.
5. Harsh Bhasin,"Algorithm Design and Analysis",First Edition,Oxford University Press.
6. Gilles Brassard and Paul Bratley,Algorithmics:Theory and Practice,Prentice Hall,1995.

COMPUTER GRAPHICS (KCS-053)		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand the graphics hardware used in field of computer graphics.	K_2
CO 2	Understand the concept of graphics primitives such as lines and circle based on different algorithms.	K_2, K_4
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	K_4
CO 4	Apply the concepts of and techniques used in 3D computer graphics, including viewing transformations.	K_2, K_3
CO 5	Perform the concept of projections, curve and hidden surfaces in real life.	K_2, K_3

DETAILED SYLLABUS		**3-0-0**
Unit		**Proposed Lecture**
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	**08**
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping	**08**
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3- D viewing, projections, 3-D Clipping.	**08**
IV	**Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	**08**
V	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	**08**

Text books:

1. Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes – "Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill
4. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – Tata MCGraw Hill.
5. Amrendra N Sinha and Arun D Udai," Computer Graphics", Tata MCGraw Hill.
6. R.K. Maurya, "Computer Graphics " Wiley Dreamtech Publication.
7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited.
8. Donald Hearn and M Pauline Baker, "Computer Graphics with OpenGL", Pearson education

KCS-055 MACHINE LEARNING TECHNIQUES

DETAILED SYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION –** Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	**08**
I I	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING -** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel,and Gaussiankernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	**08**
I I I	**DECISION TREE LEARNING** - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	**08**
I V	**ARTIFICIAL NEURAL NETWORKS –** Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING -** Introduction,concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	**08**
V	**REINFORCEMENT LEARNING–**Introduction to Reinforcement Learning , Learning Task,Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process , Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning,Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications	**08**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
5.Jianxin wu-Introduction to Convolutional Neural Networks:May 1, 2017

KNC-501: CONSTITUTION OF INDIA, LAW AND ENGINEERING
Non Credit Course 2020-21 AICTE Model Curriculum K series

Module 1: Introduction and Basic Information about Indian Constitution:
Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2: Union Executive and State Executive:
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, Lok Pal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3: Introduction and Basic Information about Legal System:
The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4: Intellectual Property Laws and Regulation to Information:
Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5: Business Organizations and E-Governance:
Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

Suggested Readings:

- M.Laxmikanth: Indian Polity,
- Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
- Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.
- S.G Subramanian: Indian Constitution and Indian Polity, 2nd Edition, Pearson Education 2020. • Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
- Madhav Khosla: The Indian Constitution, Oxford University Press.
- PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
- Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-88.
- P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi.
- Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.
- BL Wadehra: Patents, Trademarks, Designs and Geological Indications Universal Law Publishing - LexisNexis.

• Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)
•Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf.
•Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India,
https://www.meity.gov.in/writereaddata/files/eGovernance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412. pdf.
•Companies Act, 2013 Key highlights and analysis by PWC.
https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlightsand-analysis.pdf.

COURSE PLAN
DATABASE MANAGEMENT SYSTEM
KCS-501

I. Course Description : Databases are today an integral part of most information systems. In this course we will develop an understanding of how data is collected, organized, used and managed in information systems. The course covers both the traditional file management methods and database management systems. This course introduces students to concepts in database design and analysis. The course will focus on the relational model and will cover logical design of databases (schema design), physical implementation and file structures, and will provide an introduction to transaction processing systems. The emphasis will be on general concepts, and theoretical foundations, and thus will not focus on any particular commercial system.

II.Pre-Requisites: As a result of taking this course, the student will be able to:
Relate the importance of database systems in computer applications. Understand the complexities involved in designing, using, and implementing database systems and database applications. Apply the principles and techniques of database management to a database system project. Understand and use SQL to administer and query a database.

III. **Course Outcome :**

Course	Statement
C 303.1	Exhibit knowledge of database management system, it's levels , different types of model for DBMS,
C303.2	Design ER diagram related to application software.
C303.3	Design database schema for application software.
C303.4	Develop the database programming skills in SQL
C303.5	Understand the various aspects of relational algebra, tupel relational calculus, the knowledge of transaction, transaction states, concurrency control and different types of schedule**.**

IV. Mapping of CO-PO and CO-PSO:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C 303.1			3		2							
C303.2			**3**									
C303.3			**3**									
C303.4			**3**									
C303.5		**2**	**3**									
Average		**2**	**3**		**2**							

VII. **Lecture Plan:**

UNIT	LECTURES WITH TOPIC DETAILS	H	REFERENCES	Page No
Unit-1 Introduction to Database Management System	An overview of database management system	1	A1,B1.1	1,3
	Database system Vs file system, Database system concept and architecture	1	A….	14
	Data model schema and instances	1	A2.2, 2.4	42,46
	Data independence and database language and interfaces	1	B1.5,	21
	Data definitions language-DDL, DML & DCL	1	A1.4, 1.4.2, 14.1	9
	Overall Database Structure	1	A1.9	23
	Data Modeling using the Entity Relationship Model: ER model concepts	1	A7.2,B14.3	262,B(343)
	Notation for ER diagram, mapping constraints	1	B2.6	37

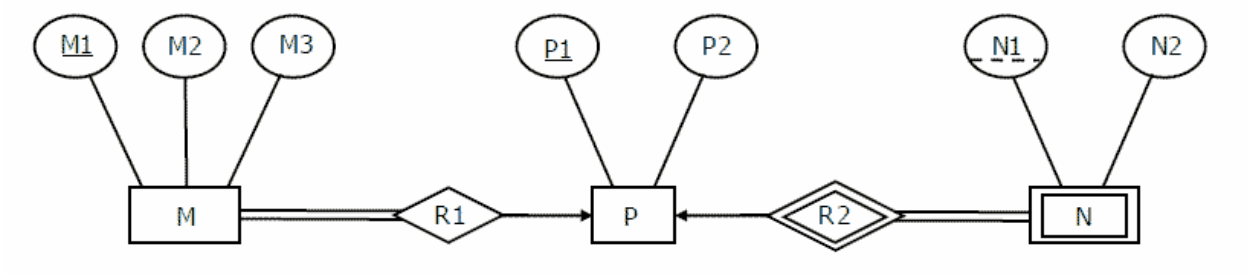
	Keys, Concepts of Super Key, candidate key, primary key	1	A2.3	45
	Generalization, Aggregation, reduction of an ER diagrams to tables, extended ER model, relationship of higher degree	1	A7.8, B1.2.1	295, B(16)
Unit-2 Relational data Model and Language, Introduction on SQL	**Relational data Model and Language:** Relational data model concepts	1	A2.1	39
	Integrity constraints, entity integrity, referential integrity	1	A4.4, 7.3	128, 269
	Keys constraints, Domain constraints	1		
	Relational algebra	1	A6.1	217
	Relational calculus, tuple and domain calculus.	1	A6.2,6.3	239, 245
	Introduction on SQL: Characteristics of SQL, advantage of SQL. SQl data type and literals. Types of SQL commands.	1	A3.1, 3.5	79
	SQL operators and their procedure. Tables, views and indexes. Queries and sub queries	1		
	Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus,	1	A3.7	84
	Cursors, Triggers, Procedures in SQL/PL SQL	1	A5.2, 5.3	173, 180
Unit-3 Data Base Design & Normalization	Functional dependencies	1	A8.4	338
	Normal forms, first, second, third normal forms,	1	A8.2,	327
	Third Normal form		A8.7	360
	BCNF, inclusion dependence	1	A8.5.1	349
	Loss less join decompositions, normalization using FD,	1	A8.4.4	345
	MVD, and JDs	1	A8.6	355
	Alternative approaches to database design.	1		
Unit-4 Transaction Processing Concept	Transaction system	1	A14.1	627
	Testing of serializability, Serializability of schedules	1	A14.6	641
	Conflict & view serializable schedule	1	A15.5	687
	Recoverability, Recovery from transaction failures	1	A16.1	721
	Log based recovery, checkpoints,	1	A16.7.3	746
	Deadlock handling		A15.2	
	Distributed Database: distributed data storage	1	A19.8	857
	Concurrency control, directory system	1	A14.2	629
Unit-5 Concurrency Control Techniques	Concurrency control	1	A26.3	840
	Locking Techniques for concurrency control,	1	A15.1	661
	Time stamping protocols for concurrency control	1		
	Validation based protocol, multiple granularity	1	A15.9.2	679, 703
	Multi version schemes, Recovery with concurrent transaction,	1	A27.4.1.4	1143
	case study of Oracle.	1		

TUTORIAL SHEETS
DATABASE MANAGEMENT SYSTEM
KCS 501

NOTE: Every Student must submit each Tutorial Sheet within Three days of completion of the Unit related to the sheet for its Evaluation. Each Tutorial sheet is of 10 marks.

TUTORIAL SHEET -1

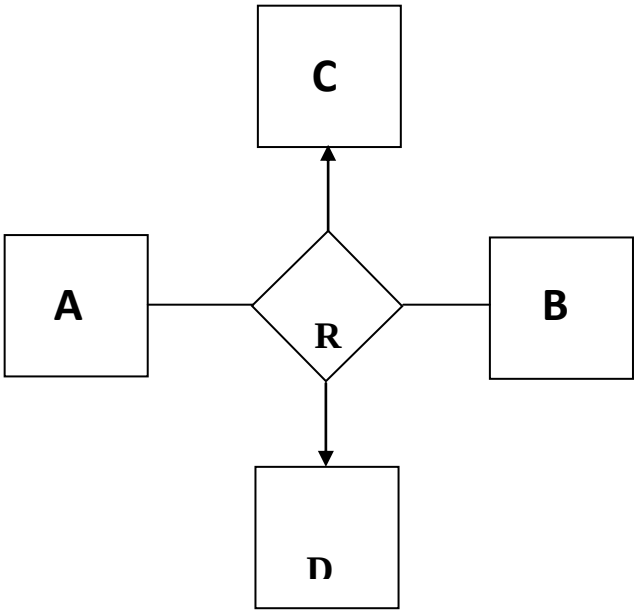
Q1. What is DBMS (Database Management System) ? **AKTU 2004-2005**
Q2.What is the need of DBMS ?
Q3.What are Advantages and Disadvantages of DBMS
Q4. What do you mean by Meta data? **AKTU 2013-2014**
Q5. Consider the following ER diagram.



What is the minimum number of tables needed to represent M, N, P, R1, R2 ?**GATE 2008**

TUTORIAL SHEET 2

Q1. What is Data Dictionary?
Q2. Explain the various keys in DBMS.
Q3. What do you mean by Entity and Entity set? **AKTU2005-2006**
Q4. What is the Difference between Single valued and multi valued attributes? **AKTU2005-2006**
Q5. Consider the following E/R diagram: **GATE 2010**



Below are three possible relationship sets for this E/R diagram:

	A	*B*	*C*	*D*
I.	a_1	b_1	c_1	d_1
	a_1	b_1	c_1	d_2

	A	*B*	*C*	*D*
II.	a_1	b_1	c_1	d_1
	a_1	b_1	c_2	d_2

	A	*B*	*C*	*D*
III.	a_1	b_1	c_1	d_1
	a_1	b_2	c_1	d_1

You may assume that different symbols stand for different values, e.g., d_1 is definitely not equal to d_2. Which of the above could ***not*** be the relationship set for the E/R diagram?

(a) **I** only
(b) **I** and **II** only
(c) **II** only
(d) **I**, **II** and **III**.

TUTORIAL SHEET 3

Q1. What is the difference among "dropping a table", "truncating a table" and "deleting all records" from a table?
Q2. What's the difference between a primary key and a unique key?
Q3.What is a join and explains different types of joins. **AKTU2010-2011**
Q4. What do you mean by Integrity Constraints? Explain Referential Integrity. **AKTU 2006-2007**
Q5Consider a schema R(A, B, C, D) and functional dependencies A -> B and C -> D. Then the decomposition of R into R1 (A, C) and R2(C, B) is
(a) dependency preserving and lossless join
(b) lossless join but not dependency preserving
(c) dependency preserving but not lossless join
(d) not dependency preserving and not lossless join **GATE 2001**

TUTORIAL SHEET 4

Q1.What are the main tasks performed by DBA?Explain Role and Responsibilities of DBA.
Q2. Explain mapping constraints with example.
Q3. What is the difference between DELETE and TRUNCATE commands? **AKTU2007-2008**
Q4. Which operator is used in query for pattern matching? **AKTU2008-2009**
Q5. Here are two possible ways to declare the relation Emps. **GATE 2009**

I.
```
CREATE TABLE Emps (
empID INT,
ssNo INT,
  name CHAR(50),
mgrID INT,
  UNIQUE (empID),
  PRIMARY KEY (ssNo),
  FOREIGN KEY mgrID REFERENECES Emps (empID)
);
```

II.
```
CREATE TABLE Emps (
empID INT PRIMARY KEY,
ssNo INT UNIQUE,
  name CHAR(50),
mgrID INT REFERENECES Emps (empID)
);
```

Which, if any, of the two declarations above will correctly (in SQL2) declare the relation Emps?
(a) Both **I** and **II**
(b) **I** only
(c) **II** only
(d) Neither **I** nor **II**

TUTORIAL SHEET 5

Q1. What are aggregate and scalar functions?
Q2. What is an Index? Explain all the different types of indexes.
Q3. What is a View? Explain with example. **AKTU 2007-2008**
Q4. What are cursors? Explain different types of cursors. What are the disadvantages of cursors? How can you avoid cursors? **AKTU 2007-2008**
Q5. The relation book (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL query list? **GATE 2005**

```
Select title
From book as B
Where (Select count(*)
  from book as T
  Where T.price<B.price) < 5
```

Find the correct option-

(a) Titles of the four most expensive books
(b) Title of the fifth most inexpensive book
(c) Title of the fifth most expensive book
(d) Titles of the five most expensive books

TUTORIAL SHEET 6

Q1. What is Normalization?
Q2.A table has fields F1, F2, F3, F4, and F5, with the following functional dependencies:
F1->F2
F3->F4
(F1,F2)->F5
in terms of normalization, explain this table is in which normal form. **AKTU 2010-11**
Q3. Consider a schema R(A, B, C, D) and functional dependencies A -> B and C -> D. Explain the decomposition of R into R1 (A, B) and R2(C, D). **AKTU 2009-10**
Q4. Consider the following functional dependencies in a database. **GATE 2003**

Date_of_Birth->Age Age->Eligibility
Name->Roll_number Roll_number->Name
Course_number->Course_name Course_number->Instructor
(Roll_number, Course_number)->Grade

Explain the form of relation (Roll_number, Name, Date_of_birth, Age).
Q5. A table has fields F1, F2, F3, F4, and F5, with the following functional dependencies:
F1->F3
F2->F4
(F1,F2)->F5
in terms of normalization, this table is in what normal form? **GATE 2005**

TUTORIAL SHEET 7

Q1. What is a transaction processing system? What are the different transaction systems are there?
Q2. Consider the following relational schemes for a library database: **GATE 2008**

Book (Title, Author, Catalog_no, Publisher, Year, Price)
Collection (Title, Author, Catalog_no)
With the following functional dependencies:
I. Title Author ->Catalog_no
II. Catalog_no -> Title Author Publisher Year
III. Publisher Title Year -> Price

Assume {Author, Title} is the key for both schemes. Which of the following statements is true?
Q3. What is the primary aim of implementing locks on a table? **AKTU2006-07**
Q4. What is granularity of locking?
Q5. Consider the following schedules. The actions are listed in the order they are scheduled, and prefixed with the transaction name.

S1: T1:W(X), T2:R(X), T1:R(Y), T2:W(Y), T1:W(Y), T2:R(Y)
S2: T3:R(X), T1:W(X), T1:R(Y), T2:W(Z), T2:R(Z), T3:R(Z)

For each of the schedules, answer the following questions: **AKTU 2007-08**

Q5.1 What is the precedence graph for the schedule?
Q5.2 Is the schedule conflict-serializable? If so, what are all the conflict equivalent serial schedules?
Q5.3 Is the schedule view-serializable? If so, what are all the view equivalent serial schedules?

TUTORIAL SHEET 8

Q1. What is Online Transaction Processing (OLTP)?
Q2. What are local and global variables and their differences?
Q3. What is user defined functions? What are all types of user defined functions? **AKTU2008-09**
Q4. Consider the following schema of a *company database*: **AKTU 2009-10**

Employees(eid: integer, ename: string, address: string, supereid: integer)
Departments(did: integer, dname: string)
Projects(pid: integer, pname: string, did: integer)
Works_on(eid: integer, pid: integer, hours: integer)

Each Employee has a supervisor (another Employee) referenced by his/her supereid. Projects are uniquely assigned to a Department. The Works_on relation records which Employee works on which Project for how many hours a week.

Formulate each of the following queries in relational algebra (RA).

1. For each Employee, find his / her name and the name of his / her supervisor.
2. Find the eids of Employees who work on a project of every Department, i.e. find the eids of Employees who work for (a project of) every Department.
3. Find the pid of Projects of Department with dname = "Toys" for which at least two different Employees work.

Q5.Consider the following four schedules due to three transactions (indicated by the subscript) using read and write on a data item x, denoted by r(x) and w(x) respectively. **GATE CS 2014**

S1: T1:W(X), T2:R(X), T1:R(Y), T2:W(Y), T1:W(Y), T2:R(Y)
S2: T3:R(X), T1:W(X), T1:R(Y), T2:W(Z), T2:R(Z), T3:R(Z)
S3: T1:R(X), T2:W(Y), T2:R(X), T1:W(Y), T1:Commit, T2:Commit1
S4: T1:R(X), T2:R(Y), T1:W(Z), T1:Commit, T3:R(Y), T3:R(Z), T2:W(Y), T3:W(X),

Which of them is conflict serializable?

TUTORIAL SHEET 9

Q1. What is time stamping? Why is time stamping not used in RDBMS always? **AKTU 2003-04**
Q2. What is a transaction log?
Q3. What is recovery? What is an instance failure in RDBMS? **AKTU 2002-03**
Q4. Consider the following schedules:
S1: T1:R(X), T2:W(Y), T2:R(X), T1:W(Y), T1:Commit, T2:Commit1
S2: T1:R(X), T2:R(Y), T1:W(Z), T1:Commit, T3:R(Y), T3:R(Z), T2:W(Y), T3:W(X),
T2:Commit, T3:Commit

For each schedule, state which of the following concurrency control protocols allows it, that is, allows the actions to occur in exactly the order shown.

- 2PL
- Strict 2PL

Please provide a brief explanation for your answer...If YES, show where the lock requests could have happened; If NO, explain briefly.

Q5. Consider the transactions T1, T2, and T3 and the schedules S1 and S2 given below. **GATE 2014**

T1: r1(X); r1(Z); w1(X); w1(Z)
T2: r2(Y); r2(Z); w2(Z)
T3: r3(Y); r3(X); w3(Y)

S1: r1(X); r3(Y); r3(X); r2(Y); r2(Z); w3(Y); w2(Z); r1(Z); w1(X); w1(Z)
S2: r1(X); r3(Y); r2(Y); r3(X); r1(Z); r2(Z); w3(Y); w1(X); w2(Z); w1(Z)
Is this conflict serializable or not?

TUTORIAL SHEET 10

Q1. Consider the following sequence of actions, listed in the order it is submitted to the DBMS (S is a shared lock, X is an exclusive lock): **AKTU 2005-06**

S1: T1:S(A), T2:X(A), T3:X(B), T1:X(B), T3:S(A)

S1: T1:X(A), T2:S(C), T1:S(B), T2:S(B), T3:X(B), T2:X(A)

For both the sequences S1 and S2 given above:

Q1.1 Mention for each request whether the request is granted or blocked by the lock manager.

Q1.2 Show the waits-for graph and indicate whether there will be a deadlock or not at the end of each sequence.

Q1.3 If there is no deadlock, is there a lock or upgrade request by some transaction which can result in a deadlock? If yes, give such a request. If not, explain briefly.

Q2.What is a stored procedure? **AKTU 2009-10**

Q3. What is a constraint? Explain types of constraints.

Q4. What are triggers? How to invoke a trigger on demand?

Q5. Consider a B+-tree in which the maximum number of keys in a node is 4. What is the minimum number of keys in any non-root node? **GATE 2010**

MODEL PAPER
(SEM V) THEORY EXAMINATION 2018-19
DATABASE MANAGEMENT SYSTEM

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. 2 x 7=14

(a) What is DBMS?
(b) What is data model? List some type of data model.
(c) What is trigger?
(d) What is normalization?
(e) What are ACID properties?
(f) What is concurrency?
(g) What is different state of transaction?
(h) What is concurrency control?
(i) **What is Lock?**
(j) **What is Transaction?**

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

(a) Explain Data Independency?
(b) Explain Integrity Constraint?
(c) Explain Serializability ?
(d) What is Deadlock?
(e) How to prevent Deadlock?

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain three level schema of Data Base Management System.
(b) What are different characteristics of DBMS?

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) What do you understand by ER Diagram? Make an ER Diagram for Library Management system.
(b) What is schedule? Explain View Serializability.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write the difference between DBMS and Traditional File System.
(b) Explain Embedded SQL and Dynamic SQL in detail

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) What do you understand by Relational Algebra? Explain different Relational Algebra Operations supported in SQL. Write SQL statement for each operation.
(b) What do you mean by Normalization ? Explain 1 NF, 2 NF, 3NF, BCNF with example.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain the Lock Based concurrency control Protocol.
(b) Time stamp based concurrency control protocol

PAPER ID-310307

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2020-21
DATABASE MANAGEMENT SYSTEM

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	What is Data Independency in DBMS?	2	CO1
b.	Write the difference between DDL and DML.	2	CO1
c.	What are different Integrity Constraints?	2	CO2
d.	Explain different Features of SQL.	2	CO2
e.	What are advantages of normalization?	2	CO3
f.	Write different Inference Rule for Functional Dependency?	2	CO3
g.	What are ACID properties of Transaction?	2	CO4
h.	What are various reasons for transaction failure?	2	CO4
i.	What are Concurrent Transactions?	2	CO5
j.	What is Lock in Transaction Management?	2	CO5

SECTION B

2. Attempt any *three* of the following: **3 x 10 = 30**

Qno.	Question	Marks	CO
a.	What is ER Diagram? Explain different Components of an ER Diagram with thier Notation. Also make an ER Diagram for Employee Project Management System.	10	CO1
b.	What is Relational Algebra? Explain Different Operations of Relational Algebra with Example.	10	CO2
c.	(i) What is highest normal form of the Relation R(W,X,Y,Z) with the set F= { WY → XZ, X →Y } (ii) Consider a relation R(A,B,C,D,E) with set F= { A→CD, C→B,B→AE} What are the prime attributes of this Relation and Decompose the given relation in 3NF.	10	CO3
d.	Explain the method of testing the serializability. Consider the schedule S1 and S2 given below S1: R1(A),R2(B),W1(A),W2(B) S2: R2(B),R1(A),W2(B), W1(A) Check whether the given schedules are conflict equivalent or not?	10	CO4
e.	Explain the Validation Based protocol for concurrency control.	10	CO5

SECTION C

3. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is Data Abstraction? How the Data Abstraction is achieved in DBMS?	10	CO1
b.	Explain the following with example (i) Generalization (ii) Specialization (iii) Aggregation	10	CO1

4. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is Aggregate Function in SQL? Write SQL query for different Aggregate Function.	10	CO2
b.	Explain Procedure in SQL/PL SQL.	10	CO2

5. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is Functional Dependency? Explain the procedure of calculating the Canonical Cover of a given Functional Dependency Set with suitable example.	10	CO3
b.	(i) Consider the relation R(a,b,c,d) with Set F={a→c,b→d}. Decompose this relation in 2 NF. (ii) Explain the Loss Less Decomposition with example.	10	CO3

6. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is Conflict Serializable Schedule? Check the given Schedule S1 is Conflict Serializable or not? S1: R1(X), R2(X),R2(Y),W2(Y),R1(Y),W1(X)	10	CO4
b.	Explain Deadlock Handling with Suitable Example	10	CO4

7. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain Time Stamp Based Concurrency Control technique.	10	CO5
b.	Explain Recovery from Concurrent Transaction.	10	CO5

Paper Id: 110501 Roll No: | | | | | | | | | | | | | |

B.TECH.
(SEM-V) THEORY EXAMINATION 2019-20
DATA BASE MANAGEMENT SYSTEM

Time: 3 Hours *Total Marks: 70*

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. What is Relational Algebra?
b. Explain normalization. What is normal form?
c. What do you mean byAggregation?
d. Define Super key, Candidate key, Primary key & foreign key
e. What is Strong & Weak Entity set?
f. What do you mean byConflict Serializable Schedule?
g. Define Concurrency Control.

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. Explain data independence with its types.
b. Describe mapping constraints with its types.
c. Define Key. Explain various types of keys.
d. Explain the phantom phenomena. Discuss a Time Stamp Protocol that avoids the phantom phenomena.
e. What are Distributed Database? List advantage and disadvantage of data Replication And data Fragmentation.

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Define Join. Explain different types of join.
(b) Discuss the following terms (i) DDL Command (ii) DML command

4. Attempt any *one*part of the following: **7 x 1 = 7**

(a) What is tuple relational calculus and domain relational calculas?
(b) Describe the following terms : (i) Multivalued dependency (ii) Trigger

5. Attempt any *one* part of the following: **7 x 1 = 7**

(a) What do you understand by ACID properties of transaction ? Explain in details.
(b) Discuss about deadlock prevention schemes.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Explain Concurrency Control. Why it is needed in database system?

(b) Give the following queries in the relational algebra using the relational schema:

student(id, name)
enrolled(id, code)
subject(code, lecturer)

i). What are the names of students enrolled in cs3020?
ii). Which subjects is Hector taking?
iii). Who teaches cs1500?
iv). Who teaches cs1500 or cs3020?
v). Who teaches at least two different subjects?
vi). What are the names of students in cs1500 or cs307?
vii). What are the names of students in both cs1500 and cs1200?

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Explain Directory System in detail.

(b) Consider the following relational DATABASE. Give an expression in SQL for each following queries Underline records are Primary Key

Employee(**person_name** , street , city)
Works(**person_name**, Company_name ,salary)
Company(**Company_name** , city)
Manages(**person_name**, manager_name)

i). Finds the names of all employees who works for the ABC bank
ii). Finds the name of all employees who live in the same city and on the same street as do their managers
iii). Find the name street address and cities of residence of all employees who work for ABC bank and earn more than 7,000 per annum
iv). Find the name of all employee who earn more than every employee of XYZ
v). Give all Employees of corporation ABC a 7% salary raise .
vi). Delete all tuples in the works relation for employees of ABC
vii). Find the name of all employees in this DATABASE who live in the same city as the company for which they work

COURSE PLAN
COMPILER DESIGN
KCS- 502

COURSE DESCRIPTION: Intermediate aspects of a compilation process with an emphasis on front-end issues. Practical issues in using compiler writing tools. Code generation for expressions, control statements and procedures including parameter passing). Symbol tables, runtime organization for simple and structured variables. Using compilers and translators for automation (filters, programs writing programs).

Unit/ Objective	Topics	Time (Hr.)	Text Book Referred	Page No.
I This Unit deals with the Basic Concepts of the compiler such that overview of the Passes, Phases, Lexical Analyzers, FG Etc.	An overview to the course and its applications	1	Lecture Notes	Internet
	Introduction To compiler- Phases and passes	1	Aho,Ullman	1-9
	Compiler Construction Tools, Bootsrapping	1	Aho,Ullman	9-14
	FSM,RE, Lexical Structure	1	Allen I. Holub	50-56
	Implementation of Lexical Analyzer	1	Aho,Ullman	109-114
	Lexical Analyzer generator	1	Aho,Ullman	140-145
	Lex compiler ,Scanner Generation	1	Aho,Ullman	166-175
	Syntax analysis, FG and Applications	1	Aho,Ullman	191-196
	BNF Notation, Ambiguity and Yacc	1	Aho,Ullman	287-295
	Context Free Grammars*, Derivation Trees	1	Aho,Ullman	197-201
II Basic idea about the different types of Parsers and their working Mechanism	About parsers: Parse Tree, About Parsers,	1	Aho,Ullman	201-204,981-986
	Shift Reduced Parsing	1	Aho,Ullman	240-245
	Operator Precedence Parsing, Top Down Parsing, Predictive Parsing	1	Aho,Ullman + Internet	217-231
	LR Parsers	1	Aho, Ullman	241-251
	Canonical Collection of items, Constructing SLR Parsing Table	1	Aho, Ullman	241-256
	Constructing CLR Parsing Table	1	Aho, Ullman	259-266
	LALR parsing Table, LALR set of Items,	1	Aho, Ullman	266-275
	Ambiguous Grammar, IMPL of LR PT*	1	Aho, Ullman	278-285
	Comparison of SA / SD & JSD Advantages & Disadvantage of LL(1) Parsing	1	Aho, Ullman + Internet	297-300
III This unit gives much more internal details about translation like how the thing are going to be stored in the compiler and what are the suitable formats for storage	Elements & Implementation of SD Transl.: Attributed grammars	1	Aho, Ullman	303-318
	Intermediate code Generation , Post Fix Notation, Parse tree, syntax trees	1	Aho, Ullman	357-360
	Three Address Code, Quadruple, Triples Translation of Assignment Op	1	Aho, Ullman	363-370
	Boolean Expressions	1	Aho, Ullman	399-404

Unit/ Objective	Topics	Time (Hr.)	Text Book Referred	Page No.
	Stmt That alter The Flow of Controls	1	Aho, Ullman	404-408
	Postfix translation* Translation with Top Down Parser	1	Aho, Ullman	328-331
IV This Unit deals with the Data structures related with the compiler and scope of the information stored and the possible errors that may arise.	Array References in The Arithmetic expression, Procedure calls, declaration, CASE Statements	1	Aho, Ullman	380-386 298-308
	Introduction to symbol table	1	Aho, Ullman	328-336
	Representing Scope of Information*	1	Aho, Ullman	518-521
	Implementation of Simple Stack, Allocation Scheme,Syntactic phase error	1	Aho, Ullman	430-440, 520-525
	Lexical phase error,	1	Aho, Ullman	194-196
	Syntactic phase error	1	Aho, Ullman	
	Semantic Errors	1	Aho, Ullman	194-197
V This unit gives the Optimization techniques that are related with the compiler process and global data flow and its Analysis etc	Introduction to Code Generation	1	Aho, Ullman	505-512
	Loop Optimization	1	Aho, Ullman	531-536
	The DAG Representation of the Basic Blocks	1	Aho, Ullman	533-535
	Value Number	1	Aho, Ullman	360-362,390
	Algebraic Laws	1	Aho, Ullman	536-537
	Global Data Flow analysis	1	Aho, Ullman	525-541
	Code Generation from DAG	1	Lecture Notes+Internet	
	Major issues of code Generation*	1	Lecture Notes+Internet	

REFERENCES:

1. Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education.
2. V Raghvan, " Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education.

COMPILER DESIGN
(KCS-502)

TUTORIAL SHEET-1

Q1. What language is generated by the following grammars? In each case justify your answer.

a) S ->0S1| 01

b) S -> +SS| -SS | a

c) S ->S(S)S | €

Q.2.What do you mean by ambiguous grammar ? Show that the following grammar is ambiguous.

S->aSbS|bSaS|ε **UPTU 2013-14**

Q3. Explain the term token, lexeme and Pattern. **UPTU 2013-14**

*Q4.*The number of states in the minimal deterministic finite automaton corresponding to the regular expression (0+1)*(10) is ……. **GATE 2015**

Q5.Consider the alphabet Σ = {0, 1}, the null/empty string λ and the sets of strings X_0, X_1, and X_2 generated by the corresponding non-terminals of a regular grammar. X_0, X_1, and X_2 are related as follows. $X_0 = 1\ X_1$, $X1 = 0\ X_1 + 1\ X_2$, $X2 = 0\ X_1 + \{\lambda\}$ .Which one of the following choices precisely represents the strings in X_0? **GATE 2015**

(A) 10(0* + (10)*)1 (B) 10(0* + (10)*)*1

(C) 11(0 + 10)* (D) 10(0 + 10)*1 + 110(0 + 10)*1

TUTORIAL SHEET-2

Q1: Differentiate between the following:

(i). Compilers and Interpreters.

(ii). Macro-processor and Pre-Processor **.** **UPTU 2003-2004**

Q2: (a) Write a Regular expression over alphabet ∑=(0,1) that represents all strings not containing 101.

(b) All strings of even number of zeros & odd number of one's.

UPTU 2002-2003

Q3: Construct the DFA for the language

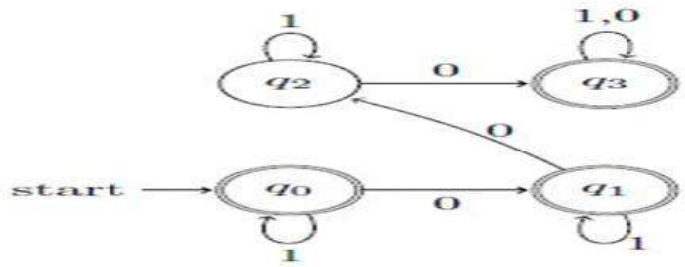
$L=\{n_a(w) \bmod 3 \leq n_b(w) \bmod 3\}$ over ∑=(a,b).

Q4.Let L be the language represented by the regular expression $\Sigma^*0011\Sigma^*$where Σ={0,1}. What is the minimum number of states in a DFA that recognizes complement of L ?

GATE 2015

(A) 4 (B) 5 (C) 6 (D) 8

Q5. Consider the finite automaton given in following figure:



Find out the language accepted by above finite automata

TUTORIAL SHEET-3

Q1. Discuss the challenges in compiler design.

Q2: Remove left recursion from the grammar E→E(T)|T, T→T(F)|F, F→id. **UPTU 2013-14**

Q3: What do you understand by left factoring ? Perform left factoring to dangling –else grammar.

S→iCtS/iCtSeS/a , C→b. **UPTU 2012-13**

Q4.

If $L_1 = \{a^n \mid n \geq 0\}$ and $L_2 = \{b^n \mid n \geq 0\}$, consider

(I) $L_1 \cdot L_2$ is a regular language
(II) $L_1 \cdot L_2 = \{a^n b^n \mid n \geq 0\}$

Which one of the following is CORRECT?

(A) Only (I)
(B) Only (II)
(C) Both (I) and (II)
(D) Neither (I) nor (II)

GATE 2014

Q.5

Consider the grammar defined by the following production rules, with two operators $*$ and $+$

$$S \longrightarrow T * P$$
$$T \longrightarrow U \mid T * U$$
$$P \longrightarrow Q + P \mid Q$$
$$Q \longrightarrow Id$$
$$U \longrightarrow Id$$

Which one of the following is TRUE?

(A) $+$ is left associative, while $*$ is right associative
(B) $+$ is right associative, while $*$ is left associative
(C) Both $+$ and $*$ are right associative
(D) Both $+$ and $*$ are left associative

GATE 2014

TUTORIAL SHEET-4

Q1:For the grammar A→(A)A|ε. Compute FIRST and FOLLOW set of A. **UPTU 2006-07**

Q2: Consider the following grammar and test whether the grammar is LL(1) or not.
S→aBDh , B→cC, C→bC|ε, D→EF, E→g|f, F→f|ε.

Q3.

Give the algorithm for computing precedence function. Consider the following operator precedence matrix and compute the precedence function :—

	a	(	)	;	$
a			·>	·>	·>
(	<·	<·	≐	<·	
)			·>	·>	·>
;	<·	<·	·>	·>	
$	<·	<·			

UPTU 2003-04

Q.4. . Consider the following two sets of LR(1) items of an LR(1) grammar.

X → c.X, c/d	X → c.X, $
X → .cX, c/d	X → .cX, $
X → .d, c/d	X → .d, $

Which of the following statements related to merging of the two sets in the corresponding LALR parser is/are **FALSE**?

1. Cannot be merged since look aheads are different.
2. Can be merged but will result in S-R conflict.
3. Can be merged but will result in R-R conflict.
4. Cannot be merged since *goto* on *c* will lead to two different sets.

(A) 1 only (B) 2 only (C) 1 and 4 only (D) 1, 2, 3 and 4

GATE 2013

Q5: Match the following:

P. Lexical analysis	1. Graph coloring
Q. Parsing	2. DFA minimization
R. Register allocation	3. Post-order traversal
S. Expression evaluation	4. Production tree

A) P-2, Q-3, R-1, S-4 (B) P-2, Q-1, R-4, S-3
(C) P-2, Q-4, R-1, S-3 (D) P-2, Q-3, R-4, S-1 **GATE 2015**

TUTORIAL SHEET-5

Q1. Find out postfix notation for the following expressions:
(i) (a+b)*(c+d)+(a+b+c) (ii) (a+b+c)*(c+d).

Q2.Define backpatching and semantic rules for Boolean expression. Derive the three address code for the following expression.
P<Q or R<S and T<S. **UPTU 2015-16**

Q3.Consider the following grammar and give the syntax directed definition to construct parse tree. For the input expression 4*7+1*2 construct an annotated parse tree according to your syntax directed definition.:
E→E*T/T , T→T*F/F , F→digit. **UPTU 2010-11**

Q4. Consider the translation scheme shown below:
S→TR , R→+T{print('+');}R|ε ,T→num{print(num.val);}
Here num is a token that represents an integer and num.val represents the corresponding integer value. For an input string '9+5+2', this translation scheme will print
(a) 9+5+2 (b) 95+2+ (c) 952++ (d) ++952 **GATE 2003**

Q5. Consider the following Syntax Directed Translation Schemes (SDTS),with non-terminals {S,A} and terminals{a,b}.
S→aA {print 1} , S→a{print 2} , A→Sb{print 3}
Using the above SDTS, the output printed by a bottom-up parser, for the input aab is:
(a) 1 3 2 (b) 2 2 3 (c) 2 3 1 (d) syntax error **GATE 2016**

TUTORIAL SHEET-6

Q1. Consider the following grammar and give the syntax directed definition to convert the infix expression into postfix expression . And also make the annotated parse tree for the following input expression:
2+3*4.
The grammar is:
E→ E+T|T , T→T*F|F , F→num.

Q2.Give the syntax directed translation scheme to translate the while control construct. Also translate the following program segment into three address code:

```
while(a>b)
  if(c>d)
    c=c-d*e;
  else
    c=c+d*e;
```

UPTU 2010-11

Q3. What are different ways to write three address code? Write three address code for the following code segment:

While A<C and B<D do
if A=1 then C=C+1
else while A<=D do A=A+2. **UPTU 2013-14**

Q4.Consider the grammar with the following translation rules and E as the starting symbol.

$E \rightarrow E_1\#T$ {E.val=E_1.value*T.value}, $E \rightarrow T$ {E.value=T.value},
$T \rightarrow T_1\&F$ {T.value=T_1.value+F.value}, $T \rightarrow F$ {T.value=F.value}
$F \rightarrow$ num {F.value=num.value}

Compute E.value for the root of the parse tree for the expression :2#3&5#6&4.

(a) 200 (b) 180 (c) 160 (d) 40 **GATE 2004**

Q5. Consider the following translation scheme:

S→ER , R→*E { print('*');}R|ε , E→E+E{print('+');}|F
F→(S)|id {print (id.value);}

Here id is a token that represents an integer and id.value represents the corresponding integer value. For an input '2*3+4', this translation scheme prints:

(a) 2*3+4 (b) 2*+34 (c) 23*4+ (d) 234+* **GATE 2006**

TUTORIAL SHEET-7

Q1: Describe symbol table and its entries. Also discuss various Data Structure used for symbol table. **UPTU 2010-11**

Q2: What is DAG ? How DAG is created from three address code ? Write algorithm for it and explain it with a relevant example. **UPTU 2013-14**

Q3: Translate the expression -(a+b) * (c+d) +(a+b+c) into

Q4: Consider the following languages over the alphabet $\Sigma = \{0,1, c\}$:

$L_1 = \{0^n 1^n \mid n \geq 0\}$
$L_2 = \{wcw^r \mid w \in \{0,1\}^*\}$
$L_3 = \{ww^r \mid w \in \{0,1\}^*\}$

Here, w^r is the reverse of the string w. Which of these languages are deterministic Context-free languages?

(A) None of the languages
(B) Only L_1
(C) Only L_1 and L_2
(D) All the three languages

GATE 2014

Q.5.Which of the following languages is/are regular?

L_1: $\{wxw^R \mid w, x \in \{a, b\}^*$ and $|w|, |x| > 0\}$, w^R is the reverse of string w
L_2: $\{a^n b^m \mid m \neq n$ and $m, n \geq 0\}$
L_3: $\{a^p b^q c^r \mid p, q, r \geq 0\}$

(A) L_1 and L_3 only (B) L_2 only (C) L_2 and L_3 only (D) L_3 only

GATE 2015

TUTORIAL SHEET-8

Q1: Generate three address code for the following code . ***UPTU 2015-16***

```
switch a+b
{
case 1: x =x+1
case 2: y = y+2
case 3: z=z+3
default :c=c-I
}
```

Q2: What are lexical phase errors, syntactic phase errors, and semantic phase errors? Explain with suitable example. **UPTU 2015-16**

Q3: Consider the following grammar

E->E+T|T
T->TF|F
F->F*|a|b

Construct the SLR parsing table for this grammar.

Q.4.

Let L be the language represented by the regular expression $\Sigma^*0011\Sigma^*$ where $\Sigma = \{0, 1\}$. What is the minimum number of states in a DFA that recognizes $\bar{L}$ (complement of L)?

(A) 4 (B) 5 (C) 6 (D) 8

GATE 2015

Q.5. Which of the following languages is Context free?

$L_1 = \{a^m b^n a^n b^m \mid m, n \geq 1\}$
$L_2 = \{a^m b^n a^m b^n \mid m, n \geq 1\}$
$L_3 = \{a^m b^n \mid m = 2n + 1\}$

(A) L_1 and L_2 only (B) L_1 and L_3 only (C) L_2 and L_3 only (D) L_3 only

GATE 2015

TUTORIAL SHEET-9

Q1: Consider the grammar

S->(L)|a
L->L,S |S

What are the terminals, non-terminals, and start symbol? What language does this grammar generate?

Q.2

Give algorithm for construction of predictive parsing table. Consider the following grammar and construct predictive parsing table :—

$S \rightarrow iEtSS_1$

$S_1 \rightarrow eS \mid E$

$E \rightarrow b$

UPTU 2003-2004

Q3: Explain the applications of DAG.

Q.4.How DAG is different from the syntax tree? Construct the DAG for the following basic blocks.

a:=b+c

b:=b-d

c:=c+d

e=b+c

Also explain the key applications of DAG.

UPTU 2015-16

Q.5. Consider the intermediate code given below:

```
(1)   i = 1
(2)   j = 1
(3)   t1 = 5 * i
(4)   t2 = t1 + j
(5)   t3 = 4 * t2
(6)   t4 = t3
(7)   a[t4] = -1
(8)   j = j + 1
(9)   if j<=5 goto (3)
(10)  i=i+1
(11)  if i<5 goto (2)
```

The number of nodes and edges in the control-flow-graph constructed for the above code, respectively, are

(A) 5 and 7 (B) 6 and 7 (C) 5 and 5 (D) 7 and 8

GATE 2015

TUTORIAL SHEET-10

Q1: What are different issues in code optimization? Explain with proper example
Q2: What is Global data flow analysis?
Q.3.

Consider the following three-address code segment :—

$PROD := 0$
$I := 1$
$T_1 := 4 * I$
$T_2 := addr(A) - 4$
$T_3 := T_2[T_1]$
$T_4 := addr(B) - 4$
$T_5 := T_4[T_1]$
$T_6 := T_3 * T_5$
$PROD := PROD + T_6$
$I = I + 1$
$if\ I <= 20\ goto\ (3)$

Find the basic block and flow graph of above sequence. **UPTU 2003-2004**

Q.4. Optimize the above code sequence by applying function preserving transformation and loop optimization techniques .

UPTU 2003-2004

Q.5. Which one of the following is NOT performed during compilation

(A) Dynamic memory allocation (B) Type checking
(C) Symbol table management (D) Inline expansion

GATE 2014

MODAL PAPER
COMPILER DESIGN
KCS-502

TIME: 3 HOURS **TOTAL MARKS: 70**

Note: Attempt all sections.

SECTION-A

Q.1. Attempt all parts. **(2*7=14)**

(a) Write down the phases of Compiler.
(b) What is boot strapping?
(c) What is LEX Tool?
(d) What is loop optimization?
(e) Translate the following arithmetic expression in to a syntax tree. b*-c +b*-c.
(f) What is the role of Symbol Table?
(g) What is Backpatching?

SECTION-B

Q.2. Attempt any threeparts of the following . **(7*3=21)**

(a) . What do you mean by ambiguous grammar? Show that the following grammar is ambiguous.
S→ aB|bA ,A →a|aS|bAA ,B→ b|bS|aBB.

(b). Discuss the operator-precedence parsing algorithm. Consider the following operator grammar.
E→E+E|E*E|id. Explain the parsing of string id+id*id.

(c) . Show that the following grammar is LR(1) but not LALR(1). S→Aa|bAc|Bc|bBa, A→d,, B→d.

(d). What are lexical phase errors, syntactic phase errors, and semantic phase errors? Explain with suitable example.

(e). Write short note on:
(i) Loop optimization (ii) Global data analysis

SECTION-C

Q.3. Attempt any one part of the following: **(7*1=7)**

(a). What will be the number of states in the minimal deterministic finite automaton corresponding to the regular expression (0+1)*(10) is. Explain by designing the state transition diagram.

(b). Explain in detail the process of compilation. Illustrate the output of each phase of compilation of the input "a=(b+c)*(c+d)".

Q.4. Attempt any one part of the following: **(7*1=7)**

(a). Eliminate left recursion from the following grammar:
S→AB , A→BS|b , B→SA|a

(b). Construct the CLR parse table for the following Grammar. S→CC, C→cC ,C→d.

Q.5. Attempt any one part of the following: **(7*1=7)**

(a). Consider the following grammar and give the syntax directed definition to construct parse tree. For the input expression 5*8+2*3 construct an annotated parse tree according to your syntax directed definition.: E→E*T/T , T→T*F/F , F→digit.

(b). Consider the following Syntax Directed Translation Schemes (SDTS),with non-terminals {S,A} and terminals{a,b}.
S→aA {print 1} , S→a{print 2} , A→Sb{print 3}
Using the above SDTS, find out the output printed by a bottom-up parser, for the input aab.

Q.6. Attempt any one part of the following: **(7*1=7)**

(a).Explain different data structure used for symbol table.

(b). What is activation record ? Explain its organization. Also discuss various storage-allocation strategies.

Q.7. Attempt any one part of the following: **(7*1=7)**

(a). Explain the use of Algebraic Identities in optimization

(b). Define a directed acyclic graph. Construct a DAG and write the sequence of instructions for the expression a+a*(b-c)+(b-c)*d.

PREVIOUS YEAR PAPER

BTECH
(SEM VI) THEORY EXAMINATION 2018-19
COMPILER DESIGN

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. What are the two parts of a compilation? Explain briefly.
b. What is meant by viable prefixes?
c. What are the classifications of a compiler?
d. List the various error recovery strategies for a lexical analysis.
e. What is dangling else problem?
f. What are the various types of intermediate code representation?
g. Define peephole optimization.

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. Write the quadruples ,triple and indirect triple for the following expression:
(x+y)*(y+z)+(x+y+z)

b. What are the problems with top down parsing? Write the algorithm for FIRST and FOLLOW.

c. Perform Shift Reduce Parsing for the given input strings using the grammar
S->(L)|a
L->L,S|S
i) (a,(a,a))
ii) (a,a)

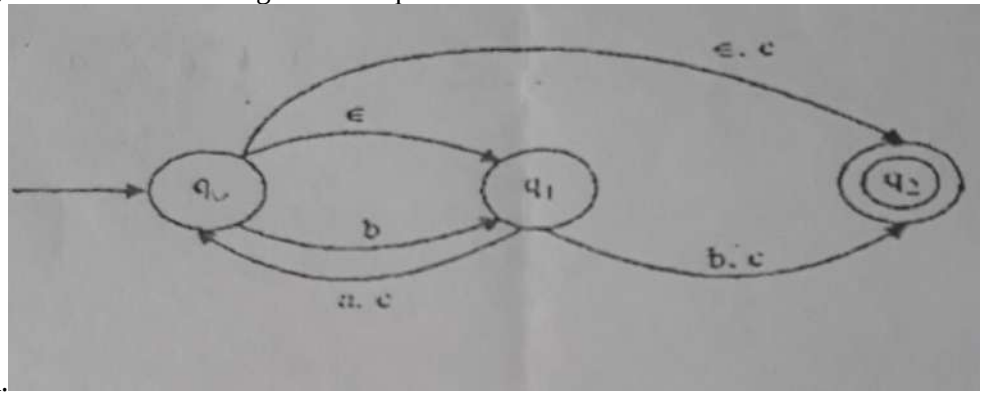
d. What is global data flow analysis? How does it use in code optimization?

e. Construct LR(0) parsing table for the following grammar
S-> cB | ccA
A->cA | a
B-> ccB | b

SCETION C

3. Attempt any one part of the following: 7x1=7

(a) Convert the following NFA to equivalent DFA and hence minimize the number of states in the DFA.



(b) Explain the various parameter passing mechanisms of a high level language.

4. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) How would you represent the following equation using DAG?

a:=b*-c−b*-c

(b) Distinguish between static scope and dynamic scope. Briefly explain access to non-local names in static scope.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Write short notes on the following with the help of example:

(i) Loop unrolling
(ii) Loop Jamming
(iii) Dominators
(iv) Viable Prefix

(b) Draw the format of Activation Record in stack allocation and explain each field in it.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Write down the translation procedure for control statement and switch statement

(b) Define Syntax Directed Translation. Construct an annotated parse tree for the expression (4 * 7 + 1) * 2, using the simple desk calculator grammar.

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Explain in detail the error recovery process in operator precedence parsing method.

(b) Explain what constitute a loop in flow graph and how will you do loop optimizations in code optimization of a compiler.

B.TECH.
(VI-SEMESTER) THEORY EXAMINATION 2017-18
COMPILER DESIGN

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. 2 x10 = 20

a. What is Bootstrapping?
b. What is Code Generator?
c. What is YACC & LEX tools?
d. Define Regular Expression using suitable example.
e. Explain Error detection in Symbol Table.
f. Explain Back patching using suitable example.
g. What is DAG?
h. What is the difference between Syntax Analyzer & Symantec Analyzer?
i. What is Data Flow Analysis?
j. Explain the difference between Top Down Parsing & Bottom Up Parsing.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. What are the Phases and Passes of compiler? Explain the function of each Phases briefly.
b. Explain LR(0) parsing Algorithm using suitable example.
c. Define a SDT to generate Three Address Code.
d. What is role of Symbol Table? Discuss Data Structures used for Symbol Table.
e. Construct the DAG for the expression:
a−a*(b-c)−(b-c)*d− e−e*(f-g)−(f-g)*h

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) i) Remove left factoring of the following grammar:
S→aAB | aA | aAC
ii) Remove left Recursion of the following grammar:
S→Ab | B, A→Ac | Sb | ε

(b) i) Explain the role of precedence & associativity for the conversion of ambiguous grammar to unambiguous grammar.

ii) Find out the FIRST() & FOLLOW() of the following grammar:
S → aBDh
B → cC
C → bC | ε
D → EF
E → g | ε
F → f | ε

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Check that the following grammar is LR(1) or LALR(1) or not by using their table:
S → Aa | bAc | Bc | bBa
A → d
B → d

(b) Explain Recursive Descent Parsing using one suitable example. How it differ from Operator Precedence Parsing.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Consider the following three address code segment:

1. If i ≤ 10 goto 3
2. goto 7
3. t1 = j * 4
4. t2 = t1 + 10
5. a = t2
6. j = j + 1
7. stop

find the basic block & flow graph of above sequence.

(b) Generate Three Address Code,Quadraple,Triple & Indirect Triple for the following statement: -(a−b)*(c−d)−(a−b−c) **10 x 1 = 10**

6. Attempt any *one* part of the following:

(a) What are lexical phase errors, syntactic phase errors & semantic phase errors? Explain with suitable example.

(b) Explain Storage allocation Strategies in Runtime Environment. **10 x 1 = 10**

7. Attempt any *one* part of the following:

(a) Explain different type of Loop Optimization Technique briefly.

(b) Write short note on :

i) Global Data Flow Analysis

ii) Peephole Optimization

PAPER ID-310531

Roll No: | | | | | | | | | | | | | |

B TECH
(SEM-V) THEORY EXAMINATION 2020-21
COMPILER DESIGN

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

Qno.	Question	Marks	CO
a.	What is YACC? Discuss about it.	2	CO 1
b.	Design a DFA for the following regular expression: $(x+y)^*xyy$	2	CO 1
c.	Consider the following grammar: S→B|SabS, B→bB| ε Compute FOLLOW(B)	2	CO 2
d.	Discuss about shift-reduce parsing.	2	CO 2
e.	Find the postfix notation for the following expression: (a+b+c)*(c+q)	2	CO 3
f.	Discuss about non-linear type intermediate code.	2	CO 3
g.	Write short note on "Activation Record"	2	CO 4
h.	Discuss about hash table.	2	CO 4
i.	Discus about constant folding.	2	CO 5
j.	Discuss about designing issues of code generator.	2	CO 5

SECTION B

2. Attempt any *three* of the following: 3 x 10 = 30

Qno.	Question	Marks	CO
a.	Explain in detail the process of compilation for the statement a=b+c*70.	10	CO 1
b.	Construct the CLR(1) parsing table for the following grammar: S→AA, A→aA|b	10	CO 2
c.	Consider the following grammar and give the syntax directed definition to construct parse tree for the input expression 4*7+3*9. Also construct an annotated parse tree according to your syntax directed definition. E→E+T|T, T→T*F|F, F→num.	10	CO 3
d.	Explain lexical, syntax, semantic phase errors in detail.	10	CO 4
e.	Explain in detail about loop optimization.	10	CO 5

SECTION C

3. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	(i). Write a regular expression to represent a language consisting of strings made up of odd number of a & odd number of b. (ii). Write a CFG to represent the language $L=\{a^{n+m}b^n \mid m,n\geq 1\}$.	10	CO 1
b.	(i). Check whether given grammar is ambiguous or not. If ambiguous then convert it into unambiguous grammar: E→E+E|E*E|id (ii). Discuss about cross compiler.	10	CO 1

4. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Check whether the given grammar is LR(0) or not: S→PQy, P→Sy|x, Q→yS	10	CO 2
b.	Find the precedence and function table of the following grammar by using operator precedence technique. P→SR|S, R→bSR|bS, S→WbS|W, W→L*W|L, L→id	10	CO 2

5. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Translate the following arithmetic expression into quadruples and triples: (i). x=y*z+y*-z (ii). a=-b*(c+d)+b	10	CO 3

b.	Generate three address code for the following code:
	Switch p+q
	{
	case 1: x=x+1
	case 2: y=y+2
	case 3: z=z+3
	default: c=c-1
	}
		10	CO 3

6. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is symbol table? Explain various data structures used for symbol table.	10	CO 4
b.	(i). Explain the function of error handling phase of a compiler. (ii). Write short note on scoping.	10	CO 4

7. Attempt any *one* part of the following:

Qno.	Question	Marks	CO

a.	Construct the flow graph for the following code segment:
	fact(n)
	{
	int f=1;
	for(i=2; i≤n; i++)
	f=f*i;
	return f;
	}
		10	CO 5

b.	Define a DAG. Construct a DAG for the expression: p+p*(q-r)+(q-r)*s	10	CO 5

COURSE PLAN
DESIGN AND ANALYSIS OF ALGORITHMS
KCS- 503

Course description: This course is designed to help the students gain an understanding to develop the algorithms systematically and to improve the algorithm development process in order to deliver the good quality maintainable softwares in time and in budget. In this course we will learn several fundamental principles for designing and analyzing algorithms, including asymptotic analysis; divide-and-conquer algorithms and recurrences; greedy algorithms; data structures; dynamic programming; graph algorithms; and randomized algorithms.

Pre-Requisites: To study this subject it is necessary to have Knowledge of ***programming language C, elementary data structures, familiarity with proofs, including proofs by induction and by contradiction, discrete mathematics and probability .***If you have not taken a probability course, you should expect to do some independent reading during the course on topics including random variables, expectation, conditioning, and basic combinatorics.

Design and Analysis of Algorithm (KCS503)		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K_4, K_6
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K_5, K_6
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	K_2, K_5
CO 4	Apply classical sorting, searching, optimization and graph algorithms.	K_2, K_4
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K_2, K_3

CO-PO MAPPING:

Course Outcome	**PO 1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO12**
CO1	2	3										
CO2	**1**	**3**										
CO3	**1**	**1**	2									
CO4	**1**	**3**	3	**3**	**2**							
CO5	**1**	**3**	3	**2**								

UNIT	TOPIC COVERED	H	REFERENCES	Page No.
I.	Defining algorithm,Algorithm Characteristics, Importance of analyzing algorithm, Techniques of designing algorithms	1	Cormen, Leiserson and Rivest	Pg. 5 - 7,29
	Performance Analysis of Algorithm,SpaceComplexity,Time Complexity	1		Pg. 23
	Asymptotic Notation,BigThethaNotation,BigOh,Big Omega Notation	1		Pg. 43-57
Introduction	Examples of Algorithms(Insertion Sort,Quick Sort etc)	1		Pg. 16,170
	Solving recurrences using Iteration method and Substitution method	1		Pg. 83
	Solving recurrences using Recursion Tree method and Master method	1		Pg. 88,93
	Analysis of Selection sort, Heap sort, Application of Heap	1		Pg 152
	Sorting in Linear Time,CountingSort,RadixSort,Bucket sort	1		Pg. 192-200
II.	Binary Search Tree, Operations on BST	1	Cormen, Leiserson and Rivest	Pg. 286-298
	Red-Black Tree, Properties, Insertion Operation in R-B Tree	1		Pg. 308-320
	Deletion Operation in R-B Tree	1		Pg. 323-329
	B Trees, Searching and Insertion Operations in B Trees	1		Pg. 484
	Splitting and Deletion in B Tress	1		Pg. 493
Advanced Data Structures	Concept of Binomial Trees, Binomial HEAP Properties	1		Pg. 527
	Operations on Binomial Heap	1		Pg. 527
	Fibonacci Heap, Properties, Operations on Fib Heap, tries, skip list.	1		Pg. 506-521
III.	Analysis of Merge sort, Strassen'sAlgo for Matrix multiplication	1	Cormen, Leiserson and Rivest	Pg. 31-37,75
	Binary search,Convex Hull using Graham's Scan	1		Pg. 1029
	Variable lengh coding(Huffman code),Activity selection Problem	1		Pg. 428,415
Greedy Algorithms and Elementary Graph Algorithms	Task scheduling problem, Traveling Salesman problem using Greedy	1		Pg. 443
	Knapsack Problem using Greedy method	1		Pg. 426
	Basic Terminolgy in Graph, BFS,DFS	1		Pg. 589-620
	Minimum Spanning Tree,Prim's and Kruskal'salgo	1		Pg. 624-636
	Finding Single Source Shortest Path	1		Pg. 644-654
IV.	Definition and Elements of dynamic programming	1	Cormen, Leiserson and Rivest	Pg. 359,378
	solving Knapsack problem using dynamic programming	1		Pg. 425
	Matrix Chain Multiplication problem	1		Pg. 370
Dynamic Programming	Finding longest common subsequence	1		Pg. 390
	Finding All pairs shortest path in a graph	1		Pg. 684

, Backtracking, Branch and Bound	General Method for Back Tracking,Graph Coloring Problem	1	Horowitz &Sahani	Pg. 323,343
	Sum of subsets,8-Queen Problem using Back Tracking	1		Pg. 337,339
	Finding Hamiltonian Circuit in a Graph	1		Pg. 348
	Solving Knapsack problem and TSP using Branch and Bound	1		Pg. 390,403
V.	Fast Fourier Transform	1	Cormen, Leiserson and Rivest	Pg. 906
	Naive Algo for string matching, RABIN-KARP algorithm	1		Pg. 985-994
Selected Topics, String matching, Theory of NPC	KMP and Boyer-Moore algorithms for string matching	1		Pg. 1002
	Theory of NP-completeness	1		Pg. 1048
	Problem of 3-CNF-SAT,Clique Problem	1		Pg. 1082-1086
	Approximation algorithms	1		Pg. 1106
	Randomized Algorithms	1		Pg. 1123

Additional Reading : After studying this course students would be familier with following concepts

1 Need of efficient algorithms in problem solving.

2 Asymptotic analysis of running time of different algorithms

3 Advanced Data Structures

4 NP Complete Problems and Approximation algorithms

References:

1. Thomas H. Cormen, Leiserson and Rivest, “Introduction to Algorithms”, PHI

2. Basse, “Computer Algorithms:Introduction to design and analysis” , Addison Wesley

3. Horowitz &Sahani, “Fundamental of Computer Algorithms”, Galgotia

4. S. Sridhar, "Design and Analysis of Algorithms", Oxford Univsersity Press

TUTORIAL SHEETS
DESIGN AND ANALYSIS OF ALGORITHM
KCS-503

NOTE: Every Student must submit each Tutorial Sheet within Three Days of completion of The Unit Related to the Sheet for its Evaluation. Each tutorial sheet is of 10 marks.

TUTORIAL SHEET-1

Q1 "Consider the searching problem:
Input: A sequence of n numbers A = $<a_1, a_2,,,,,,,,,, a_n>$ and a value v.
Output: An index i such that v = A[i] or the special value nil if v does not appear in A.
Write pseudo-code for linear search, which scans through the sequence, looking for v."

Q2. Suppose we are comparing implementing the insertion sort and merge sort on the same machine. For inputs of size n insertion sort runs in $8n^2$ steps, while merge sort runs in 64nlgn steps. For which value of n does insertion sort beat merge sort? [AKTU-2010]

Q3. What is the smallest value of n such that an algorithm whose running time is $100n^2$ runs faster than an algorithm whose running time is 2^n on the same machine? [GATE 2010]

Q4. Consider sorting n numbers stored in array A by first finding the smallest element of A and exchanging it with the element A[1]. Then find the second smallest element of A and exchange it with A[2]. Continue in this manner for the first (n-1) elements of A. Write Pseudo-code for this algorithm which is known as selection sort. What loop invariant does this algorithm maintain? Why does it need to run for only the first (n-1) elements, rather than for all n elements? [AKTU-2014]

Q5. Which sorting algorithm will take least time when all elements of input array are identical? Consider typical implementations of sorting algorithms.
(A) Insertion-Sort
(B) Heap-Sort
(C) Merge-Sort
(D) Selection-Sort [GATE 2011]

TUTORIAL SHEET-2

Q1. Show that the solution to T(n)=2T(n/2+17)+n is O(nlgn). [GATE 2001]

Q2. Solve the following recurrence relations using change of variables. [AKTU- 2008]
a) $T(n) = 2T(\sqrt{n})+\log n$
b) $t_n = n$ (if n=0,1,2,3) or $t_n = t_{n-1}+t_{n-3}+t_{n-4}$ (otherwise)

Q3. Solve
a) $T(n) = 8T(n/2)+n^2$, where T(1)=1
b) T(n) = T(2n/3)+1 using Master method.

Q4. Show that the solution of T(n)=T(n/2)+1 is O(lgn) [GATE-2005]

Q5. *Use a recursion tree to determine a good asymptotic upper bound on the recurrence T(n)=3T(n/2)+n. Use the substitution method to verify your answer?* [AKTU-2012]

TUTORIAL SHEET-3

Q1. Draw the recursion tree for T(n)=4T(n/2)+c*n where c is a constant and provide a tight asymptotic bound on its solution.

Q2. Use a recursion tree to give an asymptotically tight solution to the recurrence T(n)=T(n-a)+T(a)+c*n where a>=1 and c>0 are constants. [AKTU- 2006]

Q3. Use the master method to give tight asymptotic bounds for the following recurrence relation
T(n)=4T(n/2)+n [GATE- 2009]

Q4. Use the substitution method to prove that the recurrence $T(n)=T(n-1)+\theta(n)$ has a solution $T(n)=\theta(n^2)$.[GATE-2008]

Q5. *Using the model of quick sort, Illustrate it on the following array:-A={3,41,52,26,38,57,9,49}.What is the running time of QuickSort when all elements of array A have the same value?Show that the running time of QuickSort is $\theta(n^2)$ when the array A contains distinct elements and is sorted decreasing order?* [AKTU-2007]

TUTORIAL SHEET-4

Q1. Which of the following sorting algorithms are stable: Insertion sort ,merge sort, heap sort and quick sort? Give a simple scheme that makes any sorting algorithm stable? How much additional time and space does your scheme entail? [GATE-2011]

Q2. Illustrate the operation of Radix-Sort on the following list of Englishwords: COW, DOG, SEA, RUG, ROW, MOB, BOX, TAB, BAR, EAR, TAR, DIG, BIG, TEA, NOW, FOX.

Q3. Sort the following array with the help of Counting Sort [AKTU- 2015]

A= {1, 4, 1, 2, 7, 5, 2}

Q4. Sort the following array with the help of Bucket Sort Algorithm. [AKTU-2014]

A={.79,.13,.16,.64,.39,.20,.89,.53,.71,.42}.

Q5.*Illustrate the operation BUILD-MAX-HEAP on < 7,4,6,5,19,12,13,17,11,10,3,2 > and then apply HEAP-SORT. What is the maximum and minimum number of elements in a heap of height 'h'? Show that an n-element heap has height* $\lfloor \lg n \rfloor$. [GATE- 2007]

TUTORIAL SHEET-5

Q1. Write recursive versions of the TREE-MINIMUM and TREE-MAXIMUM procedures?[GATE-2008]

Q2. Show that if a node in a binary search tree has two children, then its successor has no left and its predecessor has no right child? [GATE-2009]

Q3. What is the largest possible number of internal nodes in a red black tree with black height K? What is the smallest possible number? Describe red black tree on n keys that realizes the largest possible ratio of red internal nodes. What is this ratio? [AKTU-2014]

Q4. Give a recursive version of the TREE-INSERT procedure?

Q5. *Suppose that a binary search tree is constructed by repeatedly inserting distinct values into the tree. Argue that the number of nodes examined in searching for a value in the tree is one plus the number of nodes examined when the value was first inserted into the tree?* [AKTU-2007]

TUTORIAL SHEET-6

Q1. Suppose that a node x is inserted into a red black tree with RB-INSERT and then immediately deleted with RB-DELETE. Is the resulting red black tree the same as the initial red black tree? Justifyanswer? [AKTU-2009]

Q2. Write pseudo-code for B-TREE-INSERT.

Q3. Write pseudo-code for BINOMIAL-HEAP-MERGE? [GATE-2013]

Q4. What is the intuition behind the Fibonacci heap data structure? Implement Decrease Key operation in a Fibonacci Heap. [AKTU-2014]

Q5. *Explain how to find the minimum key stored in a B-tree and how to find the predecessor of a given key stored in a B-tree?* [GATE-2011]

TUTORIAL SHEET-7

Q1. Given an adjacency-list representation of a directed graph, how long does it take to compute the out-degree of every vertex? How long does it take to compute the in-degrees? [AKTU-2007]

Q2.Define the Breadth First Search with example?Rewrite the procedure DFS, using a stack to eliminate recursion? [GATE- 2011]

Q3. Define the Depth First Search with example? What are applications of DFS? [AKTU-2008]

Q4. Differentiate Kruskal's and Prim's algorithms for finding minimum spanning tree? [GATE-2011]

Q5. *Given an adjacency-list representation for a complete binary tree on 7 vertices. Give an equivalent adjacency-matrix representation. Assume that vertices are numbered from 1 to 7 as in a binary heap.*

TUTORIAL SHEET-8

Q1. What do you mean by dynamic programming? Explain with the help of example? [AKTU-2011]

Q2.Show that a full parenthesization of an n-element expression has exactly (n-1) pairs of parenthesis.

Q3. What is the intuition behind Huffman coding? Justify that generating variable length codes using Huffman algorithm has Greedy-choice property.

Q4. Explain the difference between Greedy Strategy and Dynamic Programming using example of Knapsack problem. [AKTU-2015]

Q5. *Which is a more efficient way to determine the optimal number of multiplications in a matrix-chain multiplication problem: enumerating all the ways of parenthesizing the product and computing the number of multiplication for each, or running RECURSIVE-MATRIX-CHAIN? Justify your answer?* [AKTU-2008]

TUTORIAL SHEET-9

Q1. Define Dijkstra's algorithm for single source shortest path? [AKTU-2006]
Q2.Define the Floyd-Warshall algorithm for all pair shortest paths? [AKTU-2007]
Q3. Define Rabin-Karp string-matching algorithm?
Q4. Define the Knuth-Morris-Pratt Algorithm for string matching?
Q5.*For Working modulo q=11, how many spurious hits does the Rabin Karp matcher encounter in the text T=3141592653589793 when looking for the pattern P=26.* [AKTU-2015]

TUTORIAL SHEET-10

Q1. Define the clique problem,vertex cover problem related to NP- Completeness? [GATE-2008]
Q2. What do you mean by approximation algorithm? Define this with the help of example? [AKTU-2011]
Q3.Define the Hamiltonian-cycle problem and the traveling-salesman problem related to NP-Completeness?
Q4. Define the Sub-Set sum problem related to NP- Completeness? [GATE-2009]
Q5. *What do you mean by randomized algorithm? Define this with the help of example?[AKTU-2014]*

MODEL PAPER
DAA
(KCS-503)

Question A. All questions are compulsory **2*10=20**

Ques1. What is an algorithm? Define performance measurement of algorithm
Ques2. Define best case, worst case and average case step count for an algorithm
Ques3. Write algorithm using iterative function to fine sum of n numbers.
Ques4. List the factors which affects the running time of the algorithm.
Ques5. Give computing time for Binary search?
Ques6. Write an algorithm for straightforward maximum and minimum
Ques7. What are the steps required to develop a greedy algorithm?
Ques.8. What does Job sequencing with deadlines mean?
Ques 9. What is the formula to calculate optimal solution in 0/1 knapsack problem?
Ques 10. What are the searching techniques that are commonly used in Branch-and-Bound method?

Question B. Attempt any 5 questions **5*10= 50**

Ques1. Discuss the different steps in the algorithm design and analysis process in brief?
Ques2. Write an algorithm based on the dynamic programming approach to solve the knapsack problem? Mentionthe difference between dynamic programming and divide and conquer algorithm
Ques3. What do you mean by minimum spanning tree? Write an algorithm for minimum spanning trtee that maygenerate multiple forest trees and also explain with suitable example?
Ques4. Describe in detail the Strassen's Matrix multiplication algorithm based on divide and conquer strategies withsuitable example.
Ques5. What is an optimization problem? How greedy method can be solved the optimization problem?
Ques6. What is Matrix chain multiplication problem? Describe a solution for matrix chain multiplication problem
Ques7. Describe Floyd's War shall algorithm for all pair shortest path problem. Write its applications?
Ques8. Explain red-black tree. Show step of inserting the keys 2, 1,4,5,9,3,6,7 into initially empty red black tree.

Question C. Attempt any 2 questions **2*15 = 30**

Ques1. Write the Huffman's Algorithm. Construct the Huffman's tree for the following data and obtain itsHuffman's Code
Ques2. Discuss the Asymptotic notations with efficiency classes and examples?
Ques3. Write the short note on the following
- Randomized Algorithm
- NP complete problems
- String matching algorithm

B-TECH
DESIGN AND ANALYSIS OF ALGORITHM
EXAMINATION 2016-17

[Time: 3 Hours] **[Total Marks: 100]**

SECTION-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (2 X 10=20)

a) What is an algorithm? Write the characteristics of algorithm.

b) What do you understand by asymptotic notations? Describe important types of asymptotic notations in brief.

c) What do you understand by stable sort? Name two stable sort algorithms.

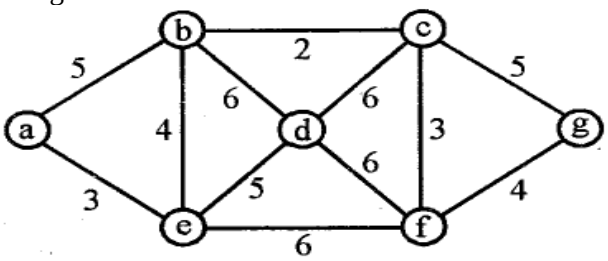
d) What is the smallest value of n such that an algorithm whose running time is $100\ n^2$ runs faster than an algorithm whose running time is 2^n on the same machine?

e) Given the six items in the table below and a knapsack with weight limit 100, what is the solution to this knapsack problem?

Item ID	Weight	Value	Value / Weight
A	100	40	0.4
B	50	35	0.7
C	40	20	0.5
D	20	4	0.2
E	10	10	1
F	10	6	0.6

f) Describe the properties of red Black tree.

g) Consider the foilowing graph. Give the sequence of edges added to the minimum spanning tree using Kruskal'salgorithm ?



h) Suppose that a node x is inserted into a red black tree with RB-INSERT and then immediately deleted with RB-DELETE. Is the resulting red black tree the same as the initial red black tree? Justify answer?

i) Describe the selection sort algorithm.

j) Solve the following 0-1 Knapsack problem with Knapsack capacity=5, P=<3,4,5,6> and W=<2,3,4,5>.

SECTION-B

Note: Attempt any five questions from this section.. (10 X 5=50)

2. a) Show the steps in heap sort to arrange the following data in non-decreasing order:1,2,5,6,9,8,7

b) Solve the following recurrences: i) $T(n) = T(\sqrt{n}) + 1$ ii) $T(n) = 16T(n/4) + n^2$

3. Explain the counting sort algorithm. Illustrate the operation of counting sort on the following array:
A= <6,0,2,0,1,3,4,6,1,3,2>

4. What is a binomial heap ? Describe and write the algorithm for union of two binomial heap.

5. Explain the insertion operation in red-black tree with example.

6. Write an algorithm to find shortest path between all pairs of nodes in a given graph.

7.What do you mean by minimum spanning tree? Write an algorithm for minimum spanning tree that may generate multiple forest trees and also explain with suitable example.

8. Discuss the problem classes P, NP and NP-complete.

9. Write short notes on Randomized algorithms.

SECTION-C

Note: Attempt any two questions from this section.. (15 X 2=30)

10. Describe and analyse the following sorting algorithm with example
a)Merge sort b)Insertion sort

11. What are Fibonacci heap. Describe the Decrease key operation on Fibonacci heap.

12. What is string matching algorithm? Write Rabin Karp algorithm with example.

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012-13

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours *Total Marks : 100*

Note : *Attempt **all** questions.*

1. Attempt any **four** parts of the following :

(a) If $f(n) = 100 * 2^n + n^5 + n$, then show that $f(n) = O(2^n)$.

(b) Consider the following function :

```
int SequentialSearch(int A[ ], int & x, int n)
{
    int i;
    for(int i = 0; i < n && a[i] ! = x; i++)
    if (i == n) return -1;
    return i;
}
```

Determine the average and worst case time complexity of the function SequentialSearch.

(c) Consider a polynomial :

$P(x) = (.....(c_n * x + c_{n-1}) * x + c_{n-2}) * x + c_{n-3}) * x .....) * x + c_0$.

Estimate the time complexity to evaluate the polynomial P(x).

(d) Show that $10 * \log_2 n + 10^5 = \theta(\log_2 n)$.

(e) What do you mean by recursion ? Explain your answer with an example.

(f) Determine the best case time complexity of merge sort algorithm.

2. Attempt any **two** parts of the following :

(a) Define a red-black tree. Explain the insertion operation in a red-black tree.

(b) Define a B-tree of order m. Explain the searching operation in a B-tree.

(c) What is a Fibonacci heap ? Discuss the applications of Fibonacci heaps.

3. Attempt any **two** parts of the following :

(a) Solve the recurrence

$T(n) = T(n-1) + T(n-2) + 1$, when $T(0) = 0$ and $T(1) = 1$.

(b) Explain Kruskal's algorithm to find the minimum cost spanning tree of an n-vertex undirected network.

(c) What is 0/1-knapsack problem ? Does greedy method effective to solve the 0/1-knapsack problem ?

4. Attempt any **two** parts of the following :

(a) What is dynamic programming ? Explain your answer with an example.

(b) Describe travelling salesman problem (TSP). Show that a TSP can be solved using backtracking method in the exponential time.

(c) Discuss n-Queen problem.

5. Write short notes on any **two** of the following :

(a) Randomized Algorithm.

(b) NP-complete problems.

(c) String matching algorithms.

Sub Code: RCS502

Paper Id: 110502 Roll No:

B. TECH.
(SEM V) THEORY EXAMINATION 2019-20
DESIGN AND ANALYSIS OF ALGORITHM

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. How do you compare the performance of various algorithms?

b. Take the following list of functions and arrange them in ascending order of growth rate. That is, if function g(n) immediately follows function f(n) in your list, then it should be the case that f(n) is O(g(n)).
$f_1(n) = n^{2.5}$, $f_2(n) = \sqrt{2^n}$, $f_3(n) = n + 10$, $f_4(n) = 10n$, $f_5(n) = 100n$, and
$f_6(n) = n^2 \log n$

c. What is advantage of binary search over linear search? Also, state limitations of binary search.

d. What are greedy algorithms? Explain their characteristics?

e. Explain applications of FFT.

f. Define feasible and optimal solution.

g. What do you mean by polynomial time reduction?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. (i) Solve the recurrence $T(n) = 2T(n/2) + n^2 + 2n + 1$
(ii) Prove that worst case running time of any comparison sort is $\Omega(n \log n)$

b. Insert the following element in an initially empty RB-Tree.
12, 9, 81, 76, 23, 43, 65, 88, 76, 32, 54. Now Delete 23 and 81.

c. Define spanning tree. Write Kruskal's algorithm for finding minimum cost spanning tree. Describe how Kruskal's algorithm is different from Prim's algorithm for finding minimum cost spanning tree.

d. What is dynamic programming? How is this approach different from recursion? Explain with example.

e. Define NP-Hard and NP- complete problems. What are the steps involved in proving a problem NP-complete? Specify the problems already proved to be NP-complete.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Among Merge sort, Insertion sort and quick sort which sorting technique is the best in worst case. Apply the best one among these algorithms to Sort the list E, X, A, M, P, L, E in alphabetic order.

(b) Solve the recurrence using recursion tree method:
$T(n) = T(n/2) + T(n/4) + T(n/8) + n$

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Using minimum degree 't' as 3, insert following sequence of integers 10, 25, 20, 35, 30, 55, 40, 45, 50, 55, 60, 75, 70, 65, 80, 85 and 90 in an initially empty B-Tree. Give the number of nodes splitting operations that take place.

(b) Explain the algorithm to delete a given element in a binomial Heap. Give an example for the same.

5. Attempt any *one* part of the following: 7 x 1 = 7

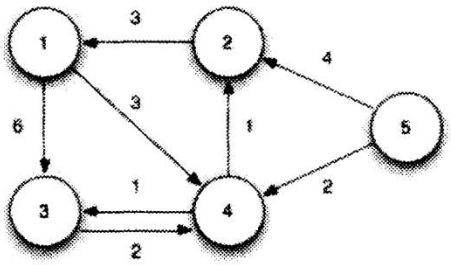
(a) Compare the various programming paradigms such as divide-and-conquer, dynamic programming and greedy approach.

(b) What do you mean by convex hull? Describe an algorithm that solves the convex hull problem. Find the time complexity of the algorithm.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Solve the following 0/1 knapsack problem using dynamic programming. P=[11,21,31,33] w=[2,11,22,15] c=40, n=4.

(b) Define Floyd Warshall Algorithm for all pair shortest path and apply the same on following graph:



7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Describe in detail Knuth-Morris-Pratt string matching algorithm. Compute the prefix function π for the pattern ababbabbabbababbabb when the alphabet is $\Sigma = \{a,b\}$.

(b) What is an approximation algorithm? What is meant by P (n) approximation algorithms? Discuss approximation algorithm for Travelling Salesman Problem.

B. TECH. (SEM-V)
THEORY EXAMINATION 2020-21
DESIGN AND ANALYSIS OF ALGORITHM

Time: 3 Hours **Total Marks: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	What is recurrence relation? How is a recurrence solved using master's theorem?	2	
b.	What is asymptotic notation? Explain Omega (Ω) notation?	2	
c.	Write down the properties of binomial tree.	2	
d.	Differentiate Backtracking algorithm with branch and bound algorithm.	2	
e.	Solve the recurrence T (n) = 4T(n/2) + n2	2	
f.	Explain Fast Fourier Transform in brief.	2	
g.	Write an algorithm for naive string matcher?	2	
h.	Explain searching technique using divide and conquer approach.	2	
i.	Explain Skip list in brief.	2	
j.	Explain how algorithms performance is analyzed?	2	

SECTION B

2. Attempt any three of the following:

Qno.	Question	Marks	CO
a.	Write an algorithm for counting sort? Illustrate the operation of counting sort on the following array: A={4, 0, 2, 0, 1, 3, 5, 4, 1, 3, 2, 3}	10	
b.	Show the results of inserting the keys F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E in order into an empty B-tree. Use t=3, where t is the minimum degree of B- tree.	10	
c.	Discuss greedy approach to an activity selection problem of scheduling several competing activities. Solve following activity selection problem S = {A1, A2, A3, A4, A5, A6, A7, A8, A9, A10} Si = {1, 2, 3, 4, 7, 8, 9, 9, 11, 12} Fi = {3, 5, 4, 7, 10, 9, 11, 13, 12, 14}	10	
d.	What is sum of subset problem? Draw a state space tree for Sum of subset problem using backtracking? Let n=6, m=30 and w [1:6] = {5, 10, 12, 13, 15, 18}	10	
e.	Write KMP algorithm for string matching? Perform the KMP algorithm to search the occurrences of the pattern abaab in the text string abbabaabaabab.	10	

SECTION C

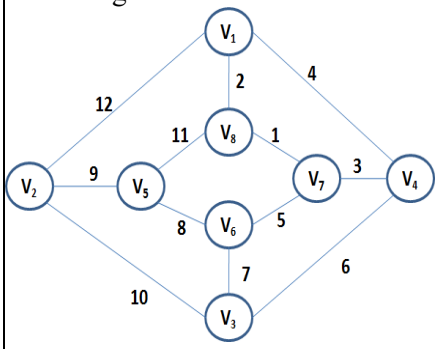
3. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Solve the following recurrence relation: i. T (n) = T (n-1) + n4 ii. T (n) = T (n/4) + T (n/2) + n2	10	
b.	Write an algorithm for insertion sort. Find the time complexity of Insertion sort in all cases.	10	

4. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Write an algorithm for insertion of key in the Red-Black Tree. Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree- 5, 16, 22, 25, 2, 10, 18, 30, 50, 12, 1.	10	
b.	Explain and write an algorithm for union of two binomial heaps and also write its time complexity?	10	

5. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Define minimum spanning tree (MST). Write Prim's algorithm to generate a MST for any given weighted graph. Generate MST for the following graph using Prim's algorithm. 	10	
b.	Explain Dijkstra's algorithm to solve single source shortest path problem with suitable example.	10	

6. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	What is travelling salesman problem (TSP)? Find the solution of following TSP using dynamic programming.	10	
b.	Discuss n queen's problem. Solve 4 queen's problem using backtracking method?	10	

0	1	15	6
2	0	7	3
9	6	0	12
10	4	8	0

7. Attempt any one part of the following:

Qno.	Question	Marks	CO
a.	Write short notes on following: (i.) Randomized algorithm. (ii.) NP- complete and NP hard.	10	
b.	What is approximation algorithm? Explain set cover problem using approximation algorithm.	10	

COURSE PLAN
COMPUTER GRAPHICS
KCS-053

Overall Objective: -Computer graphics are graphics created using computers and, more generally, the representation and manipulation of image data by a computer. The development of computer graphics has made computers easier to interact with, and better for understanding and interpreting many types of data. Developments in computer graphics have had a profound impact on many types of media and have revolutionized animation, movies and the video game industry.

COMPUTER GRAPHICS KCS-053		
Course Outcome (CO)		**Bloom's Knowledge Level (K)**
At the end of course , the student will be able to understand		
CO 1	Understand the graphics hardware used in field of computer graphics.	K_2
CO 2	Understand the concept of graphics primitives such as lines and circle based on different algorithms.	K_2, K_4
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	K_4
CO 4	Apply the concepts of and techniques used in 3D computer graphics, including viewing transformations.	K_2, K_3
CO 5	Perform the concept of projections, curve and hidden surfaces in real life.	K_2, K_3
K1- Remember, K2- Understand, K3- Apply, K4- Analyze , K5- Evaluate , K6- Create		

S.NO	**PROGRAMME OUTCOME (PO)**												**PROGRAMME SPECIFIC OUTCOME (PSO)**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO4	-	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	-	2	3	-	-	-	-	-	-	-	-	-	2	-	-
AVERAGE	3	2.5	2.5	2.5	-	-	-	-	-	-	-	-	2.5	-	-

3 – High 2 – Medium 1 – Low - null

UNIT	Topic	Time (Hr)	Text Book Referred	Page No.
1	Taxonomy of Computer Graphics, Application area of Computer Graphics	1	Computer Graphics Principle by Foley, Vandam, Feiner, Hughes ; Computer Graphics C Version by Donald Hearn and M Pauline Baker.	20-35; 24-54
	Basic CRT; Raster scan displays	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	57-60; 60-61
	Random scan displays, Frame buffer and video controller	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	61-67
	DDA algorithm	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	107-108
	Bresenham's Algorithm	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	108-114
	Circle generating algorithms	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	117-118
	Midpoint circle generating algorithms,	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	118-122
	Parallel version of these algorithms	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	120
2	Basic transformation	**1**	Computer Graphics C Version by Donald Hearn and M Pauline Baker; Computer graphics by Harrington Steven	204-209;109-115
	Homogenous coordinates	1	Computer graphics by Harrington Steven; Computer Graphics C Version by Donald Hearn and M Pauline Baker	208-210;116-125
	Composite, reflections, shearing	1	Computer graphics by Harrington Steven;	211-224; 121-135
	Viewing pipeline	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	237-242
	Cohen Sutherland line clipping algorithm	1	Computer graphics by Harrington Steven	182-183
	Liang Barsky algorithm	1	Computer Graphics Principle by Foley, Vandam, Feiner, Hughes	117-121
	Sutherland Hodgeman polygon clipping	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker; Computer graphics by Harrington Steven;	257-259; 184-190
	Weiler and Atherton polygon clipping , Curve clipping, Text Clipping	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	262-265
3	3-D geometry primitives,	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	316-322
	Transformations	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	427-446
	3-D object representation, Viewing	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	324-329;451-457
	Projection clipping.	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	476-481
	Parallel projection	1	Computer Graphics Principle by Foley, Vandam, Feiner, Hughes	253-258
	Perspective projection	1	Computer Graphics Principle by Foley, Vandam, Feiner, Hughes	253-258

4	Quadric surfaces, Sphere, ellipsoid, Blobby objects	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	330-335
	Introductory concepts of Spline	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	335-345
	B-Spline algorithms	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	354-364
	Bezier Algorithm	1	Computer Graphics C Version by Donald Hearn and M Pauline Baker	347-353
5	Back Face Detection algorithm	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	490 – 495
	Depth Buffer Method, Abuffer Method,	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	495-497
	Scan Line Method	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	497-498
	Basic Illumination Models	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	498-499
	Ambient Light, Diffuse Reflection	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	499-500
	Specular reflection and Phong model	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	501-502
	Combined Approach, Warn Model	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	502-505
	Intensity Attenuation, Color Consideration, Transparency and Shadows	1	Computer Graphics 2nd edition by Hearn Donald, Baker, M. Pauline	507-515

Text books:

1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education
2. Foley, Vandam, Feiner, Hughes – “Computer Graphics principle”, Pearson Education.
3. Rogers, “ Procedural Elements of Computer Graphics”, McGraw Hill
4. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – Tata MCGraw Hill.
5. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, Tata MCGraw Hill.
6. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication.

TUTORIAL SHEETS

TUTORIAL SHEET -1

1. Implement the DDA algorithm to draw a line from (0,0) to (8,8).
2. Write integer Bresenham algorithm and show how it draws a line whose start point is (6, 6) and end point is (-3, 0).
3. If the vector v1=(x1,x2) and v2=(y1,y2)
   Prove: v1+v1=(x1+x2, y1+y2), v1-v2=(x1-x2, y1-y2)
4. For 10*10 frame buffer, interpret the Bresenham algorithm by hand to find which pixels are turned on for the line segment (1, 3) & (7,9).
5. Nominate an application of computers that can be accommodated by either textual or graphical Computer output. Explain when and why graphics output would be more appropriate in this application.
6. Define Computer Graphics. **(AKTU-16)**

TUTORIAL SHEET -2

1. Consider three different raster systems with resolution of 640*480, 1280*1024 and 2560 *2048. What size of frame buffer (in bytes) is needed for each of these systems to store 12 bites per pixel? How much storage is required for each system if 24 bits per pixel are to be stored?
2. Suppose an RGB raster system is to be designed using an 8 inch*8 inch screen with a resolution of 100 pixels per inch in each direction. If we want to store a 6 bit per pixel in the frame buffer, how much storage (in bytes) do we need for the frame buffer?
3. What is frame buffer? In a 600*400 pixel, how many K bytes does a frame buffer need?
4. How long would it take to load a 640*480 frame buffer with 12 bit per pixel, if 10^5 bits can be transferred per second? How long would it take to load a 24 bit per pixel frame buffer with a resolution of 1280 by 1024 using this same transfer rate?
5. Suppose we have a computer with 32 bits per word and a transfer rate of 1mip (1 million instructions per second). How long would it take to fill the frame buffer of a 300 dpi (dot per inch) laser printer with a page size of 8.5 inches by 11 inches.
6. Define pixel? **(AKTU-16)**

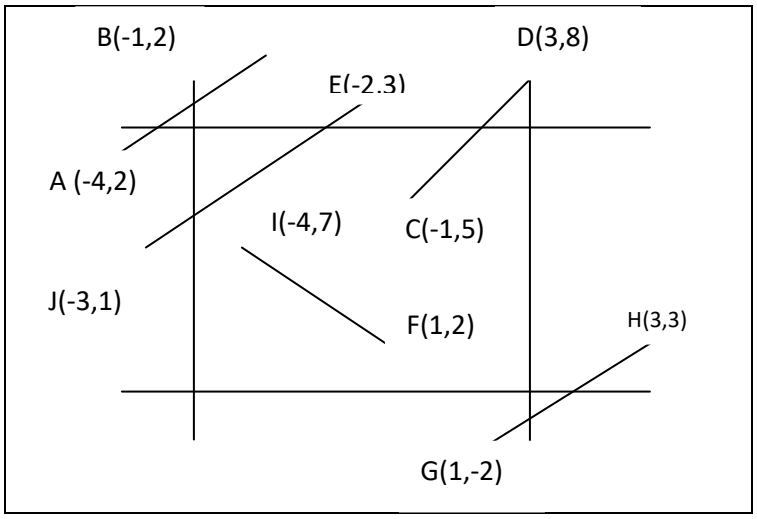
TUTORIAL SHEET -3

1. Write a 2*2 transformation matrix for each of the following scaling transformation.
   a. The entire picture three times as large
   b. The entire picture one third as large
   c. The x direction four times a large the y direction unchanged
   d. The y lengths reduced to two third their original value, the x length unchanged
   e. The x direction reduced to ¾ the original and y direction increased by a factor of 7/5.
2. Reflect the triangular polygon whose vertices area (-1, 0), b (0,-2) and c (1, 0) about the line y=x+2.
3. Define translation, scaling and rotation in three dimensional.
4. Show the three transformation matrices used to rotate a figure 90 deg anticlockwise about (3, 3). Also generates the transformation matrix
   a. Suppose we have a computer with 32 bits per word and a transfer rate of 1mip (1 million instructions per second). How long would it take to fill the frame buffer of a 300 dpi (dot per inch) laser printer with a page size of 8.5 inches by 11 inches.
   b. Show graphically that an ellipse has four-way symmetry by plotting four points on the ellipse: = + h)0cos(*ax = + k)0sin(*by where a = 2 b = 1 h = 0 k = 0 θ = π/4, 3π/4,5π/4,7π/4
5. What is 3D transformation? **(AKTU-2015)**

TUTORIAL SHEET -4

1. Find the normalization transformation that maps a window whose lower left corner is at (1, 1) and Upper right corner is at (3,5) onto
   a. a viewport that is the entire normalized device screen
   b. a viewport that lower that has lower left corner at (0,0) and upper right corner (1/2,1/2).
2. Find the normalization transformation N which uses the rectangle A(1,1),B(5,3),C(4,5) D(0,3) as a Window and the normalized device screen as a viewport.

3. Draw a flow chart illusions the logic of Sutherland Hodgeman algo.
4. Find the instance transformation which places a half size copy of square A(0,0),B(2,0),C(2,2) and D(0,2) defined in a master coordinate system into a world coordinate system in such a way that the center of the square is at (-3,-3) in the world coordinate system.
5. Let R be the rectangle window whose lower left hand corner is at L (-3,1) and upper right corner is at L(-3,1) and upper right corner is at R(2,6). Find the region coded for end points & apply Cohen Sutherland Algorithm.



6. What is 3D projection? **(AKTU-2015)**

TUTORIAL SHEET -5

1. Show how region codes could be assigned to the endpoints of a line segment for the 3D Cohen-Sutherland Line clipping algorithm:
   a. the canonical parallel view volume
   b. the canonical perspective view volume
2. Find the intersecting points of a line segment with the bounding plane of canonical view
   a. Parallel R0 section
   b. Perspective R0 section
3. How do we determine whether a point P is inside or outside of view volume?
4. Explain the term hermite spline?
5. Determine the inequalities that are needed to extend the Liang Barsky line clipping algo to 3D for -
   a. the canonical parallel view volume
   b. the canonical perspective view volume
6. What is text clipping? **(AKTU-16)**

TUTORIAL SHEET -6

1. Derive the general transformation for parallel projection onto a given view plane, where the direction of projection d=aI+bJ+cK is along the normal N=n1I+n2J+n3K with the reference point R0(x0, y0, z0).
2. Find the transformation matrix for a) cavalier projection with θ=450 , and b) cabinet projection with θ=300 c) Draw the projection of unit cube for each transformation.
3. Consider a parallel projection with the plane of projection having the normal (1, 0,–1) and passing through the origin O (0, 0, 0) and having a direction of projection d = (–1, 0, 0). Is it orthographic projection? Explain your answer with reason.
4. Compute the cavalier and cabinet projections with angles of 450 and 300 respectively of a pyramid with a square base of side 4 positioned at the origin in the xy-plane with a height of 10 along the z-axis.
5. Consider the line segment AB in 3D parallel to the z-axis with end points A (– 5, 4, 2) and B (5,-6, 18). Perform a perspective projection on the X=0 plane, where the eye is placed at (10, 0, 10).
6. Derive general form of 3D rotation about X and Y axis? **(AKTU-16)**

TUTORIAL SHEET -7

1. Set up a geometric data table for a 3d rectangle.
2. Find equation of plane which passes through point P (0, 0, 0) and say the normal to the plane is given by N(1, 0, – 1)?
3. Given p_0 (1, 1): p_1 (2, 3); p_2 (4, 3); p_3 (3, 1) as vertices of Bezier curve determine 3 points on Bezier curve?
4. Describe the difference between Bezier curve & B-Spline curve.
5. An animation shows a car driving along a road which is specified by a Bezier curve with the following control points:

A. XK	B. 0	C. 5	D. 40	E. 50
F. YK	G. 0	H. 40	I. 5	J. 15

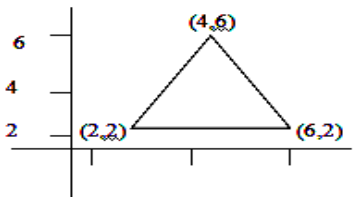
6. The animation lasts 10 seconds and the key frames are to be computed at 1 second intervals. Calculate the position of the car on the road at the start of the 6th second of the animation.
7. Explain Reflection (**AKTU-16**)

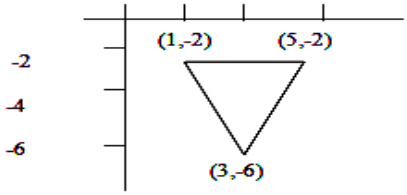
TUTORIAL SHEET -8

1. How does the z-buffer algorithm determine:
   a. Which surfaces are hidden?
   b. What is the maximum number of objects that can be handled by the zbuffer algorithm?
   c. What happens when two polygons have the same z value and the z-buffer algorithm is used?
   d. Assume that one allow 256 depth value levels to be used. Approximately how much memory would a 512x512 pixel display require to store z-buffer?
2. Given two triangles P with vertices P1(100,100,50), P2(50,50,50), P3(150,50,50) and q with vertices Q1(40,80,60), q2(70,70,50), Q3(10,75,70), determine which triangle should be painted first using the scan line method.
3. Describe Phong Model / Phong Specular Reflection Model.
4. What are merits & demerits of Ground shading and Phong shading?
5. Suppose there are three polygon surfaces P,Q, R with vertices given by: P: P1(1,1,1), P2(4,5,2), P3(5,2,5) Q: Q1(2,2,0.5), Q2(3,3,1.75), Q3(6,1,0.5) R: R1(0.5,2,5.5), R2(2,5,3), R3(4,4,5) Using the Area subdivision method, which of the three polygon surfaces P, Q, R obscures the remaining two surfaces? Assume z=0 is the projection plane.
6. Define Shearing (**AKTU-15**)

TUTORIAL SHEET -9

1. Find the transformation matrix that transforms a given square ABCD to half its size with center still remaining at the same position. The coordinate of the square are
2. A(1,1),B(3,1),C(3,3),&D(1,3) center at (2,2).
3. What is meant by composite transformation? Illustrate a transformation square for obtaining the composite matrix for rotation about specified point (Xr, Yr).
4. Find the instance transformation which places a half size copy of square A(0,0),B(2,0),C(2,2) and D(0,2) defined in a master coordinate system into a world coordinate system in such a way that the center of the square is at (-3,-3) in the world coordinate system.
5. 4. Write down the transformation matrix for rotation by PI/2 counter clockwise about a point P(1,1).
6. The 2D object in the following fig(a) is to be transformed to its position in the fig (b).show the transformation matrix for end step and also for the complete transformation





7. Explain Bezier Curve (**AKTU-15**)

TUTORIAL SHEET -10

1. Write a 2*2 transformation matrix for each of the following scaling transformation.
    a. the entire picture three times as large
    b. the entire picture one third as large
    c. the x direction four times a large the y direction unchanged
    d. the y lengths reduced to two third their original value, the x length unchanged
    e. the x direction reduced to ¾ the original and y direction increased by a factor of 7/5.
2. Write a 2*2 transformation matrix for each of the following rotation about the origin.
    a. counter clockwise by PI
    b. clockwise by PI/2
3. Write the transformation matrix for rotation by PI/2 counterclockwise about a point p(1,1).
4. What are the new coordinates of the point (2,-4) after rotation in above problem?
5. An object point P(x,y) is translated in the direction v=ai+bj and simultaneously an observer moves in the direction v. Show that there is no apparent motion(from the point of view of the observer)
6. Explain DDA line drawing algorithm (**AKTU-16**)

MODEL PAPER
COMPUTER GRAPHICS
KCS-053

Max. Marks: 70 **Time: 3:00 Hrs.**

SECTION-A

Note: Attempt all questions: **(2×7=14)**

1. Write how shear transformation works?
2. Where and why clipping is needed in graphics?
3. What do you mean by aliasing and antialiasing? Give examples.
4. Explain Phong illumination model in brief?
5. Differentiate between specular reflection and diffuse reflection.
6. What is the difference between a window and a view port? Explain with the help of sketch.
7. How will you create, delete and rename a segment?

SECTION-B

Note: Attempt any three questions: **(7×3=21)**

1. What do you understand by the term "Clipping and Windowing"? Explain the Cohen- Sutherland algorithm for clipping a line and discuss how the mid-point subdivision algorithm makes an improvement over it.
2. Give a detailed explanation about quadratic surfaces and polygon surfaces.
3. Define Area Subdivision algorithm? Also list the advantages and disadvantages of this algorithm.
4. Construct enough points on the Beizer curve whose control points are P_0 (4, 2), P_1 (8, 8) and P_2 (16, 4) to draw an accurate sketch.
   a) What is the degree of the curve?
   b) What are the coordinates at u=0.5?
5. Write short notes on:
   a) Transformation routines
   b) Display procedures

SECTION-C

Note: Attempt any one question: **(7×1=7)**

1. Explain Warnock's algorithm? Compare Back face detection method with A-Buffer method.
2. What do you understand by Hidden lines and Surfaces? Also explain warn model?

Note: Attempt any one question: **(7×1=7)**

1. Describe the construction and functioning of Beam Penetration CRT. Discuss its merits and demerits.
2. Explain Bresenham's algorithm for line drawing? Also discuss the criteria that should be satisfied by a good line drawing algorithm to have computer generated line.

Note: Attempt any one question: **(7×1=7)**

1. What is composite transformation? Derive general Pivot-Point rotation and General Fixed-point scaling matrices. Compute the computational efficiency of each.
2. Do you think that the line clipping algorithm will do for polygon clipping too? Justify your answer and explain Sutherland-Hodgman algorithm for polygon clipping?

Note: Attempt any one question: **(7×1=7)**

1. Draw the block diagram of implementation of 3-D viewing, while converting 3-D world coordinate output primitive to 2-D device coordinate. Also explain the functionality of each block?
2. Explain the issues related to three dimensional display methods. Compare Parallel projection and Perspective projection methods for 3-D objects.

Note: Attempt any one question: **(7×1=7)**

1. In parametric representation of curves, there are methods by which curve can be represented. Define and compare any three of the following-
   a) Hermite Interpolation
   b) Beizer Curve
   c) B.Spline
   d) NURBS
2. Write short notes on:
   a) Painter's Algorithm
   b) Difference between Dragging and Fixing
   c) Compare Scan line fill and Boundary Fill algorithms

Paper Id: 110264 Roll No. | | | | | | | | | | |

B.TECH.
(SEM VI) THEORY EXAMINATION, 2018-19
COMPUTER GRAPHICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

(a) What are the applications of Computer graphics?
(b) How many clippers are used by Sutherland Hodgeman for polygon clipping?
(c) Define aspect ratio and types of retracing?
(d) What is Tilting Transformation? Does the order of performing the rotation matter?
(e) What do you understand by match band effect and transparency?
(f) Explain other transformations that can be applied on 2D objects?
(g) Define Blobby objects and types of coherence.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

(a) Why do we need Video Controller? Also define the architecture of Raster Scan System?
(b) Translate the square ABCD whose co-ordinates are A(0,0), B(3,0), C(3,3) and D(0,3) by 2 units in both directions and then scale it by 1.5 units in x-direction and 0.5 units in y-direction.
(c) Write rotation matrices about X-axis, Y-axis and Z-axis and prove that for any rotation matrix R:- $R^{-1}(\theta)=R(-\theta)=R^{T}(\theta)$
(d) Discuss RGB and CMY color model in detail.
(e) Explain the True-Curve Generation algorithm. Also list the problems in this algorithm.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

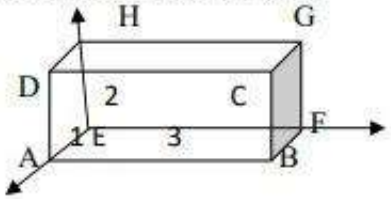
(a) What are the disadvantages of DDA algorithm? Also write Bresenham's Line Drawing algorithm for negative slope.
(b) Write Mid-Point Circle algorithm and predict the pixels in any octant of circle for radius =12 pixels with its centre at origin?

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write the Liang Barsky algorithm for Line Clipping. Use Liang Barsky Line Clipping algorithm to clip the line P1(-1,7) to P2(11,1) against the window having diagonally opposite corners as (1,2) and (9,8).
(b) Explain Window-to-Viewport transformation in detail.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) A rectangular parallelepiped is given having length on X-axis, Y-axis and Z-axis as 3, 2 and 1 respectively. First apply a rotation of -90° about the Y-axis followed by a rotation of 90° about X-axis.



(b) What do you understand by Projection? Differentiate between Parallel Projection and Perspective Projection.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Construct the Bezier Curve of order 3 and with 4 polygon vertices A(1,1), B(2,3), C(4,3), D(6,4).

(b) Write the properties of B-Spline curves. Also write advantages of B-Spline curves over Bezier curves.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain Depth buffer method and compare it with A-buffer method.

(b) Why is Gouraud shading also referred to as interpolation shading? Also discuss its advantages and disadvantages?

COURSE PLAN
MACHINE LEARNING TECHNIQUES
KCS 055

I. COURSE DESCRIPTION: Machine learning can simply be interpreted as the high-level application platform which extensively being used for the purpose of data analysis. In general, the functioning aspects of Machine Learning will be similar to that of data mining and other data interpreted concepts. But on the other side of the coin Machine Learning's main motive is to automate the decision models. Machine Learning applications help the machines or computers to gather the hidden insights.

Machine Learning also makes an extensive use of other advanced techniques like Deep Learning & Artificial Intelligence (AI) for a better analysis of data to arrive at accurate conclusions

II. PRE REQUISITES: To have a better understanding of the Machine Learning course, having prior knowledge of these below concepts is very crucial Sound knowledge of basic Linear Algebra Programming experience will surely help in understanding the subject Knowledge of statistics and probability models

III. Machine Learning Techniques COURSE OUTCOME

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To understand the need for machine learning for various problem solving	K1 , K2
CO 2	To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning	K1 , K2
CO 3	To understand the latest trends in machine learning	K1 , K2
CO 4	To design appropriate machine learning algorithms for problem solving	K3 , K6
CO 5	To understand the need for machine learning for various problem solving	K4, K5

IV. Program Outcome(PO)

PO1	**Engineering Knowledge**: Apply knowledge of mathematics and science, with fundamentals of Computer Science & Engineering to be able to solve complex engineering problems related to CSE.	
PO5	**Modern Tool Usage**: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to computer science related complex engineering activities with an understanding of the limitations	
PO12	**Life-Long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning the broadest context of technological change	

V. Program Specific Outcome(PSO)

PSO1	Foundation of mathematical concepts: To use mathematical concepts to solve problem using suitable mathematical analysis, data structure and suitable algorithm.	

VI. MAPPING OF COURSE OUTCOME (CO'S), PROGRAMME OUTCOME (PO'S) AND PROGRAMME SEPECIFIC OUTCOME (PSO'S)

	PROGRAMME OUTCOME												PROGRAMME SPECIFIC OUTCOME		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-
CO3	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-
CO4	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-
AVERAGE	3	-	-	-	3	-	-	-	-	-	-	3	3	-	-

VII. Lecture Plan:

Unit	Topics	Time (Hr.)	Text Book Referred	Page No./Website Referred
I	INTRODUCTION – Learning, Types of Learning, Well defined learning problems,	1	1	Page No. 2-4
	Designing a Learning System, History of ML	1	1	Page No. 1-4
	Issues in Machine Learning	1	1	Page No. 14-15
	Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning	1	1	Page No. 80-82,367
	Decision Tree Learning,	1	1	Page No. 52-70
	Bayesian networks,	1	1	Page No.184-185
	Support Vector Machine, Genetic Algorithm)	1	3,1	Page No. 119,249
	Data Science Vs Machine Learning;	1	3	Page No. 2-5
II	REGRESSION: Linear Regression and Logistic Regression	1	2	Page No. 21-35
	BAYESIAN LEARNING - Bayes theorem	1	1	Page No. 150-167
	Concept learning, Bayes Optimal Classifier	1	1	Page No. 174-176
	Naïve Bayes classifier,	1	1	Page No. 177-178
	Bayesian belief networks, EM algorithm.	1	1	Page No. 184-195
	SUPPORT VECTOR MACHINE: Introduction,	1	3	Page No. 119-120
	Types of support vector kernel – (Linear kernel, polynomial kernel,and Gaussiankernel),	1	3	Page No. 125-128
	Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	1	1	Page No. 119-128
III	DECISION TREE LEARNING - Decision tree learning algorithm,	1	1	Page No.52-59
	Inductive bias, Inductive inference with decision trees	1	1	Page No. 63-65

	Entropy and information theory, Information gain,	1	1	Page No. 60-65
	ID-3 Algorithm,	1	1	Page No. 60-65
	Issues in Decision tree learning.	1	1	Page No. 66-76
	INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning	1	1	Page No.230-236
	Locally Weighted Regression,	1	1	Page No. 236-238
	Radial basis function networks, Case-based learning.	1	1	Page No. 238-240
IV	**ARTIFICIAL NEURAL NETWORKS – Perceptron's, Multilayer perceptron,**	1	1	Page No. 81-83
	Multilayer networks,	1	1	Page No. 95-97
	Derivation of Backpropagation Algorithm,	1	1	Page No. 97-105
	Generalization, Unsupervised Learning	1	1	Page No. 106-108
	SOM Algorithm and its variant;	1	1	Page No. 106-112
	DEEP LEARNING - Introduction,concept of convolutional neural network ,	1	5	Page No. 5-8
	Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers,	1	1	Page No. 11-19
	Training of network, Case study of CNN	1	1	Page No. 17-25
V	**REINFORCEMENT LEARNING–Introduction to Reinforcement Learning , Learning Task,**	1	1	Page No. 367-370
	Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – Markov Decision process ,	1	1	Page No. 371-372
	Q Learning - Q Learning function, Q Learning Algorithm	1	1	Page No. 373-3798
	Application of Reinforcement Learning,Introduction to Deep Q Learning.	1	1	Page No. 380-385
	GENETIC ALGORITHMS: Introduction, Components,	1	1	Page No. 249-250
	GA cycle of reproduction, Crossover, Mutation,	1	1	Page No. 251-260
	Genetic Programming,	1	1	Page No. 262-265
	Models of Evolution and Learning, Applications.	1	1	Page No. 266-268
	Total Lectures=40			

MODEL PAPER
MACHINE LEARNING TECHNIQUES

PART – A (10×2=20 Marks)

1. List out the types of machine learning.
2. Define perceptron.
3. What is a spline ?
4. State the applications of radial basis function network.
5. Write the concept behind ensemble learning.
6. Distinguish between classification and regression.
7. What is dimensionality reduction ?
8. Define evolutionary computation.
9. What is sampling ?
10. Define Bayesian network.

PART – B (5×13=65 Marks)

11. a) Describe the perspectives and issues in machine learning.

(OR)

b) Discuss linear regression with an example.

12. a) Explain multi-layer perceptron model with a neat diagram.

(OR)

b) Describe the working behaviour of support vector machine with diagrams.

13. a) Elaborate on Classification and Regression Trees (CART) with examples.

(OR)

b) Summarize K-means algorithm and group the points (1, 0, 1), (1, 1, 0), (0, 0, 1) and (1, 1, 1) using K-means algorithm.

14. a) Describe how principal component analysis is carried out to reduce dimensionality of data sets.

(OR)

b) i) Write short notes on reinforcement learning. **(5)**

ii) What is meant by isomap ? Give its significance in machine learning. **(8)**

15. a) Discuss Markov Chain Monte Carlo Methods in detail.

(OR)

b) Explain hidden Markov models in detail.

PART – C (1×15=15 Marks)

16. a) Choose two destination with different routes connecting them. Apply genetic algorithm to find the optional path based on distance.

(OR)

b) Use decision tree to classify the students in a class based on their academic performance.

MACHINE LEARNING TECHNIQUES

THEORY EXAMINATION (SEM–II) 2016-17

MACHINE LEARNING

Time : 3 Hours *Max. Marks : 70*

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION- A

1. Attempt all parts of this section: 7×2=14

(a) Explain the various types of issues in machine earning.

(b) Describe the Artificial Neural Networks (ANN).

(c) Define the learning classifiers.

(d) Differentiated between Bayesian Learning and Instance based Learning.

(e) Discuss the complexity of in finite hypothesis spaces.

(f) Write the at least five applications of machine learning.

(g) Discuss the regression model.

SECTION- B

2. Attempt any three parts of the following: 3×7=21

(a) What is a core point in DBSCAN? What role do core points play in forming clusters?

(b) What objective function do regression trees minimize?

(c) What is the task of the E-step of the EM-algorithm? Give a verbal description (and not (just) formulas) how EM accomplishes the task of the E-step.

(d) EM uses a mixture of *k* Gaussian for clustering; what purpose does the k Gaussian serve?

(e) Describe brain-in-a box model. Compare with it a recurrent network.

SECTION- C

3. Attempt all questions in this section: 5×7=35

(a) What is learning? Write any four learning techniques and in each case give the expression for weight- updating.

OR

Discuss various Artificial Neural Network Architectures.

(b) Explain back propagation algorithm and derive expressions for weight update relations.

OR

With help of a suitable diagram discuss functioning of a simple artificial neuron. Explain how the functionality affected if two such neuron are connected in series.

(c) Define gradient. Using steepest descent rule to the following function

$$f(x) = x_1^2 + 5x_1x_2 + 10x_2^2$$

Determine first three points of trajectory starting from

$$x_0 = [0.5, 0.5]$$

OR

Write an algorithm to implement simulated annealing.

(d) Explain Perceptron training algorithm for linear classification. And explain its equation using homogeneous coordinates.

OR

Explain geometric models and probabilistic models of machine learning with suitable examples.

(e) What are neighbors? Why is it necessary to use nearest neighbor while classifying justify the answer with suitable example.

OR

Explain how genetic algorithms are influenced by knowledge based techniques. Also discuss the how Genetic Algorithm is different from traditional algorithms?

PAPER ID-310687

Roll No: | | | | | | | | | | | | | |

B. TECH
(SEM-V) THEORY EXAMINATION 2020-21
MACHINE LEARNING TECHNIQUES

Time: 3 Hours ***Total Marks: 100***

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	Explain the concept of machine learning.	2	1
b.	Compare ANN and Bayesian networks.	2	4
c.	What is the difference between linear and logistic regression?	2	2
d.	Discuss support vectors in SVM?	2	2
e.	Discuss overfitting and underfitting situation in decision tree learning.	2	3
f.	What is the task of the E-step of the EM-algorithm?	2	2
g.	Define the learning classifiers.	2	2
h.	What is the difference between machine learning and deep learning?	2	1
i.	What objective function do regression trees minimize?	2	2
j.	What is the difference between Q learning and deep Q learning?	2	5

SECTION B

2. Attempt any *three* of the following:

Qno.	Question	Marks	CO
a.	Apply KNN for following dataset and predict class of test example (A1=3, A2=7).Assume K=3	10	3
b.	Describe the Kohonen Self-Organizing Maps and its algorithm.	10	4
c.	Explain the various learning models for reinforcement learning.	10	5
d.	Explain the role of genetic algorithm? Discuss the various phases considered in genetic algorithm.	10	5
e.	Describe BPN algorithm in ANN along with a suitable example.	10	4

A1	A2	Class
7	7	True
7	4	True
3	4	False
1	4	True
5	3	False
6	3	True

SECTION C

3. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Why SVM is an example of a large margin classifier? Discuss the different kernels functions used in SVM.	10	2
b.	Explain the relevance of CBR. How CADET tool employs CBR?	10	3

4. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Discuss the applications, properties, issues, and disadvantages of SVM.	10	2
b.	Explain the Confusion Matrix with respect to Machine Learning Algorithms.	10	1

5. Attempt any *one* part of the following:

a.	Illustrate the operation of the ID3 training example. Consider information gain as attribute measure.	10	3
b.	Describe Markov Decision Process in reinforcement learning.	10	5

PlayTennis: training examples

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

6. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	What is instance based learning? How Locally Weighted Regression is different from Radial basis function networks?	10	3
b.	How is Bayes theorem used in machine learning? How naive Bayes algorithm is different from Bayes theorem?	10	2

7. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Compare regression, classification and clustering in machine learning along with suitable real life applications?	10	1
b.	Given below is an input matrix named I, kernel matrix, calculate the Convoluted matrix C using stride =1 also apply max pooling on C.	10	4

Input Matrix I

1	0	0	1	1	0	1
0	0	1	1	1	0	1
1	1	1	0	1	0	1
1	1	0	1	0	0	0
1	0	1	0	1	1	0
0	1	1	0	0	1	1
0	1	1	1	0	1	1

Kernel Matrix

1	0	0
0	1	1
1	1	0

COURSE PLAN
CONSTITUTION OF INDIA, LAW AND ENGINEERING
(KNC: 501)
Non Credit Course 2020-21 AICTE Model Curriculum K series

COURSE OBJECTIVE:

• To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
• To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
• To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
• To acquaint students with latest intellectual property rights and innovation environment with related regulatory framework.
• To make students learn about role of engineering in business organizations and e-governance.

CONSTITUTIONOFINDIA,LAWAND ENGINEERING		
Course Outcome	**Topic**	**Bloom Knowledge Level**
CO 1	Identify and explore the basic features and modalities about Indian constitution.	**K1, K2**
CO 2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	**K2**
CO 3	Differentiate different aspects of Indian Legal System and its related bodies.	**K3**
CO 4	Discover and apply different laws and regulations related to engineering practices.	**K4**
CO 5	Correlate role of engineers with different organizations and governance models	**K5, K6**

Weightage of Marks.

S.No	Subject Code	Subject Name	L-T-P	End Semester Marks	Sessional			Total	Credit
					CT	TA	PS		
1	KNC-501	CONSTITUTIONOFINDIA,LAWANDENGINEERING	2-0-0	50	15	10			0

Curriculum Plan:

Lecture No	Learning Objectives	Topics To be Covered	Reference /Text Book
1	Identify and explore the basic features and modalities about Indian constitution.	Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly,	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
2		Government of India Act of 1935 and Indian Independence Act of 1947	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
3		Enforcement of the Constitution, Indian Constitution and its Salient Features	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
4		The Preamble of the Constitution, Fundamental Rights, Fundamental Duties	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
5		Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
6		Amendment of the Constitutional Powers and Procedure	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
7		The historical perspectives of the constitutional amendments in India	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
8		Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government–Constitutional Scheme in India.	Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
9	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	Union Executive and State Executive: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha,	Granville Austin: The Indian Constitution: Corner stone of a Nation (Classic Reissue), Oxford University Press.
10		Powers and Functions of the President, Comparison of powers of Indian President with the United States,	Granville Austin: The Indian Constitution: Corner stone of a Nation (Classic Reissue), Oxford University Press.
11		Powers and Functions of the Prime Minister	Granville Austin: The Indian Constitution: Corner stone of a Nation (Classic Reissue), Oxford University Press.
12		Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation	Madhav Khosla: The Indian Constitution, Oxford University Press.
13		Judicial Activism, Lokpal, LokAyukta, The Lokpal and Lokayuktas Act 2013	Madhav Khosla: The Indian Constitution, Oxford University Press.
14		State Executives – Powers and Functions of the Governor	Madhav Khosla: The Indian Constitution, Oxford University Press.

15		Powers and Functions of the Chief Minister, Functions of State Cabinet,	Madhav Khosla: The Indian Constitution, Oxford University Press.
16		Functions of State Legislature, Functions of High Court and subordinate Courts.	Madhav Khosla: The Indian Constitution, Oxford University Press.
17	Differentiate different aspects of Indian Legal System and its related bodies.	**Introduction and Basic Information about Legal System:** The Legal System: Sources of Law and the Court Structure.	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
18		Enacted law-Acts of Parliament are of primary legislation	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
19		Common Law or Case law	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
20		Principles taken from decisions of judges constitute binding legal rules.	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
21		The Court System in India and Foreign Courtiers District Court,	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
22		District Consumer Forum, Tribunals, High Courts,	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
23		Supreme Court Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
24		Contract law, Tort, Law at workplace.	Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
25	Discover and apply different laws and regulations related to engineering practices.	**Intellectual Property Laws and Regulation to Information:** Intellectual Property Laws: Introduction, Legal Aspects of Patents,	V. K. Ahuja: Law Relating to Intellectual Property Rights(2007)
26		Filing of Patent Applications, Rights from Patents	V. K. Ahuja: Law Relating to Intellectual Property Rights(2007)
27		Infringement of Patents, Copy right and its Ownership	V. K. Ahuja: Law Relating to Intellectual Property Rights(2007)
28		Infringement of Copyright, Civil Remedies for Infringement	V. K. Ahuja: Law Relating to Intellectual Property Rights(2007)

29		Regulation to Information-Introduction, Right to Information Act, 2005	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India,
30		Information Technology Act, 2000	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India
31		ElectronicGovernance,SecureElectronicRecordsandDigitalSignatures,DigitalSignatureCertificates	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India
32		Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India
33	Correlate role of engineers with different organizations and governance models	**Business Organizations and E-Governance:** Sole Traders, Partnerships: Companies: The Company's Act: Introduction	Companies Act, 2013 Key highlights and analysis by PWC.
34		Formation of a Company, Memorandum of Association	Companies Act, 2013 Key highlights and analysis by PWC.
35		Articles of Association, Prospectus, Shares, Directors	Companies Act, 2013 Key highlights and analysis by PWC.
36		General Meetings and Proceedings, Auditor, Wind in gup.	Companies Act, 2013 Key highlights and analysis by PWC.
37		E-Governance and role of engineers in E-Governance	Companies Act, 2013 Key highlights and analysisbyPWC.
38		Need for reformed engineering serving at the Union and State level	Companies Act, 2013 Key highlights and analysis by PWC.
39		Role of I.T. professionals in Judiciary	Executive programme study material Company Law, Module II, by ICSI (The Institute ofCompaniesSecretariesofIndia)(Onlyrelevantsectionsi.e.,Study1,4and36)
40		Problem of Alienation and Secession is min few states creating hurdles in Industrial development.	Executive programme study material Company Law, Module II, by ICSI (The Institute ofCompaniesSecretariesofIndia)(Only relevantsectionsi.e.,Study1,4and36)

MODEL PAPER
(SEM-V) THEORY EXAMINATION 2020-21
CONSTITUTIONOFINDIA,LAWANDENGINEERING
KNC 501

Time:3Hours **TotalMarks: 100**

Note:1. Attempt all Sections.

SECTION-A

1. Attempt *all* questions in brief **2x10 =20**

Q. No.	Question	Marks	CO
a.	Differentiate Functional Duties and Rights.	2	1
b.	What are the President rules?	2	1
c.	Write about the roles and responsibilities of Assembly speaker?	2	2
d.	Explain Rajyasabha.	2	2
e.	Explain the power of Indian Prime Minister.	2	3
f.	Explain Judicial activism.	2	3
g.	What are the roles of Governor?	2	4
h.	What are the roles of women in panchayat?	2	4
i.	Write about the center State financial relation.	2	5
j.	Explain partnership.	2	5

SECTION-B

2. Attempt any *three* of the following: **3 x10 =30**

Q.No	Question	Marks	CO
a.	. What are the Constitutional remedies for citizen?	10	1
b.	Explain in detail about Judicial review.	10	2
c.	Differentiate between memorandum and articles of association.	10	4
d.	Describe the importance of IT Act2000.	10	3
e.	Explain in detail about Directive Principle of State policy	10	5

SECTION C

3. Attempt any *one* part of the following: **1 x 10 = 10**

Q.No	Question	Marks	CO
a.	Explain about the Constitutional amendments and Constitutional functions.	10	1
b.	Write about the important commission and explain in detail.	10	1

4. Attempt any *one* part of the following: **1 x 10 = 10**

Q.No	Question	Marks	CO
a.	Write about the assessment of working of Parliamentary system in India	10	2
b.	Explain in detail about the Union Government structure and functions.	10	2

5. Attempt any *one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss the appointment of judges in Indian Judiciary.	10	3
b.	Explain in detail about the State Legislature.	10	3

6. Attempt any *one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss digital signature and its types in detail.	10	4
b.	Describe patent infringement and its types.	10	4

7. Attempt any *one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss the use of technology in judicial process and role of IT professional in judiciary.	10	5
b.	Write about Children rights, Scheduled Caste & Scheduled Tribes and other weaker sections.	10	5

QUESTION PAPER
(SEM-V) THEORY EXAMINATION 2020-21
CONSTITUTIONOFINDIA,LAWANDENGINEERING
KNC 501

Time: 3Hours ***Total Marks: 100***

Note:1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2x10 =20

Q.No	Question	Marks	CO
a.	Define Constitution.	2	1
b.	Identify the fundamental duties.	2	1
c.	Evaluate the role of parliament in law making.	2	2
d.	Explain Rajya Sabha.	2	2
e.	Describe the court structure of India.	2	3
f.	Explain the term Tort.	2	3
g.	Describe intellectual property.	2	4
h.	Evaluate patent.	2	4
i.	Explain partnership.	2	5
j.	Discuss the types of shares.	2	5

SECTION B

2. Attempt any *three* of the following: 3 x10 =30

Q.No	Question	Marks	CO
a.	Evaluate the functions of constitution.	10	1
b.	Explain PIL and the procedure to file it.	10	2
c.	Define arbitration and explain its types.	10	3
d.	Describe the importance of IT Act 2000.	10	4
e.	Differentiate between memorandum and articles of association.	10	5

SECTION C

3. Attempt any *one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss the formation of constituent assembly.	10	1
b.	Examine Government of India Act 1935.	10	1

4. Attempt any *one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss the appointment of judges in Indian Judiciary.	10	2
b.	Explain Lokpal jurisdiction and its powers.	10	2

5. Attempt any*one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Explain the term Acts of Parliament.	10	3
b.	Define tribunal and discuss why tribunals are needed.	10	3

6. Attempt any*one* part of the following: 1 x 10 = 10

Q.No	Question	Marks	CO
a.	Discuss digital signature and its types in detail.	10	4
b.	Describe patent in fringement and its types.	10	4

7. Attempt any *one* part of the following: 1 x 10=10

Q.No	Question	Marks	CO
a.	Explain annual general meeting in detail.	10	5
b.	Discuss the use of technology in judicial process and role of IT professionals in judiciary.	10	5