MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

Department Of Computer Science and Engineering

STUDENT HAND BOOK
FOR
III B.Tech II Sem

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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**COMPILER DESIGN**			
Course Code	CS602PC			
Regulation	**R18**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Faculty	L DHANA LAKSHMI Assoc.Prof			

COURSE OVERVIEW:

This course is intended to make the students learn the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code. It also discuss various aspects of the run-time environment into which the high-level code is translated. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Computer Programming, Formal Languages Automata Theory

EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

COURSE OBJECTIVES:

I. Be familiar with major concepts of language translation and compiler design.

AI. Learn the various parsing techniques and different levels of translation

V. Extend the knowledge of parser by parsing LL parser and LR parser.

IV. Enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table.

1. Be familiar with compiler architecture and with register allocation.

VI. Learn how to optimize and effectively generate machine codes

VII. Provide practical programming skills necessary for constructing a compiler.

COURSE OUTCOMES:

5. Ability to understand the design of a compiler given features of the languages.
6. Ability to implement practical aspects of automata theory.
7. Gain Knowledge of powerful compiler generation tools.

HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Exercises
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Exercises
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Assignments
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Mini Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	H	Projects
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Projects
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	N	--

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

SYLLABUS:

UNIT – I

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator

Top down Parsing: Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

UNIT – II

Bottom up parsing: Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing , handling ambiguous grammar, YACC – automatic parser generator.

UNIT – III

Semantic analysis: Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes. Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables: Symbol table format, organization for block structures languages, hashing, tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

UNIT – IV

Code optimization: Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Data flow analysis: Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

UNIT – V

Object code generation: Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms, DAG for register allocation.

Text books:

1) A.V. Aho . J.D.Ullman, “Principles of compiler design”, Pearson Education.
2) Andrew N. Apple, “Modern Compiler Implementation in C”, Cambridge University Press.

References:

X. John R. Levine, Tony Mason, Doug Brown, “Lex & yacc”, O‟reilly.
Y. Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, “Modern Compiler Design” Wiley dreamtech.
Z. Cooper & Linda, “Engineering a Compiler”, Elsevier.
AA. Louden, “Compiler Construction”, Thomson.

COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes.

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1-4	Introduction, structure, Phases of Compilation.	**Understand** the basic compilers and compilation process	T1:1.1-1.8
5-8	Construction of regular grammar from regular expression NFA,DFA, common programming features	**Relate** regular grammar to programming feature	T1:35-3.7
9	Concept of pass and difference between pass and phase.	**Differentiate** Pass and Phases of translation	T1:3.3,T2:2.3
10	Bootstrapping and types of compiler.	**Design** of compiler for a language	T1:4.1
11-13	Lex-Lexical analyzer generator Derivations and parse tree regular expressions v/s context free grammar.	**Identify** Data structure in compilation Using lexical analyzer	T1:4.1
14-16	Backtracking, LL(1),Recursive decent parsing Finding FIRST and FOLLOW.	**Understand** Top down parsing techniques	T1:3.8,T2:2.5 T1:4.1, T2:3.1
17-20	Construction of parse tables, Predictive parsing.	**Construct** the parsing table for given inputs	T1:4.3
21-22	Shift reduce parsing, operator precedence parsing	**Understand** bottom up parsing techniques	T1:4.4
23-25	LR-SLR,LR(0)	**Differentiate** types of LR(0) parsers	T1:4.5
26-28	LALR,CLR.	**Differentiate** types of LR(1) parsers	T1: 4.6
29	Description of error recovery	**Construct** a parse tree for ambiguous grammar	T1: 4.7
30	Yacc parser generator	**Implement** parser generator	T1:4.8
31-32	Abstract syntax tree, three address code	**Implement** the construction of syntax trees	T1:4.9
33-35	Introduction to attributes grammars Syntax directed definitions, applications of SDD, implementing L-attributed SDD‟s	**Recognize** the semantics of grammar	T1:5.2
36-37	Control flow, back patching, switch statements	**Describe** the forms of intermediate code generation phases	T1:5.1.5.3,5.4
38-40	Rules, type conversions, Overloading, type inference and polymorphic functions.	**List** different types of language constructs	T1:8.1-8.6
41-43	Symbol table format, ordered and unordered symbol tables. Organization for block structures languages	**Summarize** the symbol table	T1:6.1-6.6
44-46	Static, runtime stack and heap storage allocations	**List** different types of storage allocation	T1:7.6
47-48	Storage allocation for arrays, strings and records	**Understand** storage allocations for data structures	T1: 7.7
48-50	Introduction for optimization. Local, global and scope optimization	**Understand** Various optimization techniques	T1:7.8-7.9
51-53	Basic blocks, flow graphs, loops, code	**Implementation** of basic block	T1:10.1-10.2

	motion, induction variables, reduction in strength	optimization techniques	
54-55	DAG construction, applications	**Construction** of DAG	T1:10.3-10.4
55-57	Data flow analysis of flow graphs. Flow graph, loops in flow graphs Representing data flow information, data flow equations for programming constructs	**Understand** the Data flow analysis	T1:10.5
58-60	Examples for sub expression elimination, Live variable analysis copy propagation and examples	**Implement** optimization on data flow graphs	T1:10.6-10.8 T2:9.1
61-62	Introduction, issues in code generation, object code forms Need of machine dependent code optimization, peephole optimization	**Understand** various code generation techniques	T1:10.9-10.13
63-65	Global register allocation, register assignment for outer loops Rearranging the order, heuristic ordering for DAGs, optimal ordering and labeling algorithm	**Implement** machine dependent optimizations	T1:10.12

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course	Program Outcomes												Program Specific Outcomes	
Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	S	S	S								S		H	S
II		S	H	S	S								S	H
III	H			S	H						S		S	S
IV	S			S	H						S		S	S
V		S		S	H								H	H
VI		H	S						S					S
VII		S			S						H		H	S

S - Supportive **H - Highly Related**

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course	Program Outcomes												Program Specific Outcomes	
Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H			S							S			
2	S	S	H	S	S						S			
3			H		H						S			

ASSIGNMENT

Course Name	**COMPILER DESIGN**
Course Code	CS602PC
Class	III B. Tech II Semester
Branch	Computer Science and Engineering
Year	2020-2021
Course Faculty	L DHANA LAKSHMI Assoc.Prof

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

ASSIGNMENT – I & II

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1.	**Convert** 01*+1 regular expression to finite automata?	Remember	2
2.	**Explain** phases of a compiler. Also write down the output for the following expression after each phase x= y*z+10?	Understand	1
3.	**Explain** the general format of a LEX program with example?	Apply	3
4.	**Define** regular expression? State the rules, which define regular expression?	Apply	2
5.	**Explain** the role lexical analyzer and issues of lexical analyzer?	Understand	1
6.	**Explain** the specification of tokens?	Apply	1
7.	**Define** Symbol table?	Apply	1
8.	**Explain** lexeme? Define a regular set?	Remember	2
9.	**Explain** the differences between pass and phase in detail and explain bootstrapping?	Understand	1
10.	**Consider** the grammar $S \rightarrow 0A\|1B\|0\|1 \quad A \rightarrow 0S\|1B\|1 \quad B \rightarrow 0A\|1S$ **Construct** left most derivations for parse trees for the sentence. i) 1100101 ii) 0101	Apply	3
11.	**Write** FIRST & FOLLOW, construct predictive parsing table for the following grammar $E \rightarrow TE'$ $E' \rightarrow +TE' / \varepsilon$ $T \rightarrow FT'$ $T' \rightarrow *FT'/\varepsilon$ $F \rightarrow (E) / id$	Analysis	2
12.	**Check** the following grammar is LL(1) or not and construct parsing table. S->AaAb/BbBa A-> ε B-> ε	Analysis	3
13.	**Explain** elimination of left recursion in the grammar E->E+T/T T->T*F/F	Analysis	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
	F->(E) /id		
14.	**Explain** top down parsing methods with example?	Understand	3
15.	**Analyze** whether the following grammar is LL(1) or not. Explain your answer with reasons. S → L, R S → R L → * R L → id R → L	Analysis	3
16.	**For** the operators given below, calculate the operator-precedence relations and operator precedence function. id, +, *, $	Apply	3
17.	**Check** whether the following grammar is a LL(1)grammar S→iEtS|iEtSeS|a E →b Also define the FIRST and FOLLOW procedures.	Apply	3
18.	**Define** the necessary conditions to be carried out before the construction of predictive parser?	Remember	4
19.	**Prepare** the predictive parser for the following grammar: S → a|b|(T) T → T, S|S Write down the necessary algorithms and define FIRST and FOLLOW. Show the behavior of the parser in the sentences, i. (a,(a,a)) ii. (((a,a),a,(a),a)	Apply	4
20.	Consider the following fragment of C code: float i, j; i = i*70+j+2; **Write** the output at all phases of the compiler for above „C" code.	Apply	1
UNIT – II			
1.	**Construct** SLR parsing table for S → CC C → aC / b	Apply	2
2.	**Construct** SLR parsing table for S → CC C → aC / b	Apply	2
3.	**Explain** Bottom up parsing method	Understand	2
4.	**Explain** shift reduce parsing method for the following grammar D → type tlist ; Tlist → tlist,id/id type → int/float with input string int id, id;	Apply	2
5.	**Explain** the error recovery in parsing.	Understand	2
6.	**State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing.	Understand	2
7.	**Prepare** a canonical parsing table for the grammar given below S → CC C → cC|d	Apply	2
8.	For the grammar given below, **calculate** the operator precedence relation and the precedence functions E →E + E|E- E|E * E|E / E|E .E|(E)|-E|id	Understand	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
9.	**Consider** the grammar given below. E→E+T E →T T→T*F T →F F→ (E) F→ id Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id.	Apply	2
10.	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. $S \rightarrow L,R$ $S \rightarrow R$ $L \rightarrow * R$ $L \rightarrow id$ $R \rightarrow L$	Analysis	2
1.	**State** L – attributed grammars and S- attributed 2grammars with an example?	Apply	2
2.	**Define** triple, Indirect triple, quadruples with examples?	Remember	2
3.	**Explain** Intermediate code representations?	Understand	2
4.	**Brief** about Syntax Directed Translator?	Apply	3
5.	**Explain** Abstract syntax trees with an example?	Understand	2
6.	**Define** type expression? Explain the equivalence of type expressions with an appropriate example?	Analysis	2

7.	**Generate** the three-address code for the following C program fragment
	while(a > b)
	{
	if (c < d)
	x = y + z;
	else
	x = y - z;
	}
		Understand	3

8.	**Explain** Intermediate code generation for Basic block, Control Flow and Boolean Expressions?	Apply	2
9.	**Explain** how declaration is done in a procedure using syntax directed translation?	Apply	2
10.	**List** the various ways of calling the procedures? Explain in detail?	Analysis	3
11.	**Explain** type expression, type system, simple type checker?	Understand	2
12.	**List** different data structures used for symbol table?	Remember	2
13.	**State** general activation record?	Understand	1
14.	**Explain** type checking for different expressions?	Understand	2
15.	a. **Explain** static and stack storage allocations? b. **Explain** the limitations of static allocation?	Understand	1
16.	**Write** short notes on the specification of a simple type checker?	Understand	2
17.	a. **Compare** three different storage allocation strategies? b. **Explain** symbol table organization using hashing?	Understand	1
18.	a. **List** the various attributes of a symbol table? b. **explain** symbol table organization using trees?	Understand	2
19.	**Describe** various forms of target programs?	Remember	1
20.	**Explain** heap storage allocation and static storage allocation?	Understand	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
1.	**Describe** 3 areas of code optimization?	Understand	1
2.	**Define** constant folding?	Understand	1
3.	**List** the advantages of the organization of code optimizer?	Understand	1
4.	**Explain** Local optimization and loop optimization in detail.	Understand	1
5.	**Define** Reduction in strength?	Understand	1
6.	**Define** Common Sub expressions?	Understand	1
7.	**Explain** runtime memory divisions?	Understand	1
8.	**Explain** peephole optimization?	Understand	1
9.	**Explain** in the DAG representation of the basic block with example.	Understand	1
10.	a. **Explain** copy propagation and Dead code elimination? **b. What** is live variable?	Remember	1
11.	a. **Explain** local and global common sub expression elimination? b. **Define** a flow graph. Explain how flow graph can be constructed for a given program?	Remember	1
12.	a. **Explain** code hoisting and elimination of loop invariant statements? b. **Explain** how? Redundant sub expression elimination? can be done at global level in a given program?	Understand	1
13.	a. **Describe** local optimization? b. **Explain** any three principal sources of code optimization?	Understand	2
14.	a. **Explain** strength reduction and code movement? b. **Define** basic block? write an algorithm for partitioning into blocks ?	Understand	2
15.	a. **Describe** peephole optimizations? b. **Explain** about loops in flow graphs ?	Understand	2
16.	a. **Explain** loop optimizations? b. **Describe** elimination of common sub expression and elimination of dead Code?	Understand	2
17.	a. **Explain** natural loops and inner loops of a flow graph with an example. b. **State** purpose of data flow analysis? Explain available expression and reaching definition?	Understand	2
18.	**a. Explain** strength reduction and code movement? **b. Define** basic block? write an algorithm for partitioning into blocks ?	Understand	2
19.	**a. Describe** peephole optimizations? **b. Explain** about loops in flow graphs ?	Understand	2
20.	**Explain** in detail the optimization technique "Strength Reduction"?	Understand	2
	UNIT – V		
1.	**Explain** register allocation and assignment?	Understand	1
2.	**Show** the code sequence generated by the simple code generation algorithm u := a – c v := t + u d := v + u//d live at the end	Apply	1
3.	**Explain** object code forms, generic code algorithm?	Understand	1
4.	**Explain** machine dependent and machine independent optimization?	Understand	1
5.	**List** different data flow properties? Define get reg( ) function?	Apply	1
6.	**Explain** about code generation?	Understand	1
7.	**List** various machine dependent code optimization techniques?	Understand	2
8.	**Explain** the different issues in the design of a code generator?	Understand	2
9.	a. **Describe** various register allocation optimization techniques with an example.	Apply	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
	b. **generate** code sequence for the following expression using code generation algorithm K :=(a-b) + (a-c) + (a-c)		
10.	a. **Explain** about directed acyclic graph (DAG) for register allocation? b. **Discuss** various forms of object code?	Apply	2

TUTORIAL QUESTION BANK

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S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
	UNIT-I		
	PART – A (SHORT ANSWER QUESTIONS)		
1	**Define** Complier briefly?	Understand	1
2	**Explain** the cousins of compiler?	Understand	1
3	**Define** the two main parts of compilation? What they perform?	Understand	1
4	**Explain how** many phases does analysis consists?	Understand	1
5	**Define** and explain the Loader?	Remember	3
6	**Explain** about preprocessor?	Remember	1
7	**State** the general phases of a compiler?	Understand	3
8	**State** the rules and define regular expression?	Remember	2
9	**Explain** a lexeme and define regular sets?	Remember	2
10	**Explain** the issues of lexical analyzer?	Understand	2
11	**State** some compiler construction tools?	Understand	3
12	**Define** the term Symbol table?	Understand	1
13	**Define** the term Interpreter?	Remember	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
14	**Define** the term Tokens in lexical analysis phase?	Understand	1
15	**Explain** about error Handler?	Understand	1
16	**Define** a translator and types of translator?	Understand	1
17	**Explain** about parser and its types?	Understand	1
18	**Construct** NFA for (a/b)* and convert into DFA?	Remember	2
19	**Define** bootstrap and cross compiler?	Understand	1
20	**Define** pass and phase?	Understand	3
21	**Analyze** the output of syntax analysis phase? what are the three general types of parsers for grammars?	Remember	1
22	**List** the different strategies that a parser can employ to recover from a syntactic error?	Understand	1
23	**Explain** the goals of error handler in a parser?	Understand	3
24	**Explain** why will you define a context free grammar?	Remember	3
25	**Define** context free language. When will you say that two CFGs are equal?	Remember	2
26	**Give** the definition for leftmost and canonical derivations?	Understand	4
27	**Define** a parse tree?	Understand	1
28	**Explain** an ambiguous grammar with an example?	Apply	1
29	**When** will you call a grammar as the left recursive one?	Apply	4
30	**List** different types of compiler?	Remember	1
	PART – B (LONG ANSWER QUESTIONS)		
1	**Define** compiler? State various phases of a compiler and explain them in detail.	Understand	1
2	**Explain** the various phases of a compiler in detail. Also writedow the output for the following expression after each phase a: =b*c-d.	Apply	1
3	**Explain** the cousins of a Compiler? Explain them in detail.	Understand	1
4	**Describe** how various phases could be combined as a pass in a compiler? Also briefly explain Compiler construction tools.	Remember	3
5	**For** the following expression Position:=initial+ rate*60 Write down the output after each phase	Apply	1
6	**Explain** the role Lexical Analyzer and issues of Lexical Analyzer.	Remember	1
7	**Differentiate** the pass and phase in compiler construction?	Remember	1
8	**Explain** single pass and multi pass compiler with example?	Understand	1
9	**Define** bootstrapping concept in brief?	Understand	1
10	**Explain** the general format of a LEX program with example?	Understand	3
11	**Construct** the predictive parser the following grammar: S->(L)|a L->L,S|S Construct the behavior of the parser on the sentence (a, a) using the grammar specified above	Apply	1

<table>
<tr><th>S. No.</th><th>Questions</th><th>Bloom's Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>12</td><td>Explain the algorithm for finding the FIRST and FOLLOW positions for a given non-terminal.
Consider the grammar,
E ->TE
E->+TE|@
T ->FT
T->*FT|@
F->(E)|id.
Construct a predictive parsing table for the grammar given above. Verify whether the input string id + id * id is accepted by the grammar or not.</td><td>Understand</td><td>3</td></tr>
<tr><td>13</td><td>Prepare the predictive parser for the following grammar:
S->a|b|(T)
T ->T, S|S
Write down the necessary algorithms and define FIRST and FOLLOW. Show the behavior of the parser in the sentences.
i.(a,(a,a))
ii.(((a,a),a,(a),a)</td><td>Apply</td><td>3</td></tr>
<tr><td>14</td><td>Explain operator grammar? Draw the precedence function graph for the following table.
<table>
<tr><td></td><td>A</td><td>(</td><td>)</td><td>,</td><td>$</td></tr>
<tr><td>a</td><td></td><td></td><td>></td><td>></td><td>></td></tr>
<tr><td>(</td><td><</td><td><</td><td>=</td><td><</td><td></td></tr>
<tr><td>)</td><td></td><td></td><td>></td><td>></td><td>></td></tr>
<tr><td>,</td><td><</td><td><</td><td>></td><td>></td><td></td></tr>
<tr><td>$</td><td><</td><td><</td><td></td><td></td><td></td></tr>
</table></td><td>Understand</td><td>3</td></tr>
<tr><td>15</td><td>Analyze whether the following grammar is LR(1) or not. Explain your answer with reasons.
S-> L,R
S-> R
L->*R
L-> id
R-> L.</td><td>Analysis</td><td>2</td></tr>
<tr><td>16</td><td>Difference between nondeterministic and deterministic finite automata</td><td>Understand</td><td>3</td></tr>
<tr><td>17</td><td>Construct regular grammar from regular expression</td><td>Understand</td><td>1</td></tr>
<tr><td>18</td><td>Explain the problems in top down parsing</td><td>Understand</td><td>2</td></tr>
<tr><td>19</td><td>Explain top down parsing algorithm in detail</td><td>Understand</td><td>3</td></tr>
<tr><td>20</td><td>Demonstrate left factoring with example</td><td>Understand</td><td>2</td></tr>
<tr><td colspan="4">PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Consider the following fragment of C code:
float i, j;
i = i*70+j+2;
Write the output at all phases of the compiler for above C code.</td><td>Apply</td><td>1</td></tr>
<tr><td>2</td><td>Construct an NFA for regular expression R= (aa | b) * ab convert it into an equivalent DFA.</td><td>Remember</td><td>2</td></tr>
</table>

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
3	**Describe** the languages denoted by the following regular expressions. i. (0+1)*0(0+1)(0+1) ii. 0*10*10*10*	Remember	2
4	**Explain** with one example how LEX program perform lexical analysis for the following PASCAL patterns Identifiers, Comments, Numerical constants, Keywords, Arithmetic operators?	Apply	3
5	**Check** whether the following grammar is a LL(1)grammar S-> iEtS|iEtSeS|a E-> b Also define the FIRST and FOLLOW.	Apply	2
6	**Consider** the grammar below E->E+E|E-E|E*E|E/E|a|b Obtain left most and right most derivation for the string a+b*a+b.	Apply	2
7	**Define** ambiguous grammar? Test whether the following grammar is ambiguous or not. E->E+E|E-E|E*E|E/E|E↑|(E)|-E|id	Apply	2
8	**State** the limitations of recursive descent parser?		3
9	**Convert** the following grammar into LL(1)grammar S->ABC A->aA|C B->b C->c.	Apply	3
10	**Write** a recursive descent parser for the grammar. bexpr->bexpr or bterm|bterm bterm->bterm and bfactor|bfactor bfactor->notebfactor|(bexpr)|true|false. Where ,or, and , not,(,),true, false are terminals of the grammar.	Apply	1
UNIT – II			
PART – A (SHORT ANSWER QUESTIONS)			
1	**Define** the term handle used in operator precedence?	Understand	1
2	**Define** LR(0) items in bottom up parsing?	Remember	1
3	**State** the disadvantages of operator precedence parsing?	Remember	1
4	**Explain** LR(k) parsing stands for ?	Understand	2
5	**Explain** why LR parsing is attractive one and explain?	Understand	1
6	**Define** goto function in LR parser with an example?	Understand	1
7	**Explain** why SLR and LALR are more economical to construct Canonical LR?	Understand	1
8	**Explain** about handle pruning?	Understand	1
9	**Explain** types of LR parsers?	Understand	1
10	**List** down the conflicts during shift-reduce parsing.	Remember	1
11	**Define** shift reduce parsing in detail	Understand	1
12	**Explain** conflicts in shift reduce parsing	Understand	1
13	**Explain** reduce conflicts with example	Understand	1
14	**Explain** precedence relations in detail	Understand	1
15	**Define** operator grammar with example	Understand	1
16	**Consider** the grammar E -> E + E|E *E|(E)| id Show the sequence of moves made by the shift-reduce parser on the input id1+id2*id3 and determine whether the given string is accepted by the parser or not.	Apply	2

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
17	i) **State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing. ii)For the grammar given below, calculate the operator precedence relation and the precedence functions E-> E + E|E- E|E * E|E / E|E E|(E)|-E|id	Understand	1
18	**Prepare** a canonical parsing table for the grammar given below S-> CC C->cC|d	Analysis	1
19	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. S -> L,R S-> R L->*R L -> id R->L.	Apply	1
20	i) **Consider** the grammar given below. E->E+T E->T T->T*F T->F F -> (E) F -> id Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id ii) Briefly explain error recovery in LR parsing.	Apply	1
21	**Explain** handle pruning in detail with example	Understand	1
22	**Demonstrate** stack implementation in implementation of shift reduce Parsing	Understand	1
23	**Explain** ways to determine precedence relations between pair of terminals	Understand	1
24	**Explain** operator precedence parsing algorithm	Understand	1
25	**Explain** LR parsers in detail with example	Understand	1
PART – B (LONG ANSWER QUESTIONS)			
1	Consider the grammar E->E + E|E *E|(E)| id.**Show** the sequence of moves made by the shift-reduce parser on the input id1+id2*id3 and determine whether the given string is accepted by the parser or not.	Apply	2
2	i) **State** shift-reduce parsing? Explain in detail the conflicts that may occur during shift-reduce parsing. ii)For the grammar given below, **calculate** the operator precedence relation and the precedence functions E -> E + E|E- E|E * E|E / E|E E|(E)|-E|id	Understand	2
3	**Prepare** a canonical parsing table for the grammar given below S-> CC C -> cC|d	Analysis	2
4	**Analyze** whether the following grammar is SLR(1) or not. Explain your answer with reasons. S->L,R S-> R L->*R L-> id R->L.	Apply	2

<table>
<tr><th>S. No.</th><th>Questions</th><th>Bloom's Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>5</td><td>Consider the grammar given below.
E->E+T

E->T

T->T*F

T->F

F->(E)

F-> id

Prepare LR parsing table for the above grammar .Give the moves of LR parser on id * id + id
ii) Briefly explain error recovery in LR parsing.</td><td>Apply</td><td>2</td></tr>
<tr><td>6</td><td>Explain handle pruning in detail with example</td><td>Understand</td><td>2</td></tr>
<tr><td>7</td><td>Demonstrate stack implementation in implementation of shift reduce Parsing</td><td>Understand</td><td>2</td></tr>
<tr><td>8</td><td>Explain ways to determine precedence relations between pair of terminals</td><td>Understand</td><td>2</td></tr>
<tr><td>9</td><td>Explain operator precedence parsing algorithm</td><td>Understand</td><td>3</td></tr>
<tr><td>10</td><td>Explain LR parsers in detail with example</td><td>Understand</td><td>2</td></tr>
<tr><td colspan="4">PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Explain the common conflicts that can be encountered in a shift-reduce parser?</td><td>Apply</td><td>3</td></tr>
<tr><td>2</td><td>Explain briefly, precedence functions. Construct the precedence graph using the following precedence tables.
<table>
<tr><td></td><td>+</td><td>*</td><td>)</td><td>Id</td><td>$</td></tr>
<tr><td>f</td><td>2</td><td>3</td><td>4</td><td>4</td><td>0</td></tr>
<tr><td>g</td><td>1</td><td>3</td><td>4</td><td>5</td><td>0</td></tr>
</table></td><td>Apply</td><td>2</td></tr>
<tr><td>3</td><td>Explain LALR parsing, justify how it is efficient over SLR parsing.</td><td>Remember</td><td>2</td></tr>
<tr><td>4</td><td>Analyze whether the following grammar is CLR(1) or not. Explain your answer with reasons
S -> L,R
S->R
L->*R
L-> id
R->L.</td><td>Analysis</td><td>2</td></tr>
<tr><td>5</td><td>Discuss error recovery in LL and LR parsing.</td><td>Remember</td><td>2</td></tr>
<tr><td>6</td><td>Construct SLR (1) Parsing table for following grammar
s-> xAy/xBy/xAz
A->as/q
B->q</td><td>Remember</td><td>2</td></tr>
<tr><td>2</td><td>Construct SLR (1) Parsing table for following grammar
s->0s0/1s1/10</td><td>Remember</td><td>1</td></tr>
<tr><td>2</td><td>Construct SLR (1) Parsing table for following grammar
s->aSbS/bsas/E</td><td>Remember</td><td>1</td></tr>
<tr><td>2</td><td>Construct LALR (1) Parsing table for following grammar
s->Aa/bAc/dc/bda
A->d</td><td>Remember</td><td>1</td></tr>
</table>

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
7	**Construct** LALR (1) Parsing table for following grammar s->Aa/aAc/Bc/bBa A->d B->d	Remember	2
	UNIT – III		
	PART – A (SHORT ANSWER QUESTIONS)		
1	**State** the benefits of using machine-independent intermediate form?	Remember	2
2	**List** the three kinds of intermediate representation?	Understand	2
3	**Explain how** can you generate three-address code?	Understand	2
4	**Define** syntax tree? Draw the syntax tree for the assignment statement. a :=b * -c + b * -c.	Apply	2
5	**Explain** postfix notation?	Remember	2
6	**Explain** the usage of syntax directed definition?	Apply	2
7	**Define** abstract or syntax tree?	Understand	2
8	**Show** the DAG for a: =b *-c + b * -c?	Apply	2
9	**Translate** a or b and not c into three address code?	Apply	2
10	**Define** basic blocks?	Understand	1
11	**Discuss** back-end and front-end?	Understand	1
12	**Define** the primary structure preserving transformations on basic blocks?	Understand	1
13	**List** common methods for associating actual and formal parameters?	Understand	1
14	**List** various forms of target programs?	Remember	1
15	**Define** back patching?	Understand	1
16	**List** different data structures used for symbol table?	Remember	3
17	**Explain** the steps to search an entry in the hash table?	Understand	3
18	**List** the different types of type checking? Explain?	Understand	3
19	**Explain** general activation record?	Understand	3
20	**State** the difference between heap storage and hash table?	Understand	3
	PART – B (LONG ANSWER QUESTIONS)		
1	**Explain** with an example to generate the intermediate code for the flow of control statements?	Apply	1
2	**List** the various ways of calling the procedures? Explain in detail?	Analysis	2
3	**Explain** 3addresscodes and mention its types. How would you implement the three address statements? Explain with suitable examples?	Apply	2
4	**Explain** how declaration is done in a procedure using syntax directed translation?	Apply	2
5	a) **Write** a note on the specification of a simple type checker. b) **Define** a type expression? Explain the equivalence of type expressions with an appropriate example.	Analysis	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome

6	**Generate** the three-address code for the following C program fragment
	while(a > b)
	{
	if (c < d)
	x = y + z;
	else
	x = y - z;
	}
		Understand	1

7	**Generate** the code for the following C statements using its equivalent three address code. a = b + 1 x = y+3 y = a/b a = b+c	Understand	1
8	**Describe** the method of generating syntax directed definition for control Statements?	Understand	2
9	**Explain** procedure calls with suitable example?	Understand	1
10	**Explain** Intermediate code generation for Basic block, Control Flow and Boolean Expressions?	Apply	1
11	**Write** about Quadruple and Triple with its structure?	Apply	1
12	**Explain** different schemes of storing name attribute in symbol table.	Understand	1
13	**Write** the advantages and disadvantages of heap storage allocation strategies?	Apply	2
14	**Distinguish** between static and dynamic storage allocation?	Understand	2
15	**Differentiate** between stack and heap storage?	Understand	2
16	**Demonstrate** semantic actions in semantic analysis	Understand	2
17	**Explain** translations on parse tree semantic analysis	Understand	1
18	**Explain** type checking in semantic analysis	Understand	2
19	**Explain** symbol table management in compiler design	Understand	2
20	**Demonstrate** hash tables by symbol table management	Understand	2
PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)			
1	**Suppose** that the type of each identifier is a sub range of integers, for expressions with operators +, -, *, div and mod, as in Pascal. Write type-checking rules that assign to each sub expression the sub range its value must lie in.	Understand	1
2	**Define** type expression? Write type expression for the following type i.Functions whose domains are functions from integers to pointers to integers and whose ranges are records consisting of an integer and a character.	Understand	1
3	**Write** an S-attributed grammar to connect the following with prefix rotator. L→E E→ E+T|E-T|T T→ T*F|T/F|F F→ P↑F|P P→ (E) P→ ID	Apply	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
4	**Construct** triples of an expression: a *- (b + c).	Apply	2
5	**Explain** SDD for Boolean expression with and without back patching?	Remember	2
6	**Explain why** are quadruples preferred over triples in an optimizing compiler?	Remember	2
7	**Explain** about reusing the storage space for names?	Remember	2
8	**Define** self-organizing lists? How can this be used to organize a symbol table? Explain with an example?	Apply	2
9	**Discuss** and analyze about all allocation strategies in run-time storage environment?	Understand	3
10	**Define** activation records? Explain how it is related with run-time storage organization?	Remember	3
11	Only one occurrence of each object is allowable at a given moment during program execution. **Justify** your answer with respect to static allocation?	Apply	3
12	**Explain** the use of Symbol table in compilation process? List out various attributes stored in the symbol table?	Understand	3
13	**List** the advantages and disadvantages of Static storage allocation strategies?	Understand	1
14	**Explain** the data structure used for implementing Symbol Table?	Understand	1
15	**Explain** the following: i) Static and Dynamic Checking of types ii) Over loading of Operators & Functions	Understand	1
1	**Explain** the principle sources of optimization?	Understand	2
2 2	**Explain** the patterns used for code optimization?	Understand	1
3	**Define** the 3 areas of code optimization?	Understand	1
4	**Define** local optimization?	Understand	1
5	**Define** constant folding?	Understand	1
6	**List** the advantages of the organization of code optimizer?	Understand	1
7	**Define** Common Sub expressions?	Understand	1
8	**Explain** Dead Code?	Understand	1
9	**Explain** the techniques used for loop optimization and Reduction in strength?	Understand	1
10	**Mention** the issues to be considered while applying the techniques for code Optimization?	Understand	1
11	**List** the different data flow properties?	Understand	1
12	**Explain** inner loops?	Understand	1
13	**Define** flow graph?	Understand	1
14	**Define** a DAG? Mention its Apply?	Understand	1
15	**Define** peephole optimization?	Understand	1
16	**Explain** machine instruction for operations and copy statement?	Understand	1
17	**Analyze** global data flow?	Understand	1
18	**Explain** about live variable analysis**?**	Understand	1
19	**Define** the term copy propagation?	Understand	2

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
20	**Explain** data flow equation?	Understand	2
1	**Explain** the principle sources of code optimization in detail?	Understand	1
2	**Explain** peephole optimization?	Understand	1
3	**Discuss** about the following i. Copy propagation ii. Dead code elimination iii. Code motion	Understand	1
4	**Explain** in the DAG representation of the basic block with example.	Understand	1
5	**Explain** Local optimization and loop optimization in detail	Understand	1
6	**Write** about Data Flow Analysis of structural programs?	Understand	1
7	**Explain** various Global optimization techniques in detail?	Understand	1

8	**Generate** target code for the given program segments:
	main()
	{
	int i=4,j;
	j = i + 5;
	}
		Apply	1

9	**Discuss** algebraic simplification and reduction in strength?	Understand	1
10	**Explain** the various source language issues?	Understand	1
11	**Explain** in detail the issues in design of a code generator?	Understand	1
12	**Demonstrate** the simple code generator with a suitable example?	Apply	1
13	**List** the different storage allocation strategies? Explain.	Understand	1
14	(a) **Write** the procedure to detect induction variable with example? (b) With example **Explain** dead code elimination?	Understand	2
15	(a) **Explain** how loop invariant computation can be eliminated? (b) **Explain** how "Redundant sub-expression eliminates" can be done in a given program?	Understand	2
16	**Explain** reachable code in code optimization	Understand	2
17	**Explain** characteristics of peep hole optimization	Understand	2
18	**Explain** depth first search in data flow analysis	Understand	2
19	**Explain** node splitting in data flow analysis	Understand	2
20	**Explain** depth first ordering in iterative algorithms	Understand	2
1	**Explain** how loop invariant computation can be eliminated?	Apply	3
2	**Describe** the procedure to compute in and out values using data flow equations for reaching definition in structured programs?	Apply	3

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome

3	**Consider** the following part of code.
	int main()
	{
	int n,k=0;
	scanf("%d",&n);
	for(i=2;i<n;i++)
	{
	if((n%I)==0)break;
	}
	k=1;
	if(i==n)
	printf("number is prime");
	else
	printf("number is not printed");
	}
	Identify the basic blocks in the given program & Draw the domination tree for the program
		Understand	1

4	**Construct** the DAG for the following basic block. D:=B*C E:=A+B B:=B+C A:=E-D	Apply	1

5	**Consider** the following program which counts the prime from 2 to n using the sieve method on a suitable large array, begin read n
	for i:=2 to n do
	a[i]:=true
	count=0;
	for i:=2 to n**.5 do
	if a[i]then
	begin
	count:=2*I to n j=j+1 do
	a[j]:=false end
	i. print count end
	ii. Propagate out copy statements wherever possible.
	iii. Is loop jamming possible? If so, do it.
	iv. Eliminate the induction variables wherever possible
		Apply	1

6	**Write** an algorithm to eliminate induction variable?	Apply	1
7	**Explain** how the following expression can be converting in a DAG. a+b*(a+b)+c+d	Apply	
8	**State** loop invariant computations? Explain how they affect the efficiency of a program?	Understand	1
9	**Explain** how "Redundant sub-expression Eliminates" can be done at global level in a given program?	Understand	1
10	**Explain** role of DAG in optimization with example?	Understand	1
1	**Explain** about machine dependent and machine independent optimization?	Remember	1
2	**Explain** the role of code generator in a compiler?	Understand	1
3	**Write** in detail the issues in the design of code generator.	Apply	1
4	**Show** the code sequence generated by the simple code generation	Apply	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
	Algorithm u := a – c v := t + u d := v + u//d		
5	**Explain** the instructions and address modes of the target machine?	Understand	2
6	**Identify** the register descriptor target code for the source language statement "(a-b) + (a-c) + (a-c);" The 3AC for this can be written as t := a – b	Understand	2
7	**Mention** the properties that a code generator should possess.	Apply	
8	**Explain** how do you calculate the cost of an instruction?	Understand	2
9	**Explain** how will you map names to values?	Understand	2
10	**Generate** the code for x: =x+1 for target machine?	Understand	2
11	**Explain** the input taken by code generation algorithm	Understand	2
12	**Mention** the applications of DAG	Apply	2
13	**Describe** register descriptors in detail	Understand	2
14	**Describe** address descriptors in detail	Understand	2
15	**Demonstrate** global register allocation with example	Understand	2

1	a) **Explain** the concept of object code forms?
	b) **Generate** optimal machine code for the following C program.
	main()
	{
	int i, a[10];
	while (i<=10)
	a[i] =0;
	}
		Apply	2

2	**Explain** Machine dependent code optimization in detail with an example?	Understand	2
3	(a) **Discuss** various object code forms? (b) **Write** a short note on code generating algorithms?	Understand	2
4	**Write** about target code forms and explain how the instruction forms effect the computation time?	Understand	2
5	**Consider** the following basic block of 3-address instructions: a := b + c x := a + b b := a – d c := b + c d := a – d y := a – d **Write** the next-use information for each line of the basic block?	Apply	2
6	**Demonstrate** register allocation by graph coloring	Understand	1
7	**Explain** the steps involved in Dag construction	Understand	1
8	**Demonstrate** code generation algorithm in detail	Understand	1
9	**Explain** the principle of dynamic programming in detail	Understand	1

S. No.	Questions	Bloom's Taxonomy Level	Course Outcome
10	**Explain** code generation by tree rewriting in detail	Understand	1
1	**Explain** how the instruction forms effect the computation time?	Apply	3
2	**Explain** how the nature of the object code is highly dependent on the machine and the operating system?	Apply	3
3	**Explain** why Next-use information is required for generating object code?	Apply	3
4	Efficient code generation requires the Remember of internal architecture of the target machine. **Justify** your answer with an Example?	Understand	3

5	**Generate** optimal machine code for the following wing c program.
	main()
	{
	int i,a[10];
	while(i<=10)
	a[i]=0;
	}
		Apply	3

6	**Generate** 3 address code for below code X = (a+b)- /((c+d)-e)	Apply	3

7	**Generate** 3 address code for below code
	For(i=1;i<=10;i++)
	If(a<b) then x = y + z
		Apply	3

8	**Generate** 3 address code for below code
	If a < b then
	While c > d do
	x = x+y
	else
	do
	p = p+q
	while e<=f
		Apply	3

9	**Generate** 3 address code for below code X = 1 X = y X = x++	Apply	3

10	**Generate** 3 address code for below code
	main( )
	{
	int i;
	int a[10];
	While(i<=0)
	a[i]=0;
	}
		Apply	2

Prepared by: **HOD, COMPUTER SCIENCE AND ENGINEERING**

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**INTELLECTUAL PROPERTY RIGHTS**			
Course Code	MC510			
Regulation	**R18-JNTUH**			
Course Structure	**Lectures**	**Tutorials**	**Practical**	**Credits**
	5	-	-	4
Course Faculty	**B SRINIVAS GOUD Asst.Prof**			

AI. COURSE OVERVIEW:

This course introduces the importance of intellectual property and the protection of creation or innovation or ideas which are to be used to make a product or service or design layout or process which is economical called patents, utilities etc. The course emphasizes on intellectual property protection and its importance of estimating the intelligence of an individual correlates with financial advantages. It also deals with fundamentals of laws to protect and encourage the inventions and creations. The main objective of this course is to examine the laws and the procedures to protect the intellectual property rights of an intellectual or expert and make it like another property which is non tangible. This course is presented to students by power point projections, lecture notes, course handouts, assignments, objective and subjective tests.

V. PREREQUISITE(S):

Level	Credits	Periods / Week	Prerequisites
UG	4	5	-

III. MARKS DISTRIBUTION:

Sessional Marks (25 Marks)	University End Exam Marks	Total Marks
Mid Semester Test There shall be 2 midterm examinations. Each midterm examination consists of subjective type and Objective type tests. The subjective test is for 10 marks, with duration of 1 hour. The objective type test is for 10 marks with duration of 20minutes. It consists of 10 Multiple choice and 10 fill in the blanks. The student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. Marks shall be awarded considering the average of two midterm examinations in each course reason whatsoever, will get zero marks(s).	75	100

IV EVALUATION SCHEME:

Mid Semester Test	25
End Semester Examination	75

BI. COURSE OBJECTIVES:

At the end of the course, the student will be able to:

1. Be familiar with different types of Intellectual Property (IP)
2. Be familiar with the Rights of Ownership
3. Be familiar with procedures of evaluation, registration, protection and acquisition of trademarks
4. Be familiar with Law of Intellectual Property
5. Explore knowledge in Trademarks, Copyrights, Patents and Trade Secrets
6. Adequate knowledge in New Developments in IP
7. Be familiar with auditing and advantages

IV. COURSE OUTCOMES:

1. Understand different types of Intellectual Property
2. List the International organizations and its functions to protect Intellectual Property
3. Explain in detail about agencies and treaties related to Intellectual Property Rights.
4. Explain the importance of Intellectual Property Rights
5. Explain the purpose and function of Trademarks
6. Explain the acquisition of Trademark Rights
7. Explain the Trademark Evaluation, Registration Processes
8. Describe the fundamentals of Copyright Law
9. Explain the originality of material and Rights or reproduction
10. Illustrate international Copyright law with respect to ownership and registration of Copyrights
11. Explain the patent searching processes and transfer of ownership on patents
12. Explain Trade Secrets determination, misappropriation, protection for submission and litigation
13. Explain the New International Developments in Trademarks Law and Copyright Law and Patent Law
14. Explain the New International Developments in Copyright Law and Patent Law Explain Intellectual Property Audits

1 HOW COURSE OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	H	Assignments
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the	S	--

Program Outcomes		Level	Proficiency assessed by
	public health and safety, and the cultural, societal, and environmental considerations		
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	H	Designing, Exercises
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	S	Designing .
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	S	Prototype Models
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	S	Document Preparation, Presentation
PO11	**Project Management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	S	Assignments
PO12	**Life-long learning**:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	H	Assignments

N = None **S = Supportive** **H = Highly Related**

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

SYLLABUS:

UNIT – I
INTRODUCTION TO INTELLECTUAL PROPERTY:
Introduction, Types of Intellectual Property (IP), International Organizations, Agencies and treaties, Importance of Intellectual Property Rights.

UNIT - II
TRADE MARKS:
Purpose and Function of Trademarks, Acquisition of Trademarks Rights, Protectable Matter, Selecting and Evaluating Trademark, Trademark Registration Processes

UNIT - III
LAW OF COPYRIGHTS:
Fundamentals of Copyrights Law, Originality of Material, Rights to Reproduction, Rights to Perform the Work Publicly, Copyright Ownership issues, Copyright Registration, Notice of Copyright, International Copyright Law.
LAW OF PATENTS:
Foundation of Patent Law, Patent searching Process, Ownership Rights and transfer

UNIT - IV
TRADE SECRETS:
Trade Secrets Law, Determination of trade Secrets Status, Liability for misappropriations of Trade Secrets, Protection for submission, Trade Secrets Litigation

UNFAIR COMPETITION: Misappropriation of Right of Publicly, False Advertising

UNIT – V
NEW DEVELOPMENTS OF INTELLECTUAL PROPERTY:
New Developments in Trade Law, Copyright Law, Patent Law, Intellectual Propety Audits
International overview of Intellectual Property, International-Trademark Law, Copyright Law, International Patent Law, International Development in Trade Secrets Law

TEXT BOOKS:

1. Deborah.E.Bouchoux, "Intellectual Property Right", Cengage Learning
2. Prabuddha Ganguli, "Intellectual Property Right", Unleashing the knowledge economy", Tata Mc.Graw Hill Publishing Company Ltd.

COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	CLO	Unit	Course Learning Outcomes	Topics to be covered	Reference
1-5	1	I	**Describe** different types of Intellectual Property	Introduction of Intellectual Property (IP), Types of IP	T1:1.1, T1:1.2
6-8	2		**Describe** the organizations	International Organizations	T1:1.4
9-11	3		**List** Agencies and treaties related to Intellectual Property	Agencies and Treaties	T1:1.4
12-13	4		**Understand** the different Laws in IP	Importance of Intellectual Property Rights	T1:1.5
14-16	5	II	**Understand** the purpose and function of trademarks	Purpose and function of Trademarks	T1:2.2
17-20	6		**Describe** acquisition of trademark rights and protectable matter	Acquisition of Trademarks Rights and Protectable Matter	T1:2.4, 2.9
21-23	7		**Describe** the evaluation of trademark and its selection	Selecting and Evaluating Trade Mark	T1:3.1

Lecture No.	CLO	Unit	Course Learning Outcomes	Topics to be covered	Reference
24-26	8		**Elevate** trademark Registration Processes	Trademark Registration Processes	T1:4.5
27-30	9	III	**Understand** fundamentals of Copyright Law	Fundamentals of Copyright Law	T1:10.2
31-32	10		**Understand** Originality of material and rights of reproduction	Originality of material and rights of Reproduction	T1:11.2
33-36	11		**Explain** the rights to perform the work publicly, copyright ownership and copyright registration	The Rights to perform the work publicly, Copyright ownership issues and Copyright registration	T1:11.5, T1:12.1, T1:13.4
37-40	12		**Know** International Copyright law and notice of copyright	Notice of copyright, International Copyright Law	T1:16
41-43	13		**Explain** the foundation of patent law	Foundation of patent Law	T1:17
44-46	14		**Explain** the patent searching process	Patent Searching Process	T1:18.1
47-48	15		**Learn** patent ownership rights and transfer	Ownership Rights and Transfer	T1:19
49-50	16	IV	**Describe** Trade Secret Law and determine trade secret status	Trade Secrets Law, Determination of Trade Secrets status	T1:2.1, T1:2.3, T1:22.2
51-53	17		**Identify** liability for misappropriation of trade secrets	Liability for misappropriations of Trade Secrets	T1:22.2
54-56	18		**Identify** trade secrets litigation	Protection for submission, trade secrets Litigation	T1:22.5, T1:22.8
57-59	19		**Describe** misappropriation right of publicity	Unfair Competition: Misappropriation of right of publicly	T1:23
60-63	20		Identify False advertising	False advertising	T1:23.3
64-65	21	V	**Describe** new developments in Trade Law	New developments in Trade Law	T1:7
66-67	22		**Describe** new developments in Copyright law	New developments in Copyright Law	T1:8
68-69	23		**Describe** new developments in patent law	New developments in Patent Law	T1:15.7
70-71	24		**Understand** IP audits	Intellectual Property Audits	T1:16
72-73	25		**Understand** International Overview of IP	International Overview of IP	T1:21.1,2
74-75	26		**Understand** International Trademark Law	International Trademark Law	T1:21.1, 2
76-77	27		**Understand** International Copyright law	International Copy right Law	T1:24.2
78-79	28		**Understand** International Patent Law	International patent Law	T1:24.2
80-83	29		**Understand** International Trade Secrets Law	International Development in Trade Secrets Law	T1:24.2

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAMME OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H	H	S	S	S	H		H		S		S	H	S
II	H	H	S										H	S
III	H	H	S	S				S				S	S	H
IV	H	H						S				S	H	S
V	H	H						S					H	

S = Supportive **H = Highly Related**

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H	S	S	S	S	H		S		S		S	H	S
2	S	H	S	S	S	S		H		S		S	S	H
3	S	S	S	S	S	H		S		S		S	H	S
4	S	S	S	S	S	S		S		S		S	S	H
5	H	S											S	H
6	H			S								S	H	S
7	S			H									S	H
8	S	H											H	S
9			H	H	S							S	S	H
10	H			S									S	H
11	H			S	S								H	S
12	H		H									S	S	H
13	H		S							S		S	S	
14	H		S							S		S	S	

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	**INTELLECTUAL PROPERTY RIGHTS**
Course Code	MC510
Class	III B. Tech II Semester
Branch	Computer Science and Engineering
Year	2020– 2021
Course Faculty	**B SRINIVAS GOUD Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

ASSIGNMENT-I

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-I		
1	**Explain** different types of intellectual property in detail?	Understand	1
2	**Explain** the functions of international intellectual property organizations?	Understand	1
3	**Explain** the agencies and treaties of intellectual property?	Understand	8
4	**Describe** the importance of intellectual property rights?	Knowledge	4
5	**Describe** about IPR? Do you think this is useful rights for us? Explain	Knowledge	4
6	**Explain** about International Organizations, Agencies, and Treaties?	Understand	4
7	**Discuss** whether the following items would be protectable as trademarks, copyrights, patents, or trade secrets: „Freeze You" as the name of a new type of ice cream a company"s plans for its future business operations and possible mergers a new type of rose a new slogan to be used by Burger King a new novel by Toni Morrison	Understand	4
8	**Distinguish** between Trademark and Trade secrets.	Understand	4
9	**Explain** why agencies responsible for Intellectual Property Registration with any two examples?	Understand	1
10	**Describe** the importance of International organisation? When it was established?	Knowledge	1
S. No	**Question**	**Blooms Taxonomy Level**	**Course Outcome**
	UNIT – II		
1	**Explain** acquisition of trademark rights?	Understand	4
2	**Write** the procedure for Selecting and evaluating of trademark?	Apply	4
3	**Discuss** the functions of trademark?	Understand	1
4	**Describe** Protectable matter?	Knowledge	1
5	**Explain** trademark registration processes?	Understand	3
6	**Discuss** the method of protecting the prior-used trademarks in the system of acquisition-through-registration?	Understand	3
7	**Explain** the reasons for protecting trademarks in the system of acquisition?	Understand	5
8	**Discuss** new developments in Trademark Law? How do you avoid cyberspace trademark issues?	Understand	2
9	**Explain** how do you select and evaluate Trademark?	Understand	1
10	**Explain** about the process of Trademark?	Understand	1
	UNIT – III		
1	**Explain** about copyright Law and when it was founded?	Apply	6
2	**Discuss** about the Rights under the 1976 copyright act?	Understand	5
3	**Explain** the subject matter of copyright?	Understand	9
4	**Explain** the fundamental of Copyright Law?	Understand	8
5	**Define** the originality of material and how it is identified?	Knowledge	5
6	**Explain** the rights afforded by copyright law?	Understand	9
7	**Discuss** the rights of reproduction?	Understand	9
8	**Discuss** about "the rights to perform the work publicly" and explain it.	Understand	5

9	**Explain** copyright ownership issues?	Understand	9
10	**Explain** when the terminations of transfers of copyrights take place?	Understand	8

ASSIGNMENT-II

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
1	**Explain** how the ownership rights and transfers are taken place?	Understand	5
2	**Write** about the notice of copy right.	Apply	8
3	**Describe** about copy rights.	Knowledge	5
4	**Explain** how the patent searching process is taken place?	Understand	9
5	**Discuss** about copy rights.	Understand	9
6	**What** did you understand about Law of patents?	Understand	8
7	**Write** about the procedure for „the notice of the copy right" is prepared.	Apply	7
8	**Define** the rights of ownership issues.	Knowledge	9
9	**Write** surplusage in Copyright Notice.	Apply	9
10	**Describe** the procedure restoration of Copyright is done.	Knowledge	8
	UNIT – IV		
1	**Define** Trade Secrets Law? Explain about Trade Secrets Law.	Knowledge	13
2	**Explain** the liability for misappropriation of trade secrets?	Understand	11
3	**Illustrate** Trade Secret Litigation.	Understand	10
4	**Discuss** about trade secret protection programs. Explain?	Understand	10
5	**Write** about new development in International trade secrets law. What are they?	Apply	9
6	**Explain** about unfair competition? Write its types?	Understand	9
7	**Discuss** right of publicity. Explain?	Understand	9
8	**Discuss** Misappropriation in Trade Secrets and how the Right of Publicity help in misappropriation?	Understand	9
9	**Discuss** whether the New Developments in the Right of Publicity is necessary, if so in what way.	Understand	9
10	**Explain** false advertising with examples?	Understand	8
	UNIT – V		
1	**Explain** about the new developments in Trademark law?	Understand	12
2	**Discuss** how you protect a domain name. Explain the precautionary steps to be taken for protecting domain name in trademark?	Understand	12
3	**Explain** how the cyber crime can control in trademark? How you hyperlink?	Understand	12
4	**Explain** cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	12
5	**Discuss** new development in protecting copyright law. What are they? Explain?	Understand	12
6	**Explain** how a copyright protection is overcoming the cyber crime?	Understand	12
7	Describe about copyright protection act? How the copyright protection for automated database is processed?	Knowledge	13
8	**Explain** copyright in the electronic age?	Understand	11
9	**Describe** the digital millennium copyright act?	Knowledge	13
10	**Explain** the new developments in copyright and recent developments in copyright law?	Understand	13

TUTORIAL QUESTION BANK

Course Name	**INTELLECTUAL PROPERTY RIGHTS**
Course Code	MC510
Class	III B.Tech II Semester
Branch	Computer Science and Engineering
Year	2020 – 2021
Course Faculty	**B SRINIVAS GOUD Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education? The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner"s learning process.

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Define** intellectual property?	Knowledge	1
2	**Discuss** intellectual property rights?	Understand	1
3	**Discuss** condition of purchase a book and make photocopies of it and sell, Is it violation?	Understand	8
4	**Explain** with an example of why intellectual properties need to be protected?	Understand	4
5	**Describe** how monopoly nature of owner is controlled by Patent Trademark Organization?	Knowledge	4
6	**Describe** how long will patent protections for the invention for which application was filed on August 10 and patent was issued on January 28, 2003 last?	Knowledge	4
7	**Explain** how long will the copy right last if a novel written by Moby Dick in 1851 and died in 1891?	Understand	4
8	**Explain** how long will protections for the song composed by bala in1982 last?	Understand	4
9	**Define** trademark?	Knowledge	1
10	**Define** service mark?	Knowledge	1
11	**Explain** united states trademark law from which time trademark is considered?	Understand	3
12	**Explain** the time validity for registered trademark?	Understand	3
13	**Explain** the additional period of protection with trademark renewal?	Understand	5
14	**Discuss** the protection time period for utility and plant patents?	Understand	2
15	**Explain** the protection time period for design patents?	Understand	11
16	**Define** Trade Secrets?	Knowledge	13
17	**Explain** which type of IPR is preferable for a Jewellery design item; design patent or copyright?	Understand	11
18	**Explain** significant changes to US intellectual property law from General	Apply	3

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	Agreement on Tariffs and Trade (GATT)?		
19	**Explain** the functions of united nations agency for promoting Intellectual property?	Understand	12
20	**Explain** Paris Convention?	Understand	4
21	**Write** a short note on Berne Convention?	Apply	4
22	**Explain** Madrid Protocol?	Understand	12
23	**Write** the duties of NAFTA?	Apply	4
24	**Define** Trademark?	Understand	12
25	**Write** the importance of IP?	Knowledge	11
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** different types of intellectual property in detail?	Understand	1
2	**Explain** the functions of international intellectual property organizations?	Understand	1
3	**Explain** the agencies and treaties of intellectual property?	Understand	8
4	**Describe** the importance of intellectual property rights?	Knowledge	4
5	**Describe** about IPR? Do you think this is useful rights for us? Explain	Knowledge	4
6	**Explain** about International Organizations, Agencies, and Treaties?	Understand	4
7	**Discuss** whether the following items would be protectable as trademarks, copyrights, patents, or trade secrets: a) „Freeze You" as the name of a new type of ice cream b) a company"s plans for its future business operations and possible mergers c) a new type of rose d) a new slogan to be used by Burger King e) a new novel by Toni Morrison	Understand	4
8	**Distinguish** between Trademark and Trade secrets?	Understand	4
9	**Explain** why agencies responsible for Intellectual Property Registration with any two examples?	Understand	1
10	**Describe** the importance of International organisation? When it was established?	Knowledge	1
11	**Explain** why the International Organization, Agencies and Treaties were established? Give any Five International agreements and treaties that affect Intellectual property?	Understand	3
12	**Explain** the reasons for increasing importance for Intellectual Property Rights?	Understand	3
13	**Explain** the International organizations, Agencies and treaties?	Understand	5
14	**Explain** Federal Registration of Trademarks?	Understand	2
15	**Describe** why Trade Secrets are necessary? how do they function?	Knowledge	5
16	**Explain** the functions of INTA, WIPO?	Knowledge	1
17	**Express** your views about the Intellectual Property Rights necessity for the countries?	Understand	1
18	**Explain** about patent?	Understand	8
19	**Explain** about different types of Intellectual property??	Understand	4
20	**Write** about the following terms: a) Trademark and Service marks b) Copyrights c) Patent d) Trade Secrets	Apply	4
21	**Explain** the scope of searching in Trademark?	Understand	5

S.No	Questions	Blooms Taxonomy Level	Course Outcome
22	**Write** the procedure for "use of mark" owned by Third parties?	Understand	2
23	**Write** the New Development in Assignment of Domain Names under Trademark	Knowledge	5
24	**Explain** cybersquatters and the dilution doctrine under protecting a Domain name in Trademark?	Knowledge	1
25	**Explain** Cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	1
	Part – C (Problem Solving and Critical Thinking)		
1	**Categories** whether the following items would be protectable as trademark, Copyrights, Patents or Trade Secrets: a) a vacuum cleaner (the name of a new type of ice cream) b) a company"s plans for its future business operations and possible mergers c) a new type of rose d) a new slogan to be used by Burger King e) a new novel by Toni Morrison	Apply	1
2	**Analyze** Mc Donald"s Corporation has filed a trademark application for MCMAGIC MIXERS for new condiment blends, will the mark is protectable if so explain?	Analyze	1
3	**Discriminate** types of copyrights in cinema autography in India?	Understand	8
4	**Estimate** the time period for the protection of son "Allentown" was composed Billy Joel in 1982?	Analyze	4
5	**Calculate** the loss occurred to the US for infringement in IP and counterfeiting of goods and piracy	Analyze	4
	UNIT – II		
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Explain** the purpose of Trademark?	Understand	3
2	**Define** goodwill?	Knowledge	2
3	**Explain** the origin function of trademark?	Understand	2
4	**Explain** the trademark rights arise in law of United states?	Understand	3
5	**Explain** the Quality guarantee in function of trademark?	Understand	5
6	**Explain** the Advertising function of trademark?	Understand	4
7	**Write** about the procedure for recognizing trademark in France?	Apply	4
8	**Define** the uses of acquisition of Trademark rights?	Knowledge	3
9	**Give** examples for acquisition of Trademark rights taken place?	Understand	4
10	**Explain** how protectable matter did rises and on what basis it is adopted?	Understand	4
11	**Define** evaluating trademark?	Knowledge	4
12	**Evaluate** the trademark?	Analyze	3
13	**Explain** how the trademarks and service marks properly identified and used?	Understand	7
14	**Classify** the types of marks?	Understand	6
15	**Give** examples for trade mark selection?	Understand	7
16	**Write** about Indian Trade mark law?	Apply	7
17	**Write** the scope for searching the state trademark?	Apply	6
18	**Discuss** the conflicts of trademarks?	Understand	8
19	**Explain** the procedure for evaluating Trademark?	Understand	6
20	**Write** the classes in Service mark?	Understand	1
21	**Write** the types of Marks?	Knowledge	6
22	**Write** the procedure of Trademark search?	Understand	7

S.No	Questions	Blooms Taxonomy Level	Course Outcome
23	**Explain** duty to search for Trademark?	Understand	6
24	**Discuss** types of searching process?	Understand	7
25	**Write** the duty of an applicant in selecting a Trademark?	Knowledge	9
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** acquisition of trademark rights?	Understand	4
2	**Write** the procedure for Selecting and evaluating of trademark?	Apply	4
3	**Discuss** the functions of trademark?	Understand	1
4	**Describe** Protectable matter?	Knowledge	1
5	**Explain** trademark registration processes?	Understand	3
6	**Discuss** the method of protecting the prior used trademarks in the system of acquisition-through-registration?	Understand	3
7	**Explain** the reasons for protecting trademarks in the system of acquisition?	Understand	5
8	**Discuss** new developments in Trademark Law? how do you avoid cyberspace trademark issues?	Understand	2
9	**Explain** how do you select and evaluate Trademark?	Understand	1
10	**Explain** about the process of Trademark?	Understand	1
11	**Explain** how the investigation is taken place in resolving conflicts?	Understand	8
12	**Explain** the methods used in preparing the application in Trademark registration?	Understand	4
13	**Explain** the Principal and Supplemental Registers?	Understand	4
14	**Write** the procedure of the trademark registration?	Apply	4
15	**Explain** the Post registration procedures?	Understand	4
16	**Discuss** about the advantages of Trademark use and compliance policies?	Knowledge	4
17	**Describe** the Procedure for transfer of ownership in Trademarks?	Understand	1
18	**Explain** about Inter partes and inter partes proceedings? What is the role of Inter partes?	Understand	1
19	**Explain** Infringement of Trademarks?	Understand	3
20	**Discuss** about the methods of preparing the Trademark application?	Understand	3
21	**Write** the Rights afforded by Copyright Law?	Knowledge	1
22	**Discuss** the Rights to display the work publically?	Understand	3
23	**Explain** the effects of works made for hire?	Understand	3
24	**Write** the different types of Application Forms in Copyright?	Knowledge	1
25	**Explain** the searching process in copyright office records?	Understand	3
	Part – C (Problem Solving and Critical Thinking)		
1	**Devise** an application for registration of different types of marks in PTO and an Indian IPR organization?	Understand	3
2	**Distinguish** the register mark AVALON BAY PERFUME and AVALAR BAY PERFUME? Discuss whether the marks are confusingly similar and will they accepted by the PTO, explain?	Knowledge	2
3	**Illustrate** the basis for filling application and methods of use with appropriate acts	Analyze	2
4	**Describe** the type of specimen that would support use of the following marks: PLAYROOM (for child care center services) AQUARIUM (for restaurant services)	Understand	3
5	**Explain** if an application for INTEGRA COMPUTER SERVICES (for computer consulting services) is refused registration on the basis that the mark is merely descriptive, how the applicant should respond?	Understand	5

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
	PART A (SHORT ANSWER QUESTIONS)		
1	**Define** the law of copyrights?	Knowledge	6
2	**Write** the Fundamental of Copyrights laws was formulated	Apply	5
3	**Discuss** the originality of material in copyrights?	Understand	9
4	**Explain** the rights of reproduction in copy rights?	Understand	8
5	**Write** the procedure of „rights to perform the work publicly" in copy rights?	Apply	5
6	**Explain** how the copy right ownership issues are solved?	Understand	9
7	**Explain** how the copy rights are registered?	Understand	9
8	**Discuss** the Foundation of patent law?	Understand	5
9	**Describe** the advantages of Law of patent?	Knowledge	9
10	**Illustrate** patent searching process?	Analyze	8
11	**Explain** how the ownership rights and transfers are taken place?	Understand	5
12	**Write** about the notice of copy right?	Apply	8
13	**Describe** about copy rights?	Knowledge	5
14	**Explain** how the patent searching process is taken place?	Understand	9
15	**Discuss** about copy rights?	Understand	9
16	**What** did you understand about Law of patents?	Understand	8
17	**Write** about the procedure for „the notice of the copy right" is prepared?	Apply	7
18	**Define** the rights of ownership issues?	Knowledge	9
19	**Write** surplusage in Copyright Notice?	Apply	9
20	**Describe** the procedure restoration of Copyright is done?	Knowledge	8
21	**List** out the copyright excluded from protection?	Knowledge	8
22	**Explain** "Works made for Hire"?	Apply	7
23	**Write** the types of Application?	Knowledge	7
24	**Write** the procedure of filing the application?	Understand	8
25	**Write** the importance of Copyright Notice?	Apply	7
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** about copyright Law and when it was founded?	Apply	6
2	**Discuss** about the Rights under the 1976 copyright act?	Understand	5
3	**Explain** the subject matter of copyright?	Understand	9
4	**Explain** the fundamental of Copyright Law?	Understand	8
5	**Define** the originality of material and how it is identified?	Knowledge	5
6	**Explain** the rights afforded by copyright law?	Understand	9
7	**Discuss** the rights of reproduction?	Understand	9
8	**Discuss** about "the rights to perform the work publicly" and explain it?	Understand	5
9	**Explain** copyright ownership issues?	Understand	9
10	**Explain** when the terminations of transfers of copyrights take place?	Understand	8
11	**Explain** when the duration of copyright act come into force?	Understand	5
12	**Explain** the procedure for fill the application and registration of copyright?	Understand	8
13	**Explain** the copyright notice and when it is issued?	Understand	5
14	**Discuss** about copyright infringement? Explain?	Understand	9
15	**Differentiate** Contributory Infringement and Vicarious Infringement?	Understand	9
16	**Discuss** about new developments in copyright law? What are they?	Understand	8
17	**Explain** the international copy right law?	Understand	7

S.No	Questions	Blooms Taxonomy Level	Course Outcome
18	**Define** Patentability? Explain the utility of patents?	Knowledge	9
19	**Write** about the need of patent searching? Explain?	Apply	9
20	**Explain** the process of the Patent Application?	Understand	8
21	**Explain** the Digital Millennium Copyright Act?	Understand	8
22	**Discuss** New development in Copyright?	Understand	7
23	**Discuss** New development in Patent?	Knowledge	9
24	**Explain** Vessel Hull Protection in Copyright?	Understand	
25	**Write** the Gray Market Goods?	Knowledge	9
	Part – C (Problem Solving and Critical Thinking)		
1	**Classify** the following as likely copyrightable or not copyrightable: a) a live broadcast of a radio program; b) a speech written for the secretary of defence; c) the artwork for the cover of a CD; d) a new method of calculating the value of business;	Analyze	6
2	**Analyze** a highly stylized electric mixer be copyrightable? Discuss?	Understand	5
3	**Analyze** if two artists each paint an oil painting of Niagara Falls, which painting receives copyrights protection? Discuss?	Understand	9
4	**Describe** the principles governing while a purchased book is later sold to others?	Knowledge	8
5	**Explain** the violation of copyrights in dramatic performances on television channels and cinema autography?	Knowledge	5
	UNIT – IV		
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Write** about Trade secrets?	Apply	9
2	**Explain** the determination of trade secrete status?	Understand	9
3	**Determine** the affect for misappropriations of trade secrets?	Apply	12
4	**Write** the procedure to be followed for protection for submission?	Apply	11
5	**Discuss** about trade secrets?	Understand	11
6	**Explain** liability for misappropriation of trade secrets?	Understand	12
7	**Discuss** about the protection for submission?	Understand	11
8	**Explain** defences to Trade Secret Misappropriation? Give to remedies for Misappropriation?	Understand	12
9	**Define** trade secret protection programs?	Knowledge	12
10	**Describe** trade secret protection program	Understand	12
11	**Explain** about the new developments in International Trade secrets law?	Understand	12
12	**Write** five physical protections in trade secret protection program?	Apply	12
13	**Write** four written agreements? Briefly explain them?	Apply	12
14	**Discuss** unfair competition?	Understand	12
15	**Discuss** about unfair competition act? When it came into existence?	Understand	12
16	**Describe** the unfair competition act is useful in the trademarks?	Understand	8
17	**Write** about two unfair competitions?	Apply	11
18	**Write** about misappropriation under unfair competition?	Apply	12
19	**What** is Right of Publicity?	Understand	12
20	**Discuss** about false advertising?	Understand	12
21	**Discuss** whether written agreement is compulsory or not in Trade secret?	Understand	12
22	**Write** the relationship between Employer and Employee in a Trade Secret?	Understand	8

S.No	Questions	Blooms Taxonomy Level	Course Outcome
23	**List** out the defences to trade secret misappropriation?	Apply	11
24	**Write** four examples for False advertising?	Apply	12
25	**Explain** five New International Development in Trade secrets?	Understand	12
	PART - B (LONG ANSWER QUESTIONS)		
1	**Define** Trade Secrets Law? Explain about Trade Secrets Law?	Knowledge	13
2	**Explain** the liability for misappropriation of trade secrets?	Understand	11
3	**Illustrate** Trade Secret Litigation?	Understand	10
4	**Discuss** about trade secret protection programs? Explain?	Understand	10
5	**Write** about new development in International trade secrets law? What are they?	Apply	9
6	**Explain** about unfair competition? Write its types?	Understand	9
7	**Discuss** right of publicity? Explain?	Understand	9
8	**Discuss** Misappropriation in Trade Secrets and how the Right of Publicity help in misappropriation?	Understand	9
9	**Discuss** whether the New Developments in the Right of Publicity is necessary, if so in what way?	Understand	9
10	**Explain** false advertising with examples?	Understand	8
11	**Discuss** about the regulations taken by the Federal Trade Commission?	Understand	8
12	**Define** product disparagement? Explain them	Knowledge	8
13	**Explain** how the infringement of trade dress is involved in trade mark?	Understand	8
14	**Describe** defences to secret misappropriation?	Knowledge	8
15	**Explain** about the remedies for misappropriation in Trade Secrets?	Understand	8
16	**Discuss** about trade secret litigation?	Understand	9
17	**List** out the new developments in International Trade Secrets?	Knowledge	9
18	**Explain** the liability for misappropriation of trade secrets taken place?	Understand	9
19	**Describe** the determination of trade secret status?	Knowledge	9
20	**Explain** the product disparagement in unfair competition?	Understand	9
21	**Explain** with suitable examples about patentable subject matter?	Understand	10
22	**Write** the methods of Patent searching process?	Apply	9
23	**Explain** about patent infringement Litigation?	Understand	9
24	**Write** five new developments in International Patent?	Understand	9
25	**Write** the remedies in patents infringement?	Understand	9
	Part – C (Problem Solving and Critical Thinking)		
1	**Explain** the action taken by PepsiCo? On a competitor selling another type of cola beverage in Pepsi bottles?	Knowledge	11
2	**Discuss** what type of trademark dilution is involved for each of the following: a) Nestle pens; b) Lexus photocopiers c) Mattel"s Head Shop (for a shop selling drug paraphernalia)	Knowledge	13
3	**Classify** the liability for misappropriation of trade secrets?	Analyze	10
4	**Explain** different types of remedies for misappropriation from a court?	Knowledge	10
5	**Discuss** the remedies for Mr Woods for using his photograph in the following: a) an advertisements for golf clubs b) a new story about young golfers; and c) an advertisement for pizza	Understand	9
	UNIT – V		

S.No	Questions	Blooms Taxonomy Level	Course Outcome
	PART - A (SHORT ANSWER QUESTIONS)		
1	**Discuss** New Developments in Patent Law?	Understand	13
2	**Write** about International patent protection?	Apply	11
3	**Explain** how the International patent protection act is used?	Understand	10
4	**Discuss** about International Patent protection?	Understand	10
5	**Explain** about the Paris convention?	Understand	9
6	**When** did Paris convention established and for what?	Understand	9
7	**Explain** why the Paris convention is introduced?	Understand	9
8	**Explain** copy write law?	Understand	9
9	**Define** the copy write law is useful?	Knowledge	9
10	**Describe** the reasons for introducing copyright law?	Knowledge	8
11	**Explain** about intellectual property audit?	Understand	8
12	**Write** the duties of IP audit?	Apply	8
13	**Discuss** about the International trade mark Law?	Understand	8
14	**Discuss** about the International patent law?	Understand	8
15	**Describe** the advantages of International Patent law?	Knowledge	8
16	**Explain** trade secrets Law?	Understand	9
17	**Write** the advantages about trade secrets law?	Apply	9
18	**Discuss** why the trade secrets law is developed internationally?	Understand	9
19	**Explain** the patent law treaty?	Understand	9
20	**Discuss** about patent cooperation treaty?	Understand	9
21	**Discuss** about Dilution?	Understand	12
22	**Write** about Trade dress?	Understand	12
23	**Explain** about Post audit activity?	Understand	8
24	**List** out the liabilities for misapplication of Trade Secrets?	Apply	11
25	**Write** the determination of trade secret statues?	Apply	12
	PART - B (LONG ANSWER QUESTIONS)		
1	**Explain** about the new developments in Trademark law?	Understand	12
2	**Discuss** how do you protect a domain name? Explain the precautionary steps to be taken for protecting domain name in trademark?	Understand	12
3	**Explain** how the cyber crime can control in trademark? how you hyperlink?	Understand	12
4	**Explain** cybersquatters and the Anticybersquatting consumer Protection Act?	Understand	12
5	**Discuss** new development in protecting copyright law? what are they? Explain?	Understand	12
6	**Explain** how a copyright protection is overcoming the cyber crime?	Understand	12
7	Describe about copyright protection act? how the copyright protection for automated database is processed?	Knowledge	13
8	**Explain** copyright in the electronic age?	Understand	11
9	**Describe** the digital millennium copyright act?	Knowledge	13
10	**Explain** the new developments in copyright and recent developments in copyright law?	Understand	13
11	**Define** Vessel Hull protection? How it is useful in copyrights act?	Knowledge	13
12	**Explain** semiconductor chip protection?	Understand	
13	**Discuss** new developments in international patent law? How can you analyze them?	Understand	13
14	**Explain** the International patent protection?	Understand	13

S.No	Questions	Blooms Taxonomy Level	Course Outcome
15	**Discuss** about patent cooperation treaty?	Understand	13
16	**Discuss** about European patent organization and what are its duties?	Understand	13
17	**Explain** about patent law treaty with suitable examples?	Understand	13
18	**Discuss** new developments in trade secrets law?	Understand	13
19	**Discuss** about international developments in trade secrets law?	Understand	13
20	**Discuss** about intellectual property audits?	Understand	13
	Discuss what type of Trademark Dilution is involved for each of the following and why it is in Trademark Dilution? a. Lexuz photocopiers b. Nestle pens c. Barbie‟s Toys d. Mattle‟s Head shop	Knowledge	13
22	**Write** the advantages and disadvantages of TRIPs**?**	Understand	12
23	**Explain** EPO**?**	Knowledge	13
24	**Write** the Digital Millennium Copyright Act?	Understand	12
25	**Write** recent Developments in Copyright law?	Knowledge	13
	Part – C (Problem Solving and Critical Thinking)		
1	**Explain** new developments in the copyright protection for following: a) Computer programs b) Video games c) Piracy of software	Analyze	12
2	**Describe** the new development in patent law relating for the: a) Business method b) Software patents c) Biotechnology patents	Understand	12
3	**Illustrate** the importance of IP audit in different business organisation?	Knowledge	12
4	**Explain** the practical aspects of IP audits and process of conducting audit?	Knowledge	12
5	**Distinguish** International trademark law and copy right law?	Understand	12

1.	**Calculate** the efficiency of this transmission at the UDP level (ratio of useful bytes to total bytes)?A client uses UDP to send data to a server. The data are 15 bytes.	Understand	2
2.	**Design** a diagram to show the situation of the window before and after?A TCP connection is using a window size of 12000 bytes and the previous acknowledgement number was 22001.It receives assignment with acknowledgment number 24001 and window size advertisement of 12000.	Understand	2
3.	**Determine** which of the following an FQDN is and which is a PQDN? a) mil b) edu c) xxx.yyy.net d) zzz.yyy.xxx.edu	Understand	2
4.	**Interpret** the following sequences of characters (In hexa decimals) received by a TELNET client or server? a) FFFB01 b) FFFE01 c) FFF4 d) FFF9	Understand	2
5.	**Show** the sequence of bits sent from a client TELNET for the binary transmission of 11110011 00111100 11111111	Understand	2
6.	**State** the main rules that should be used when installing a cable. Show that maximum cabling area for LAN for horizontal cabling runs is approximately 200m.What do you understand by the term „structure cabling"?	Understand	2
7.	**Calculate** the maximum number of class A, B and C network ids.What is the various classes of IP addressing?	Understand	2

PART -C (CRITICAL THINKING QUESTIONS)

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**SOFTWARE TESTING METHODOLOGIES**			
Course Code	CS615PE			
Regulation	**R18 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	1	-	4
Course Faculty	KNikhil Asst.Prof			

K. COURSE OVERVIEW:

The software testing is a process of executing a program or application with the intent of finding the bugs. This course will help students learn catch bugs and break software as you discover different testing methods that will help build better software. It will teach and make students think like a software tester and help in finding bugs in code earlier and write better code. The course demonstrates an in-depth understanding of the tools and technologies for software testing and do better programming and test the programs efficiently.

AJ. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	5	Software Engineering

BI. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.	75	100

HOW PROGRAM OUTCOMES ARE ASSESSED:

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

X. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I Be familiar with the concept of software testing objectives, process criteria, strategies and methods.

AI Master various software testing issues and solutions in software unit test, integration, regression and system testing.

BI Be familiar with the advanced software testing topics such as object oriented software testing methods and component based software testing issues, challenges and solutions.

IV. Master the techniques and skills on how to use modern software testing tools to support Software testing projects.

V Be familiar with the important concepts of complexity metrics and object oriented metrics.

VI. Be familiar with the knowledge of the foundations, techniques, and tools in area of software testing and its practice in the industry.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Ability to apply the process of testing and various methodologies in testing for developed software.
2. Ability to write test cases for given software to test it before delivery to the customer.

VII.

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments and Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Projects
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Assignment and Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	H	Mini Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Tutorials
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	----
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	----
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	----
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Projects
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	----
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Assignments
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	N	----

N - None **S - Supportive** **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

N - None **S - Supportive** **H - Highly Related**

IX. SYLLABUS:

UNIT-I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs. **Flow graphs and Path testing**: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT-II

Transaction Flow Testing: Transaction flows, transaction flow testing techniques.
Dataflow testing : Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT-III

Domain Testing : Domains and paths, Nice and ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT-IV

Paths, Path products and Regular expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection
Logic Based Testing: Overview, decision tables, path expressions, k v charts, specifications.

UNIT-V

State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips.
Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to tool like jmeter and win runner)

Text books:

1. Boris Beizer, “Software Testing techniques”, Dreamtech, 2e.
7. Dr.K.V.K.K.Prasad, “Software Testing Tools”, Dreamtech.

References:

Y. Brian Marwick, “The craft of software testing”, Pearson Education.
Z. P. C. Jorgenson, “Software Testing”, 3e, Aurbach Publications (Dist.by SPD).
AA. N. Chauhan, “Software Testing”, Oxford University Press.
AB. P. Ammann, J. Offutt, “Introduction to Software Testing”, Cambridge University Press.
AC. Perry, “Effective methods of Software Testing”, John Wiley, 2e, 1999.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1-2	**Introduction**: Purpose of testing.	**Explain** the importance of testing and purpose of testing.	T1:1.1
3-4	Dichotomies, model for testing.	**Illustrate** different and compare dichotomies of testing.	T1:1.2
5-6	Model for testing.	**Demonstrate** the model for testing and different testing levels and role of models.	T1:1.3
7-9	Consequences of bugs, taxonomy of bugs.	**Describe** the consequences and taxonomy of bugs and different bugs in project environment.	T1:2.2
10-13	Path testing and predicate, loops and path sensitization.	**Illustrate** the concepts of path testing and predicate loops and path sensitization.	T1:3.2
14-15	Path instrumentation and their applications and link markers.	**Explain** Path instrumentation and their applications and link markers.	T1:3.5
16-19	Transaction flows techniques ,Transaction flows, transaction flow testing technique	**List** Transaction flows techniques and transaction flow structures and their test databases.	T1:4.3
20-23	Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.	**State** Basics of data flow testing and Strategies in data flow testing, applications of dataflow testing.	T1:5.2
24-27	Domains and paths, Nice and ugly domains, domain testing.	**Describe** Domains and paths and explain about domains and bugs and their tools effectiveness.	T1:6.2
28-31	Domains and interfaces testing, domain and interface testing, domains and testability.	**Demonstrate** Domains and Interfaces testing .explain linearising transformation and coordinate transformation.	T1:6.5
32-33	Path products and path expression.	**State** Path products and path expression, different laws used in path testing.	T1:8.3
34-38	Reduction procedure, applications, regular expressions and flow anomaly detection.	**Demonstrate** Reduction procedure and applications, Regular expressions and Flow anomaly detection.	T1:8.4
39-44	Logic based testing and decision tables.	**Describe** Logic based testing and Decision tables and compare hardware and software testing.	T1:10.2
45-51	Path expressions, k v charts, specifications.	**Illustrate** Path expression and KV Charts and their specifications.	T1:10.4
52-59	State graphs, good & bad state graphs, state testing, Testability tips.	**Explain** State Graphs and state testing and their Testability Tips. Explain finite state behavior in state graphs.	T1:11.3
60-63	Motivational overview, matrix of graph, relations, power of a matrix.	**Describes** Graph Matrices and Node reduction algorithm. Explain break loops and their applications.	T1:12.2
64-65	Node reduction algorithm, building tools.	**Demonstrate m**atrix properties and node reduction algorithm.	T1:12.6

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	H				S								H	S
II			H		S								S	H
III			H						S				H	S
IV				H					S				H	S
V		H									S		S	H
VI			H		S								H	H

S – Supportive **H - Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H				S								H	H
2			H						S					

S – Supportive **H - Highly Related**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	**SOFTWARE TESTING METHODOLOGIES**
Course Code	CS615PE
Class	III B. Tech II Semester
Branch	Computer Science and Engineering
Year	2020--2021
Course Faculty	KNikhil Asst.Prof

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	a. **Describe** is it impossible for a tester to find all the bugs in a system ? why might it not be necessary for a program to be completely free of defects before it is delivered to its customers? b. **Discuss** to what extent can testing be used to validate that the program is fit for its purpose?	Understand	1
2	a. **Demonstrate** the phases in a testers mental life? b. **Describe** that testing is not everything? c. **Define** testing and explain the purpose of testing?	Apply	1
3	a. **Explain** the principles of test case design? b. **List** out various dichotomies and Explain?	Understand	2
4	a. **State** differences between functional and structural testing? b. **List** factors about the importance of bugs depends and give the metric for it? c. **Explain** various consequences of bugs?	Knowledge	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	d. **Discuss** the remedies for test bugs?		
5	a. **Classify** the different kinds of bugs and explain? b. **Explain** the procedure used in quantifying the nightmare list to stop testing? c. **Explain** the five types of structural bugs?	Understand	2
6	a. **Discuss** clearly about requirements, features and functionality of bugs? b. **Discuss** control and sequence bugs? How they can be caught?	Understand	2
7	a. **Discuss** Interface, Integration and System bugs with an example? b. **Explain** about resource management problem in software testing? c. **Define** testing? List out the remedies for test design bugs?	Understand	2
8	a. **Demonstrate** various types of structural bugs, coding bugs, data bugs and system bugs? Discuss how these bugs can be caught? b. **Discuss** the classes of bugs in the taxonomy of bugs?	Apply	1
9	a. **Define** integration testing? Discuss the goals of integration testing? b. **Explain** clearly the white - box tests and behavioural tests?	Knowledge	1
10	a. **Define** integration testing and discuss the goals of integration testing? b. **Explain** clearly the white box tests and behavioural tests?	Knowledge	1
11	a. **Define** statement coverage (C1) and branch coverage (C2)? Explain with an example, how to select enough paths to achieve C1+C2? b. **Define** Loop? State and explain various kinds of Loops with suitable examples. Also discuss how to select optimal paths for C1+C2. (Statement coverage + Branch coverage)?	Knowledge	2
12	a. **Discuss** about assignment blindness, and equality blindness of Predicates?	Understand	2
13	a. **Discuss** about "Traversal marker" form of path instrumentation? b. **Explain** coincidental correctness? Give an example?	Understand	2
14	a. **Explain** about program's control flow? Is it useful for path testing? b. **Discuss** various flow graph elements with their notations?	Understand	2
15	a. **Explain** that flowchart is different from a control flow graph? b. **Explain** about multi entry and multi exit routines and fundamental path selection criteria?	Understand	2
16	a. **Define** path sensitization and write heuristic the procedure used in path sensitization? b. **Explain** how concatenated loops can be tested? c. **Discuss** the three cases for single loop testing?	Knowledge	2
17	a. **Explain** about path instrumentation and how link counters are useful in path instrumentation method? b. **Write** about implementation of path testing and various applications of path testing? c. **Explain** the linear predicates with the help of an example?	Understand	2

	d. **Draw** a flow graph for calculating the sum of n given numbers ?		
18	a. **Explain** clearly the single link marker path instrumentation with an example? b. **Explain** the terms i. New code ii. Maintenance iii. Rehosting	Understand	2
19	Consider the following fragment of code, **Explain** how many tests are required for 100% decision coverage? if width > length then biggest_dimension = width if height > width then biggest_dimension = height end_if else biggest_dimension = length if height > length then biggest_dimension = height end_if end_if	Understand	2

20	Given the following code, **Discuss** the minimum number of test cases required for full statement and branch coverage?
	
	Read p
	Read q
	IF p+q > 100 THEN
	Print "Large"
	ENDIF
	IF p > 50 THEN
	Print "p Large"
	ENDIF
		Understand	2

	UNIT – II		
1	a. **Discuss** that data flow testing is helpful in fulfilling the gaps in path testing? b. **Explain** about data flow graphs? c. **Name** and explain Data flow testing Strategies?	Understand	2
2	a. **Demonstrate** an anomaly can be detected. Explain different types of data flow anomalies and data flow anomaly state graphs? b. **Write** applications of data flow testing?	Apply	2
3	a. **Demonstrate** the transaction flows? Discuss their complications? b. **Discuss** about static and dynamic anomaly detection? c. **Discuss** the reasons why only the static anomaly detection is not enough?	Apply	2
4	a. **Discuss** the following strategies of data flow testing with suitable examples: i. All-predicate-uses (APU) strategy ii. All-computational (ACU) strategy b. **Compare** the path flow and data-flow testing strategies?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
5	a. **Explain** data-flow model? Discuss various components of it? b. **Demonstrate** transaction flows occurrence , illustrate with help of examples. Implementation of a transaction flow is usually implicit in the design of the systems control structure and database explains? c. **Discuss** about sensitization & instrumentation based on transaction flows?	Understand	2
6	a. **Explain** the transaction flow testing with an example? b. **Distinguish** between control flow and transaction flow?	Understand	2
7	a. **Define** transaction flow structure? Discuss the reasons why the transaction flows are often structured? b. **Discuss** the advantages and disadvantages of path selection in transaction flow?	Knowledge	2
8	a. **Discuss** the different data object states in data-flow graphs? b. **List** nine possible two-letter combinations of the object states of data anomalies. Classify them as buggy, suspicious and ok?	Understand	2
9	Consider the following techniques,which are static and which are dynamic techniques **Explain** them? i. Equivalence Partitioning ii. Use Case Testing iii. Data Flow Analysis iv. Exploratory Testing v. Decision Testing vi. Inspections	Understand	2
10	**Discuss** the most important difference between the metrics based approach and the expert based approach to test estimation?	Understand	2
	UNIT - III		
1	a. **Demonstrate** a nice domain? Give an example for nice two-dimensional Domains? b. **Discuss** the following terms: i. Linear domain boundaries ii. Non linear domain boundaries iii. Complete domain boundaries iv. Incomplete domain boundaries c. **Discuss** in detail the nice domains and ugly domains with suitable	Apply	2
2	a. **Demonstrate** what is meant by domain testing? Discuss various applications of domain testing? b. **Explain** with a neat diagram, the schematic representation of domain testing ?	Apply	2
3	a. **Explain** the domain boundary bugs for two dimensional domains? b. **Discuss** about systematic boundaries? c. **Discuss** about random testing?	Understand	2
4	a .**Define** the following concepts. i. Domains ii. Domain closure iii. Domain dimensionality iv. Bug Assumptions for domain Testing	Knowledge	2

	b. **Explain** simple domain boundaries and compound predicates?		
5	a. **Discuss** about specified and implemented domains?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	b. **Discuss** about domain closure and domain dimensionality? c. **Explain** different one-dimensional domain bugs?		
6	a. **Describe** short notes on i. Ambiguities and contradictions ii. Simplifying the topology iii. Rectifying boundary closures b. **Define** the terms i. Interior point ii. exterior point iii. Boundary point iv. on point and off point	Understand	2
7	a. **Explain** the terms i. Domains and range ii. Closure compatibility iii. Domain compatibility testing b. **Explain** the differences between linearizing transformations and Co-ordinate transformation?	Understand	2
8	a. **Explain** in detail about domains and testability b. **Explain** the following terms a. Domain Testing b. Linear zing Transformation c. Non-Linear zing Transformation d. Canonical program form c. **Define** domain and explain domain model in detail?	Understand	2
9	**Demonstrate** why it is necessary to develop test cases for both valid and invalid input condition. How important is document for product? How will you test requirement and design Document?	Apply	2

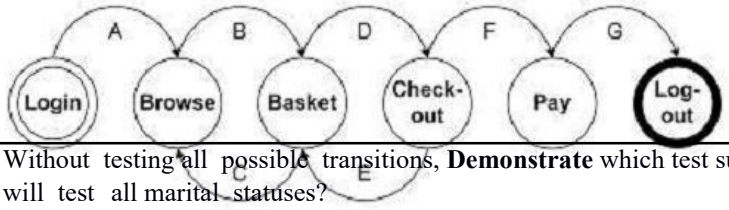
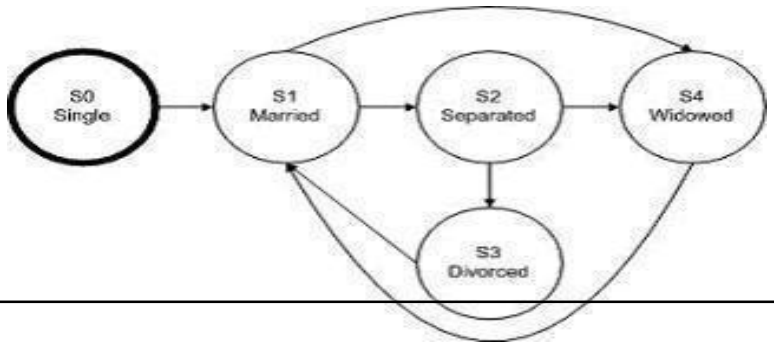
10	Given the following sample of pseudo code?
	
	Input number of male rabbits
	Input number of female rabbits
	If male rabbits > 0 and female rabbits > 0 then
	Input Do you want to breed (Yes / No)
	If breed = "No"
	Print "Keep male and female rabbits apart!"
	End if
	End If.
	Demonstrate which of the following test cases will ensure that statement "06" is executed?
		Apply	2

	UNIT – IV		
1	a. **Define** structured code. Explain lower path count Arithmetic? b. **Discuss** the looping probability of a path expression? Write arithmetic rules and explain with an example?	Knowledge	2
2	a. **Demonstrate** the steps involved in node reduction procedure. illustrate all	Apply	1

	the steps with help of neat labelled diagrams? b. **Demonstrate** using reduction procedure to convert flow graph whose links are labelled into a path expression. Explain each step with flow graph?		

S. No.	Question	Blooms Taxonomy Level	Course Outcome
3	a. **Explain** about Maximum path count arithmetic with an example? b. In reduction procedure **explain** about: i. Cross-Term step ii. Parallel Term iii. Loop Term iv. Comments, Identities and Node - Removal Order	Understand	2
4	a. **State** huang's theorem. Explain its implementation .explain its generalizations and limitations? b. **Write** short notes on: i.Distributive laws ii.Absorption Rule iii.Loops iv.Identity Elements.	Knowledge	1
5	a. **Demonstrate** how to find approximate minimum no. of paths with an example? b. **Explain** the probability of getting path expression with an example?	Apply	2
6	a. **Discuss** regular expressions and flow anomaly detection? b. **Explain** a regular expression and flow anomaly detection method with an example and limitations?	Understand	2
7	a. **Explain** about the mean processing time of a routine with an example? b. **Explain** the generalizations and limitations of regular expressions?	Understand	2
8	a. **Explain** the push/pop arithmetic with an example? b.**Explain** the get/return arithmetic with an example?	Understand	2
9	a. **Explain** the problem occurred in the regular expressions with an example? b. **Explain** which method will be useful for regular expressions with an	Understand	2
10	**Evaluate** the mean processing time of a program represented by the following flow graph. Numbers in the brackets are the probabilities and the other numbers are processing times.	Evaluate	1
11	a. **Demonstrate** decision table and how is a decision table useful in testing? also explain with the help of an example? b. **Explain** prime implicant , sum-of-product form and product-of-sum form?	Apply	2
12	a. **Describe** the procedure for specification validation using KV charts? b. **Demonstrate** methods to check the consistency and completeness in the decision tables?	Understand	1

S. No.	Question	Blooms Taxonomy Level	Course Outcome
13	a. **Discuss** that we can form the specifications into the sentences and write down the different phrases which can be used for the words? b. **Explain** the following in logic based systems i. Path and domain ii. Test case design	Understand	2
14	a. **Demonstrate** to Minimize the function using Karnaugh Map method: F(A,B,C,D)= P(1,2,3,8,9,10,11,14)+ Pd(7,15) b. **Demonstrate** by means of truth tables the validity of the following theorems	Apply	1
15	a. **Demonstrate** Reduction the following functions using Karnaugh Map method F(A,B,C,D)=π (4,5,6,7,8,12,13)+d(1,15) b. **Minimize** the function using Karnaugh Map method F(A,B,C,D)= P(1,2,3,7,9,10,11,14)+ Pd(6,12)	Apply	1
16	a. **State** the representation of Minterm and Maxterm for three variables(D+M) b. **Minimize** the given expression using four variable k-map. F(A,B,C,D)= _ m(0,1,3,4,7,8,15).	Knowledge	2
17	a. **Explain** the terms i. Hardware logic testing ii. Specification systems and languages iv. Knowledge based systems b. **Explain** the terms i. Decision table processors ii. Expansion of immaterial cases iii. Test case design	Understand	2
18	a. **Explain** KV charts for two variables and three variables with examples b. **Define** the terms predicate, relational operator of case statements and multi valued logics?	Understand	1
19	Given the following state transition diagram: **Demonstrate** which of the test cases below will cover the following series of state transitions?	Apply	2
20	**Illustrate** the following functions using K-Maps F(A,B,C,D) = P(4,5,6,7,9,11,13)+d(4,15)	Apply	1
	UNIT – V		
1	a. **Differentiate** between good state graphs and bad state graphs? b. **Discuss** the principles of state testing? Explain its advantages and Disadvantages?	Understand	2
2	a. **Compare** the differences between logic based testing , state testing and	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	path testing? b. **Explain** all the rules in the conversion of specification into a state graph?		
3	a. **Explain** the terms i. No of states ii. Impossible states iii. .Equivalent States b. **Describe** the types of bugs that can cause state graphs?	Understand	1
4	a. **Demonstrate** the software implementation issues in state testing? b. **Discuss** testers comments about state graphs?	Apply	2
5	a. **Explain** state testing and testability tips with an example? b. **Explain** state graphs with implementation with an example?	Understand	2
6	a. **Define** the following terms i. states ii. Inputs and transitions iii. Outputs iv. State tables b. **Define** the terms i. Unreachable states ii. Unspecified and contradictory transitions	Knowledge	2
7	a. **Illustrate** designer's comments about state graphs? b. **Draw** a hard disk recovery a state graph with a state table?	Apply	2
8	**Demonstrate** design guidelines for building finite state machines into your code?	Understand	2
9	Consider the following state transition diagram .**Show** which of the following series of state transitions contains an invalid transition which may indicate a fault in the system design? 	Apply	2
10	Without testing all possible transitions, **Demonstrate** which test suite will test all marital statuses? 	Apply	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
11	a. **Demonstrate** an algorithm for node reduction (general)? b. **Illustrate** the applications of node reduction algorithm?	Apply	1
12	a. **Discuss** a node reduction algorithm in terms of matrix operations? b. **Define** graph matrices and their applications?	Understand	2
13	a. **Illustrate** Partitioning Algorithm with an example ? b. **Discuss** how to write an algorithm for All Pairs Paths using Matrix Operations?	Apply	2
14	a. **Demonstrate** what operations does a toolkit consist for the representation of graphs?	Apply	1
15	a. **Demonstrate** the advantages of array representations? b. **Define** relations and give their properties? c. **Describe** loops and demonstrate loops in matrix representation?	Apply	2
16	a. **Define** graph matrices and evaluate graph matrix with pictorial graph. explain the basic algorithms? b. **Demonstrate** maximum element and minimum element of a graph?	Knowledge	2
17	a. **Define** a relation. Explain relation matrix with examples? b. **Explain** the properties of relations? Explain them with example?	Knowledge	2
18	a. **Explain** parallel reduction and loop reduction? b. **Write** about equivalence relation and partial ordering relation	Understand	2
19	**Explain** win runner testing process?	Understand	2
20	**Illustrate** the advanced scripting techniques for test execution tools?	Apply	2

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**SOFTWARE TESTING METHODOLOGIES**			
Course Code	CS615PE			
Regulation	R18			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	1	-	4
Team of Instructors	KNikhil Asst.Prof			

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

GROUP - A (SHORT ANSWER QUESTIONS)

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1.	**Explain** goals for testing and model for testing in software testing?	Understand	1
2.	**Describe** phases in tester's mental life and state Complexity Barrier?	Knowledge	1
3.	**Explain** about test design and explain different types of testing?	Understand	1
4.	**Explain** the following a) Environment b) Program c) Bugs	Apply	1
5.	**State** pesticide paradox and complexity barrier in purpose of testing?	Knowledge	2
6.	**Demonstrate** nightmare list and when to stop testing in the consequences of bugs?	Knowledge	2
7.	**Illustrate** hardware architecture and software architecture?	Understand	2
8.	**Differentiate** function versus structure testing .and compare small versus large programming?	Understand	2
9.	**Demonstrate** test bug remedies and illustrate requirement bugs?	Understand	2
10.	**Explain** external interfaces and internal interfaces and discuss the consequences of bugs?	Understand	2
11.	**Define** path testing and explain about decision and case statements?	Knowledge	2
12.	**Explain** bug assumption and compare control flow graphs and flow charts?	Understand	2
13.	**State** control flow graph and list independence and co-relation of variables and predicates?	Knowledge	2

14.	**State** process blocks and defines predicate and path predicates?	Knowledge	2
15.	**Demonstrate** path statement, path testing criteria and explain branch testing?	Understand	2
16.	**Explain** about simple independent and co-related predicates?	Knowledge	2
17.	**Define** loops and explain different types of loops and **Explain** nested loops	Understand	2
18.	**Explain** flow graph notational evolution and explain co-related independent predicates?	Understand	2
19.	**Explain** path nodes and links and explain the effectiveness and limitations of path testing?	Understand	2
20.	**Explain** multi entry and multi exit routines and describe path predicate expression?	Understand	1
	UNIT – II		
1.	**Define** transaction flow graph and define transaction with an example?	Knowledge	2
2.	**Illustrate** all c-uses/some p-uses strategies and discuss all p-uses/some c-uses strategies?	Knowledge	2
3.	**Explain** births and mergers in a transaction flow testing?	Understand	2
4.	**Demonstrate** transaction flow structure and discuss transaction flow testing techniques?	Apply	2
5.	**Demonstrate** du-path and define all du-paths?	Understand	2
6.	Define path selection and illustrate path sensitization?	Knowledge	2
7.	**Describe** all predicate uses and all computational uses strategy?	Apply	2
8.	**Explain** transaction flow sensitization and discuss transaction instrumentation?	Understand	2
9.	**Demonstrate** data flow anomalies and explain components of data flow model?	Understand	2
10.	**Define** data flow testing and explain the application tools and effectiveness of data flow testing?	Understand	1
	UNIT – III		
1.	**Explain** domain and explain different domain bugs?	Understand	1
2.	**Explain** domain closure and define domain dimensionality?	Understand	1
3.	**Discuss** liberalizing transformation and co-ordinate transformation?	Knowledge	1
4.	**Explain** about a) Interior Point b) Boundary Point c) Extreme Point d) on-point e) off-point	Understand	1
5.	**Describe** co-incidental correctness and discuss representative outcome?	Understand	1
6.	**Demonstrate** complete and systematic boundaries and describe non-linear boundaries?	Understand	1
7.	**Explain** simple domain boundaries and compound predicates?	Understand	2
8.	**State** functional homogeneity of bugs and define random testing?	Knowledge	2
9.	**Illustrate** linear vector space and illustrate one-dimensional domain bugs closed boundaries?	Apply	2
10.	**Explain** loop free software and explain interface range/domain compatibility testing?	Understand	2
	UNIT – IV		
1.	**Define** path expression and path product and discuss distributive law?	Knowledge	2
2.	**Explain** path sum and discuss approximate minimum number of paths?	Understand	2
3.	**Explain** the methods of regular expressions and flow anomaly detection?	Understand	2
4.	**Demonstrate** absorption law and explain the limitations of path testing?	Apply	2
5.	**Define** loops and explain different loop terms?	Knowledge	1
6.	**Explain** identity elements and explain mean processing time of a routine?	Understand	1
7.	**Discuss** about cross-term step and explain maximum path count arithmetic?	Understand	2
8.	**Explain** parallel terms and demonstrate how many paths in a flow graph?	Understand	1
9.	**Discuss** loop terms and demonstrate lower path count arithmetic?	Understand	2
10.	**Explain** applications of path testing and explain push/pop and get/return?	Understand	2
11.	**Define** hardware logic testing and explain KV-charts?	Knowledge	1
12.	**Explain** about knowledge based systems in logic based testing?	Understand	2

13.	**Define** decision table and explain about don't care and impossible terms?	Knowledge	2
14.	**Compare** condition stub and action stub and discuss three successive stages of canonical processors?	Understand	2
15.	**Explain** decision table processors and discuss finding and translating the logic?	Understand	2
16.	**Explain** test case design and sketch KV-charts of 3 variables and 4 variables?	Understand	2
17.	**Discuss** predicates and relational operators in logic based testing?	Understand	2
18.	**Define** case tables and multi valued logics in knowledge based systems?	Knowledge	2
19.	**Demonstrate** the rules of boolean algebra and explain them in detail?	Apply	2
20.	**Define** the operators of boolean algebra and list them with examples?	Knowledge	2
	UNIT-V		
1.	**Define** finite state machine and define number of states and impossible states?	Knowledge	1
2.	**Explain** state graphs and explain about equivalent states?	Understand	2
3.	**Define** transition and discuss unreachable states?	Knowledge	2
4.	**Explain** about state tables and define dead states?	Understand	1
5.	**Compare** time and sequence and explain about state bugs?	Understand	1
6.	**Explain** input encoding and input alphabet and illustrate output errors?	Understand	2
7.	**Discuss** output encoding and output alphabet and explain encoding bugs?	Understand	1
8.	**Demonstrate** state codes and state symbol products and explain limitations of state graphs?	Apply	2
9.	**Explain** the application comments for designers and testers?	Understand	1
10.	**Explain** switches, flags and unachievable paths and demonstrate unspecified and contradictory transitions?	Understand	1
11.	**Define** graph matrix and explain out-degree and in-degree?	Knowledge	2
12.	**Explain** connection matrix and explain about relations?	Understand	2
13.	**Explain** properties of relations and define parallel reduction?	Understand	2
14.	**Define** equivalence relation and explain loop reduction?	Knowledge	2
15.	**Explain** partial ordering relations and demonstrate cross-term reduction?	Understand	2
16.	**Explain** the powers of a matrix and define node reduction optimization?	Understand	2
17.	**Discuss** matrix power and products and illustrate linked list representation of graph matrices?	Understand	2
18.	**Demonstrate** set of all paths and define loops?	Apply	2
19.	**Explain** partitioning algorithm of graph matrices?	Understand	2
20.	**Discuss** node reduction algorithm of graph matrices?	Understand	2

GROUP-B (LONG ANSWER QUESTIONS)

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	a. **Discuss** that software testing will ensure the quality of a developed software? b. **Demonstrate** the trade - off between quality assurance costs and manufacturing costs?	Apply	1
2	a. **Describe** is it possible for a tester to find all the bugs in a system? Why might it not be necessary for a program to be completely free of defects before it is delivered to its customers? b. **Discuss** to what extent can testing be used to validate that the program is fit for its purpose?	Understand	1
3	a. **Demonstrate** the phases in a tester's mental life? b. **Describe** that testing is not everything? c. **Define** testing and explain the purpose of testing?	Apply	1
4	a. **Explain** the principles of test case design? b. **List** out various dichotomies and explain?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
5	a. **State** differences between functional and structural testing? b. **List** the factors on which the importance of the bugs depend and give the metrics for them? c. **Explain** various consequences of bugs? d. **Discuss** the remedies for test bugs?	Knowledge	2
6	a. **Classify** the different kinds of bugs and explain? b. **Explain** the procedure used in quantifying the nightmare list to stop testing? c. **Explain** the five types of structural bugs?	Understand	2
7	a. **Discuss** clearly about requirements, features, and functionality of bugs? b. **Discuss** control and sequence bugs and the methods to be caught?	Understand	2
8	a. **Summarize** white box testing and black box testing and give the differences between them? b. **Compare** static data and dynamic data?	Understand	2
9	a. **Discuss** interface, integration and system bugs with an example? b. **Explain** about resource management problem in software testing? c. **Define** testing and list out the remedies for test design bugs?	Understand	2
10	a. **Demonstrate** structural bugs, coding bugs, data bugs and system bugs and discuss methods to catch these bugs? b. **Discuss** the classes of bugs in the taxonomy of bugs?	Apply	2
11	a. **Define** software bug in software testing? b. **Discuss** pesticide paradox and complexity barrier? c. **Explain** model for testing?	Knowledge	2
12	a. **Define** integration testing and discuss the goals of integration testing? b. **Explain** clearly the white box tests and behavioural tests?	Knowledge	2
13	a. **Define** statement coverage (C1) and branch coverage (C2)? Explain with an example methods to select enough paths to achieve C1+C2 ? b. **Define** loop? State and explain various kinds of loops with suitable examples also discuss methods to select optimal paths for C1+C2. (Statement coverage + Branch coverage)?	Knowledge	2
14	a. **Discuss** about assignment blindness, and equality blindness of predicates? b. **Explain** the terms achievable and unachievable paths?	Understand	2
15	a. **Discuss** about "Traversal marker" form of path instrumentation? b. **Explain** coincidental correctness? Give an example?	Understand	2
16	a. **Discuss** statement testing and branch testing? Give suitable examples? b. **State** and explain various path selection rules for path testing?	Understand	2
17	a. **Explain** about program's control flow? Is it useful for path testing? b. **Discuss** various flow graph elements with their notations?	Understand	2
18	a. **Justify** flowchart is different from a control flow graph? b. **Explain** about multi entry and multi exit routines and fundamental path selection criteria?	Understand	2
19	**Describe** the following concepts a. Predicates b. Predicate Expression c. Predicate Coverage d. Achievable paths	Understand	2
20	a. **Define** path sensitization and write heuristic the procedure used in path sensitization? b. **Explain** how concatenated loops can be tested? c. **Discuss** the three cases for single loop testing?	Knowledge	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
21	a. **Explain** path instrumentation and link counters are useful in path instrumentation method? b. **Write** about implementation of path testing and various applications of path testing ? c. **Explain** the linear predicates with the help of an example? d. **Draw** a flow graph for calculating the sum of n given numbers algorithm?	Understand	2
22	a. **Explain** clearly the single link marker path instrumentation with an example? b. **Explain** the following terms i. New code ii. Maintenance iii. Re-hosting	Understand	2
23	a. **Define** predicates? Explain multi-way branches and inputs used in path testing? b. **Discuss** predicate interpretation? Explain independence and co-relation of variables and predicates? c. **Explain** the path sensitization for achievable and unachievable paths?	Knowledge	2
24	a. **Explain** the following terms i. Independent and un co-related predicates ii. Co-related independent predicates iii. Dependent predicates b. **Explain** about link marker, link counters and other instrumentation methods used in Path testing?	Understand	1
	UNIT – II		
1	a. **Discuss** that data flow testing is helpful in fulfilling the gaps in path testing? b. **Explain** about data flow graphs? c. **Name** and explain data flow testing strategies?	Understand	2
2	a. **Demonstrate** an anomaly can be detected. Explain different types of data flow anomalies and data flow anomaly state graphs? b. **Write** applications of data flow testing?	Apply	2
3	a. **Demonstrate** the transaction flows? Discuss their complications? b. **Discuss** about static and dynamic anomaly detection? c. **Discuss** the reasons why only the static anomaly detection is not enough?	Apply	1
4	a. **State** and explain various transaction flow junctions and mergers? b. **Explain** the terms inspections, reviews and walkthroughs? c. **Discuss** the three possible interpretations of the decision symbol with two or more out links?	Knowledge	2
5	a. **Discuss** the following strategies of data flow testing with suitable examples: i. All-predicate-uses (APU) strategy ii. All-computational (ACU) strategy b. **Compare** the path flow and data-flow testing strategies?	Understand	1
6	a. **Define** program slice? Discuss about static and dynamic program slicing? b. **Explain** the terms Dicing, Data-flow and Debugging?	Knowledge	1
7	a. **Explain** data-flow model? Discuss various components of it? b. **Demonstrate** transaction flows occurrence , illustrate with help of examples. implementation of a transaction flow is usually implicit in the design of the systems control structure and database explain? c. **Discuss** about sensitization and instrumentation based on transaction flows?	Understand	2
8	a. **Explain** the transaction flow testing with an example? b. **Distinguish** between control flow and transaction flow?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
9	a. **Define** transaction flow structure? Discuss the reasons that the transaction flows are often structured? b. **Discuss** the advantages and disadvantages of path selection in transaction flow?	Knowledge	2
10	a. **Define** the terms i. Biosis ii. Mitosis iii. Absorption iv. Conjugation b. **Demonstrate** transaction flow, explain it for online information retrieval system with the help of an example?	Knowledge	2
11	a. **Discuss** the different data object states in data-flow graphs? b. **List** nine possible two-letter combinations of the object states of data anomalies. classify them as buggy, suspicious and ok?	Understand	2
12	a. **Define** du path and definition-clear path segment? b. **Discuss** All-du-Paths (ADUP) is the strongest data-flow testing strategy?	Knowledge	2
13	a. **Explain** the modelling rules in data flow model? b. **Define** the terms i. Definition clear path segment ii. Loop free path segment iii. Simple path segment	Understand	2
14	a. **Explain** the procedure to construct a Data flow graph? b. **Construct** the Dataflow graph for the following problem. i. Given L, t, and d, solve for Z. ii. cos(C) = cos(L) sin(t) iii. tan(M)= cot(L) cos(t) iv. tan(Z+F)= -sin(L) tant(t) v. tan (F) = cos(M) tan(M+d).	Understand	2
Unit - III			
1	a. **Demonstrate** a nice domain? Give an example for nice two-dimensional domains? b. **Discuss** the following terms: i. Linear domain boundaries ii. Non linear domain boundaries iii. Complete domain boundaries iv. Incomplete domain boundaries c. **Discuss** in detail the nice domains and ugly domains with suitable examples?	Apply	2
2	a. **Demonstrate** meaning of domain testing? Discuss various applications of domain Testing? b. **Explain** with a neat diagram, the schematic representation of domain testing ?	Apply	2
3	a. **Explain** clearly method for testing one dimensional domains b. **Discuss** about equality and inequality predicates. Also explain how they are treated in domain testing?	Understand	2
4	a. **Explain** the domain boundary bugs for two dimensional domains? b. **Discuss** about systematic boundaries? c. **Discuss** about random testing?	Understand	1
5	a. **Discuss** in detail the domains and interface testing? b. **Classify** what can go wrong with boundaries, then define a test strategy for each case in domain testing?	Understand	1
6	a. **Discuss** about Linear, Non orthogonal, Tilted domain boundaries with suitable examples? b. **Discuss** about ugly domains with suitable examples? c. **Discuss** about variations, tools and effectiveness of domain testing ?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
7	a. **Define** the following concepts. i. Domains ii. Domain closure iii. Domain dimensionality iv. Bug Assumptions for domain Testing b. **Explain** simple domain boundaries and compound predicates?	Knowledge	2
8	a. **Define** domains and paths? Explain domains and testability tips b. **Explain** that domain testing can be used in both functional and structural testing?	Knowledge	2
9	a. **Discuss** about specified and implemented domains? b. **Discuss** about domain closure and domain dimensionality? c. **Explain** different one dimensional domain bugs?	Understand	2
10	a. **Describe** short notes on i. Ambiguities and contradictions ii. Simplifying the topology iii. Rectifying boundary closures b. **Define** the terms i. Interior point ii. Exterior point iii. Boundary point iv. On point and Off point	Understand	2
11	a. **Explain** the terms i. Domains and range ii. Closure compatibility ii. Domain compatibility testing b. **Explain** the differences between linearizing transformations and Co-ordinate transformation?	Understand	2
12	a. **Discuss** that programmers and testers treat ugly domains? b. **Explain** the restrictions that are made on the domains?	Understand	2
13	a. **Explain** in detail about domains and testability b. **Explain** the following terms i. Domain Testing ii. Linear zing Transformation iii. Non-Linear zing Transformation iv. Canonical program form c. **Define** domain and explain domain model in detail?	Understand	2
	UNIT – IV		
1	a. **Define** structured code and explain lower path count arithmetic? b. **Discuss** the looping probability of a path expression? Write arithmetic rules and explain with an example?	Knowledge	1
2	a. **Demonstrate** the steps involved in node reduction procedure. illustrate all the steps with help of neat labelled diagrams? b. **Demonstrate** using reduction procedure to convert flow graph whose links are labelled into a path expression. explain each step with flow graph ?	Apply	1
3	a. **Explain** about maximum path count arithmetic with an example. b. In reduction procedure explain about: i. Cross-Term step ii. Parallel Term iii. Loop Term iv. Comments, Identities and Node - Removal Order	Understand	1
4	a. **Define** path product, path expression and path sum? Explain with an example? b. **Explain** applications of paths, path products and regular expressions?	Knowledge	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
5	a. **State** Huang's Theorem and explain its implementation ?Explain its generalizations and limitations? b. **Write** short notes on: i. Distributive laws ii. Absorption Rule iii. Loops iv. Identity Elements	Knowledge	2
6	a. **Demonstrate** how to find approximate minimum numbers of paths with an example? b. **Explain** the probability of getting path expression with an example?	Apply	2
7	a. **Discuss** regular expressions and flow anomaly detection? b. **Explain** a regular expression and flow anomaly detection method with an example and limitations ?	Understand	1
8	a. **Explain** about the mean processing time of a routine with an example? b. **Explain** the generalizations and limitations of regular expressions?	Understand	2
9	a. **Explain** the push/pop arithmetic with an example? b. **Explain** the get/return arithmetic with an example?	Understand	2
10	a. **Explain** the problem occurred in the regular expressions with an example? b. **Explain** the method that will be useful for regular expressions with an example?	Understand	2
11	a. **Demonstrate** decision table and how is a decision table useful in testing? Explain with the help of an example? b. **Explain** prime implicant, sum-of-product form and product-of-sum form?	Apply	2
12	a. **Explain** about the don't care conditions in the logic based testing? b. **Discuss** about the ambiguities and contradictions in the specifications ?	Understand	2
13	a. **Describe** the procedure for specification validation using KV charts? b. **Demonstrate** methods to check the consistency and completeness in the decision tables?	Understand	1
14	a. **Discuss** that can we form the specifications into the sentences and write down the different phrases which can be used for the words? b. **Explain** the following in logic based systems i. Path and domain ii. Test case design iii. Boolean equations	Understand	1
15	a. **Demonstrate** to minimize the function using karnaugh map method: F(A,B,C,D)= P(1,2,3,8,9,10,11,14)+ Pd(7,15) b. **Demonstrate** by means of truth tables the validity of the following theorems of Boolean algebra: i. Associative laws ii. Demorgans theorems for three variables iii. Distributive law of + over	Apply	2
16	a. **Demonstrate** boolean algebra rules. illustrate the rules with path expressions. b. Use a Karnaugh map to minimize F= B'C'D'+A'B'C'D'+ABC'D+A'BCD+ABD+B'CD'+A'BC'D	Apply	2
17	a. **Demonstrate** reduction the following functions using karnaugh map method F(A,B,C,D)=π (4,5,6,7,8,12,13)+d(1,15) b. **Minimize** the function using Karnaugh Map method F(A,B,C,D)= P(1,2,3,7,9,10,11,14)+ Pd(6,12)	Apply	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
18	a. **Discuss** the different operators used in boolean algebra and give tracts tables for them? b. **Explain** the testing strategies for KV charts?	Understand	1
19	a. **State** the representation of minterm and maxterm for three variables(D+M) b. **Minimize** the given expression using four variable k-map. F(A,B,C,D)= _ m(0,1,3,4,7,8,15).	Knowledge	1
20	a. **Explain** the terms i. Hardware logic testing ii. Specification systems and languages iii. Knowledge based systems b. **Explain** the terms i. Decision table processors ii. Expansion of immaterial cases iii. Test case design	Understand	2
21	a. **Explain** KV charts for two variables and three variables b. **Define** the terms predicate, relational operator of case statements and multi valued logics?	Understand	1
	UNIT – V		
1	**Discuss** short notes on i. Transition bugs ii. Dead states iii. State bugs iv. Encoding bugs	Understand	2
2	a. **Differentiate** between good state graphs and bad state graphs? b. **Discuss** the principles of state testing? Explain its advantages and disadvantages?	Understand	2
3	a. **Compare** the differences between logic based testing , state testing and path testing? b. **Explain** all the rules in the conversion of specification into a state graph?	Understand	1
4	a. **Explain** the terms i. No of states ii. Impossible states iii. Equivalent States b. **Describe** the types of bugs that can cause state graphs ?	Understand	2
5	a. **Demonstrate** the software implementation issues in state testing? b. **Discuss** testers comments about state graphs?	Apply	2
6	a. **Explain** state testing and testability tips with an example? b. **Explain** state graphs with implementation with an example?	Understand	2
7	a. **Define** the following terms i. States ii. Inputs and transitions iv. Outputs iv. State tables b. **Define** the terms i. Unreachable states ii. Unspecified and contradictory transitions	Knowledge	2
8	a. **Illustrate** designer's comments about state graphs? b. **Draw** a hard disk recovery a state graph with a state table?	Apply	2
9	**Explain** and write a short notes on i. Switches, Flags, unachievable paths. ii. Essential an Inessential finite state behaviour	Understand	2
10	**Demonstrate** design guidelines for building finite state machines into your code?	Understand	2
11	a. **Demonstrate** an algorithm for node reduction (general)? b. **Illustrate** the applications of node reduction algorithm?	Apply	2
12	a. **Discuss** a node reduction algorithm in terms of matrix operations? b. **Define** graph matrices and their applications?	Understand	1

S. No.	Question	Blooms Taxonomy Level	Course Outcome
13	a. **Illustrate** a partitioning algorithm with an example? b. **Discuss** strategy to write an algorithm for all pairs paths using matrix operations?	Apply	2
14	a. **Describe** about equivalence relation and partial ordering relation? b. **Discuss** relative merits and demerits of different graph matrix representations?	Understand	2
15	a. **Demonstrate** the operations does a toolkit consist for the representation of graphs? b. **Illustrate** about matrix powers and products?	Apply	2
16	a. **Demonstrate** the advantages of array representations? b. **Define** relations and give their properties? c. **Describe** loops and demonstrate loops in matrix representation?	Apply	1
17	a. **Discuss** the linked list representation? b. **Demonstrate** the matrix operations in tool building?	Understand	2
18	a. **Define** graph matrices and evaluate graph matrix with pictorial graph explain the basic algorithms? b. **Demonstrate** maximum element and minimum element of a graph?	Knowledge	2
19	a. **Define** a relation? Explain relation matrix with examples? b. **Explain** the properties of relations? Explain them with example?	Knowledge	2
20	a. **Explain** parallel reduction and loop reduction? b. **Write** about equivalence relation and partial ordering relation?	Understand	2

GROUP-III (ANALYTICAL QUESTIONS)

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I		
1	**Discuss** in practice, that life cycle model may have more, fewer or different levels of development and testing, depending on the project and the software product?	Understand	1
2	**Demonstrate** when the build comes to the QA team, the parameters to be taken for consideration to reject the build upfront without committing for testing?	Apply	2
3	**Discuss** that test cannot be automated? Acceptance test plan is prepared from? Explain the test case design methodology? does test plan contain bug tracing procedure and reporting procedure?	Understand	2
4	**Discuss** the importance of a document for product? How will you test requirement and design document?	Understand	2
5	**Identify** yourself as a developer of flight control system? Describe any three test adequacy criteria you would consider applying to develop test cases for flight control system?	Understand	1
6	**List** and explain types of system test? Why is testing plan important for developing a repeatable and managed testing process? Give example.	Knowledge	1
7	**Define** role do user/client play in the development of test plan for a project? Should they be present at any of the test plan reviews? Justify.	Knowledge	2
8	**Discuss** developing a patient record system for health care centre, why one of the stop test will be most appropriate for this system? What is the role of the tester in supporting, monitoring and controlling of testing?	Understand	2
9	**Demonstrate** why is it important to meticulously inspect test result? Give Example? Discuss the drawbacks in case if you fail to inspect?	Apply	1
10	**Enumerate** why is it impossible for a tester to find all the bugs in a system? Why might it not be necessary for a program to be completely free of defects before it is delivered to its customers?	Knowledge	2

11	Consider the following fragment of code. **Explain** how many tests are required for 100% decision coverage? if width > length then biggest_dimension = width if height > width then biggest_dimension = height end_if else biggest_dimension = length if height > length then biggest_dimension = height end_if end_if	Understand	1
12	**Design** test cases to provide 100% statement and 100% decision coverage for the following fragment of code. if width > length then biggest_dimension = width else biggest_dimension = length end_if The following has been added to the bottom of the code fragment above. print "Biggest dimension is " & biggest_dimensionprint "Width: " & width print "Length: " & length. how many more test cases are required?	Create	2
13	Given the following code, **Demonstrate** which statement is true about the minimum number of test cases required for full statement and branch coverage? Read p Read q IF p+q > 100 THEN Print "Large" ENDIF IF p > 50 THEN Print "p Large" ENDIF	Apply	2
14	**Describe** the activities or tasks and responsibilities for developer or tester in support of multilevel testing?	Understand	2
15	**List** the tasks that must be performed by the developer or tester during the preparation for unit testing?	Knowledge	2
16	**Illustrate** the importance of security testing and what are the consequences of security breaches, also write the various areas which has to be focused on during security testing and State the need for integration testing in procedural code?	Apply	2

17	For the code fragment given below, **Demonstrate** which answer correctly represents minimum tests required for statement and branch coverage respectively
	Discount rate=1;
	Fare = 1000;
	If ((person == "senior citizen") and ("travel month = January"))
	Bonuspoints = 100+Bonuspoints;
	If (class=="first")
	discountRate = .5;
	Fare = fare * discountRate;
		Apply	2

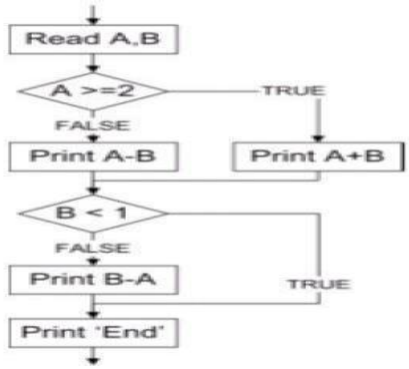
18	Consider pseudo code below were a programming language **Find** the no of tests are required to achieve 100% statement coverage?
	If x=3 then
	Display_messageX;
	If y=2 then
	Display_messageY;
	Else
	Display_messageZ;
	Else
	Display_messageZ;
		Apply	2

19	Given the following code, **Discuss** the minimum number of test cases required for full statement and branch coverage?
	Read p
	Read q
	IF p+q > 100 THEN
	Print "Large"
	ENDIF
	IF p > 50 THEN
	Print "p Large"
	ENDIF
		Understand	2

20	**Define** which combination of p, q and r values will ensure 100 % statement coverage?
	if (p = q) {
	r = r + 1;
	if (r < 5) {
	s = 10;
	}
	} else if (p > q) {
	s = 5;
	}
		Knowledge	2

21	For the following piece of code **Demonstrate** how many test cases are needed to get 100% statement coverage?
	
	Procedure X
	Read (Color) // Input color from user
	IF (Color == RED•) THEN
	Call Roses(Color)
	ELSEIF (Color == BLUE•) THEN
	Call Violets(Color)
	ELSE
	PRINT User is no Shakespeare
	SaveToDatabase(Color)
	End Procedure X
		Apply	2

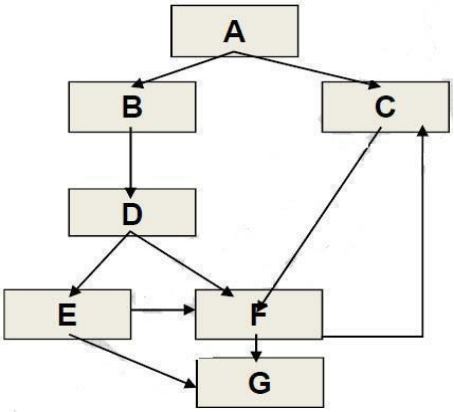
22	For the following piece of code, **Demonstrate** how many test cases are needed to get 100% statement coverage?
	
	Procedure X
	Read (Color) // Input color from user
	IF (Color == “Red”) THEN
	Call Roses(Color)
	ELSEIF (Color == “Blue”) THEN
	Call Violets(Color)
	ELSE
	PRINT “User is no Shakespeare”
	SaveToDatabase(Color)
	End Procedure X
		Apply	2

23	Consider the following flow chart diagram:  **Demonstrate** the minimum number of test cases required for 100% statement coverage and 100%decision coverage, respectively?	Apply	2

24	Consider the following sample of pseudo code:
	
	Read A, B, C;
	If A > B then
	Print "Primary ratio is" & A / B;
	End If
	If A > C then
	Print "Secondary ration is" & A / C;
	End If.
	
	Show which of the following test cases would achieve 100% statement coverage
		Apply	2

25	Consider the following sample of pseudo code:
	
	Input ExamScore
	If ExamScore <= 75 then
	Print "Candidate has failed"
	Else
	Print "Candidate has passed"
	If ExamScore >= 120 then
	Print "Candidate has achieved a distinction"
	EndIf
	EndIf.
	
	Show the minimum number of test cases required to guarantee 100% decision coverage?
		Apply	2

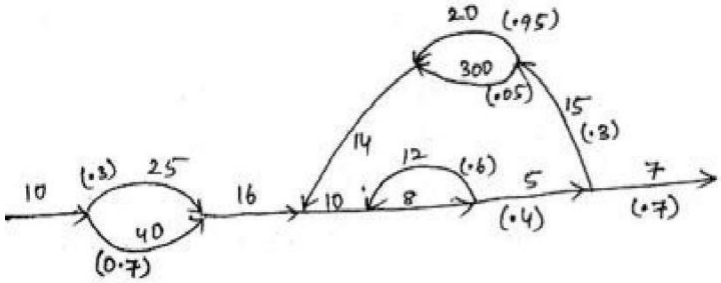
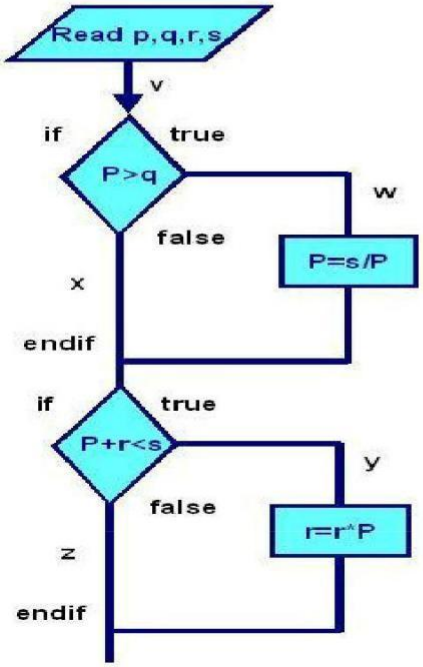
26	If the system requires 100% decision coverage at component testing for all modules. The following module has been tested with a single test case. The test case follows the path A, B, D, E, F, G.**Demonstrate** What level of decision coverage has been achieved?	Apply	2

27	**Discuss** one of the test goals for the project is to have 100% decision coverage. The following three tests have been executed for the control flow graph shown below? Test A covers path: A, B, D, E, G. Test B covers path: A, B, D, E, F, G. Test C covers path: A, C, F, C, F, C, F, G. 	Understand	2
	UNIT – II		
1	Consider the following techniques. Find the static and dynamic techniques **Explain** them? i. Equivalence Partitioning. ii. Use Case Testing. iii. Data Flow Analysis. iv. Exploratory Testing. v. Decision Testing. vi. Inspections.	Understand	2
2	**Discuss** during an early period of test execution, a defect is located, resolved and conformed as resolved re-testing ,but is seen again later during subsequent test execution .what type of testing can be conducted for a related aspect of configuration management that is most likely to have broken down?	Understand	2
3	If a Product risk analysis is performed during the planning stage of the test process. During the execution stage of the test process, the test manager directs the testers to classify each detect report by the known product risk it relates to other. once a week test manager runs a report that shows the percentage of defects related to each known product risk and to unknown risks. **Discuss** what is one possible use of such a report?	Understand	2
4	**Demonstrate** the two specification based techniques are most closely related to each other? Write some key characteristics of specification based techniques?	Apply	2
5	**Discuss** the most important difference between the metrics based approach and the expert –based approach to test estimation?	Understand	2
	UNIT - III		
1	Consider a wholesaler sells printer cartridges. The minimum order quantity is 5. There is a 20% discount for orders of 100 or more printer cartridges. You have been asked to prepare test cases using various values for the number of printer cartridges ordered. **Demonstrate** which of the following groups contain three test inputs that would be generated using boundary value analysis?	Apply	2
2	**Discuss** that would like to know whether black box testing techniques like boundary value analysis and equivalence partitioning during which phases of testing are they used, if possible with examples ?	Understand	2
3	**Demonstrate** why is it necessary to develop test cases for both valid and invalid input condition?	Apply	2

4	**Demonstrate** why it is necessary to develop test cases for both valid and invalid input condition. how important is document for product? how will you test requirement and design Document?	Apply	2
5	Consider programmer A and programmer B are working on a group of interfacing modules. Programmer A tends to be a poor communicator and does not get along well with Programmer B. Due to this situation, **Discuss** what types of defects are likely to surface in these interfacing modules?	Understand	2
6	A program validates a numeric field as follows: values less than 10 are rejected, values between 10 and 21 are accepted, values greater than or equal to 22 are rejected. **Define** which of the following covers the most boundary values?	Knowledge	2
7	**Discuss** In a system designed to work out the tax to be paid: An employee has $4000 of salary tax free. The next $1500 is taxed at 10% The next $28000 is taxed at 22%. Any further amount is taxed at 40% To the nearest $ which of these is a valid boundary value analysis test case?	Understand	2
8	**Demonstrate** the digital "Rainbow Thermometer" uses 7 colors to show the ambient temperature. Each color spans a range of just 5 Deg. C, with an operating minimum and maximum of minus 5 Deg. C and 30 Deg.C. Which of the following values is least likely to have been identified when applying the boundary value test design technique?	Apply	2

9	Given the following sample of pseudo code?
	Roman"'>
	Input number of male rabbits
	Input number of female rabbits
	If male rabbits > 0 and female rabbits > 0 then
	Input Do you want to breed (Yes / No)
	If breed = "No"
	Print "Keep male and female rabbits apart!"
	End if
	End If.
	Demonstrate which of the following test cases will ensure that statement "06" is executed?
		Apply	1

10	Consider Arrive and Go airline wants to clarify its baggage handling policy, whilst maximizing revenues, and will introduce the following tariffs for all baggage per individual customer (weights are rounded up to the nearest 0.1Kg): The first 2Kg will be carried free of charge. The next 10 Kg will be carried for a flat charge of $10. An additional 15Kg will be charged a total charge of $17. Luggage over this amount will be charged at $5 per Kg, up to a maximum of 150Kg per person. No passenger may take more that 150Kg with them**. Define** Which of the following would constitute boundary values for baggage weights in the price calculation?	Knowledge	2
11	For a system designed to work out the tax to be paid. An employee has $4000 of salary tax free. The next $1500 is taxed at 10%. The next $28000 is taxed at 22% .Any further amount is taxed at 40% .To the nearest $.**Discuss** which of these is a valid boundary value analysis test case?	Understand	2
12	If the order numbers on a stock control system can range between 10000 and 99999 inclusive. **Demonstrate** the following inputs might be a result of designing tests for only valid equivalence classes and valid boundaries?	Apply	2

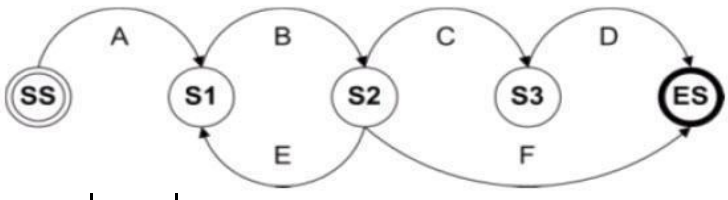
UNIT – IV			
1	**Evaluate** the mean processing time of a program represented by the following flow graph numbers in the brackets are the probabilities and the other numbers are processing times.? 	Evaluate	1
2	**Describe** the minimum combination of paths required to provide full statement coverage? 	Understand	2

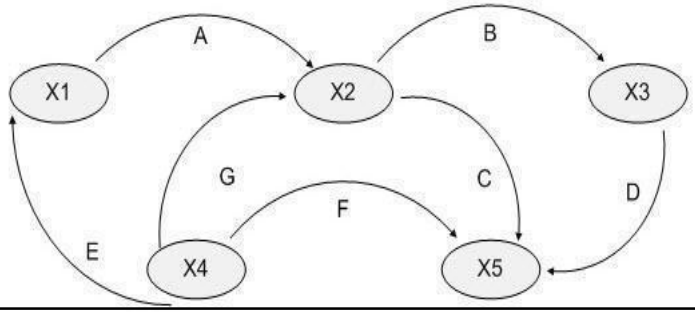
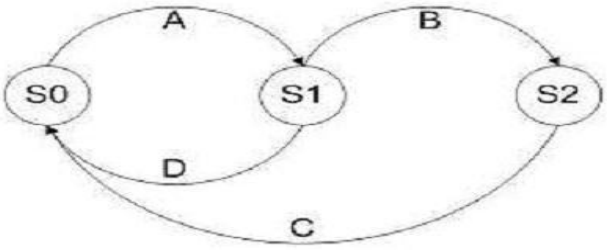
3	Given the following highly simplified procedure
	Ask: "What type of ticket do you require, single or return?"
	IF the customer wants return
	Ask: "What rate, Standard or Cheap-day?"
	IF the customer replies Cheap-day
	Say: "That will be 11:20"
	ELSE
	Say: "That will be 19:50"
	ENDIF
	ELSE
	Say: "That will be 9:75"
	ENDIF
	Calculate the minimum number of tests that are needed to ensure that all the questions have been asked, all combinations have occurred and all replies given.
		Understand	1

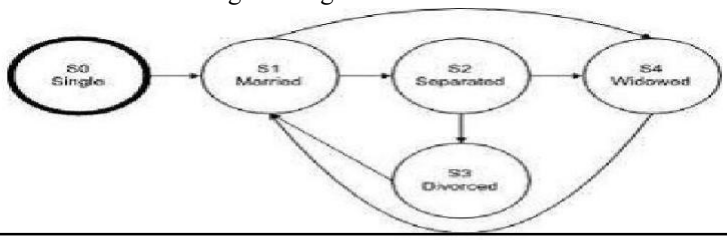
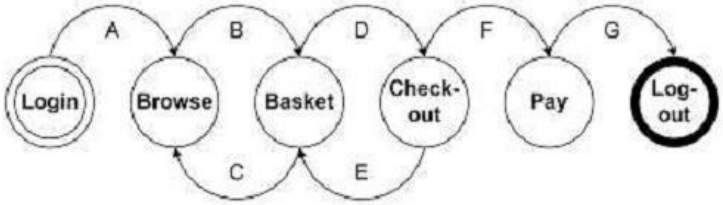
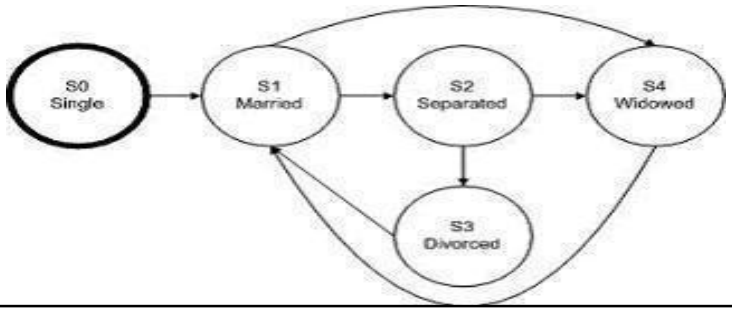
4	**Explain** the relations between regular expressions and flow anomaly detection with an example. If X and Y are following path expressions, answer the given questions. X = abc + def + ghi Y = uvw + z i)Find value of XY ii)Is XY = YX. Justify your answer.	Understand	2
5	Consider the following decision table for car rental. Given this decision table, Discuss what is the expected result for the following test cases?	Understand	2
6	Given the following decision table: **Describe** what is the expected result for each of the following test cases?	Understand	1
7	Given the following state transition diagram: Demonstrate which of the test cases below will cover the following series of state transitions? SS-S1-S2-S1-S2-ES	Apply	1

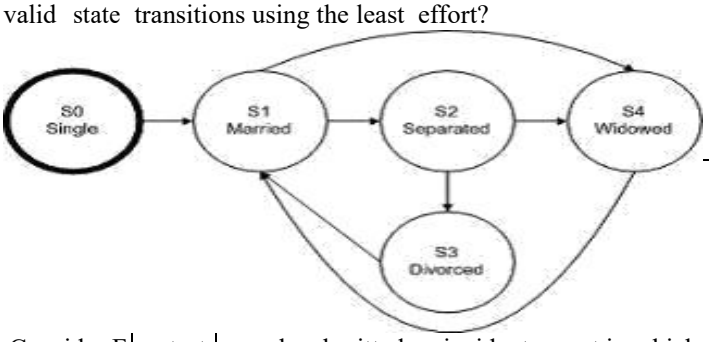
Conditions	Rule 1	Rule 2	Rule 3	Rule 4
Over 23?	F	T	T	T
Clean driving record?	Don't care	F	T	T
On business?	Don't care	Don't care	F	T
Actions				
Supply rental car?	F	F	T	T
Premium charge	F	F	F	T

	Rule 1	Rule 1	Rule 1	Rule 1
Conditions				
Frequent Flyer	Gold	Gold	Silver	Silver
Class	Business	Economy	Business	Economy
Actions				
Free Upgrade	First	Business	No	Business
Discounted Upgrade	N/A	First	First	None



<table>
<tr><td>8</td><td>Define how many test cases are required to cover 100% 0 - switch coverage respectively from X2?
 
</td><td>Knowledge</td><td>2</td></tr>
<tr><td>9</td><td>Given the decision table .Show which of the following test cases and expected results is valid?
<table>
<tr><td></td><td>Rule 1</td><td>Rule 2</td><td>Rule 3</td><td>Rule 4</td></tr>
<tr><td>Conditions</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Age</td><td><21 yrs</td><td>21-29 yrs</td><td>30-50yrs</td><td>> 50yrs</td></tr>
<tr><td>Insurance Class</td><td>A</td><td>A or B</td><td>B. C or D</td><td>C or D</td></tr>
<tr><td>Actions</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Premium</td><td>100</td><td>90</td><td>70</td><td>70</td></tr>
<tr><td>Excess</td><td>2,500</td><td>2,500</td><td>500</td><td>1000</td></tr>
</table></td><td>Apply</td><td>2</td></tr>
<tr><td>10</td><td>Illustrate the following functions using K-Maps
F(A,B,C,D) = P(4,5,6,7,8,12,13)+d(1,15)</td><td>Apply</td><td>2</td></tr>
<tr><td>11</td><td>Explain how can we form specifications into sentences? Write down different phrases that can be used for words?</td><td>Understand</td><td>2</td></tr>
<tr><td>12</td><td>Demonstrate by means of truth tables the validity of the following theorems of Boolean algebra
i. Associative Laws
ii. Demorgan's theorems for three variables
iii. Distributive Law
iv. Absorption Rule</td><td>Apply</td><td></td></tr>
<tr><td>13</td><td>Discuss an example of decision table testing for a financial application applied at the system level?</td><td>Understand</td><td>1</td></tr>
<tr><td colspan="4">UNIT - V</td></tr>
<tr><td>1</td><td>Explain the given following state transition table which of the test cases below will cover the following series of state transitions? S1 SO S1 S2 SO
 
</td><td>Understand</td><td>2</td></tr>
<tr><td>2</td><td>Consider Postal rates for 'light letters' are 25p up to 10g, 35p up to 50g plus an extra 10p for each additional 25g up to 100g. Discuss which test inputs (in grams) would be selected using equivalence partitioning</td><td>Understand</td><td>2</td></tr>
</table>

<table>
<tr><td>3</td><td>If thermometer measures temperature in whole degrees only. If the temperature falls below 18 degrees, the heating is switched off. It is switched on again when the temperature reaches 21 degrees. Show the best values in degrees to cover all equivalence partitions?</td><td>Apply</td><td>1</td></tr>
<tr><td>4</td><td>Evaluate a system designed to work out the tax to be paid: An employee has 4000 of salary tax free. The next 1500 is taxed at 10%.The next 28000 after that is taxed at 22%.Any further amount is taxed at 40%.To the nearest whole pound, Discuss which of these groups of numbers fall into three different equivalence classes?</td><td>Evaluate</td><td>1</td></tr>
<tr><td>5</td><td>Consider there is one application, which runs on a single terminal. there is another application that works on multiple terminals. Demonstrate what are the test techniques you will use on the second application that you would not do on the first application? which test suite will check for an invalid transition using the diagram below?
 
</td><td>Apply</td><td>2</td></tr>
<tr><td>6</td><td>Consider the following state table:
<table>
<tr><th></th><th>On</th><th>Off</th><th>Channel 1</th><th>Channel 2</th><th>Channel >2</th><th>Stby</th></tr>
<tr><td>Standby</td><td>Live</td><td>N</td><td>N</td><td>N</td><td>N</td><td>N</td></tr>
<tr><td>Live</td><td>N</td><td>Standby</td><td>Display Channel 1</td><td>Display Channel 2</td><td>N</td><td>Standby</td></tr>
<tr><td>Display Channel 1</td><td>N</td><td>N</td><td>N</td><td>Display Channel 2</td><td>Live</td><td>Standby</td></tr>
<tr><td>Display Channel 2</td><td>N</td><td>N</td><td>Display Channel 1</td><td>N</td><td>Live</td><td>Standby</td></tr>
</table>
Demonstrate which of the following represents an invalid transition (N)?</td><td>Apply</td><td>2</td></tr>
<tr><td>7</td><td>Consider the following state transition diagram .Show which of the following series of state transitions contains an invalid transition which may indicate a fault in the system design?
 
</td><td>Apply</td><td>2</td></tr>
<tr><td>8</td><td>Without testing all possible transitions, Demonstrate which test suite will test all marital statuses?
 
</td><td>Apply</td><td>2</td></tr>
</table>

9	Using the diagram below, **Explain** which test suite will check for all valid state transitions using the least effort?  	Understand	1
10	Consider Four testers each submitted an incident report in which each reported a problem with the user log-on process. User log-on is a critical component of the system. The table below describes the four defect reports submitted?	Apply	2

Tester ID	Incident Description	Inputs / Expected & Actual Results	Business Priority (1 High 2 Medium 3 Low)
Tester 1	User Log-on validation error	Entered user ID of Ram Kumar & password ABCREATE but got an error message	1
Tester 2	Log-on does not meet requirements	Inputs: Entered valid user ID & password Expected result: Main menu screen to be displayed Actual result: Error saying incorrect password	2
Tester 3	Log-on password validation error	Inputs: User ID Ram Kumar & password ABCREATE Expected result: Main menu screen Actual result: Error Message – "Incorrect password" This test has worked many times before	2
Tester 4	Password validation error	Inputs: User ID Ram Kumar & password ABCREATE Expected result: Main menu screen Actual result: "Incorrect password" N. B: The same inputs worked yesterday, before code release 1.2 was delivered	1

Demonstrate which tester has reported the incident most effectively, considering the information and priority they have supplied?

11	**Explain** win runner testing process?	Understand	1

12	**Discuss** how does win runner recognize objects on the application?	Understand	2
13	If a company is going to provide their employees with a bonus which will be based on the employee's length of service in the company. The bonus calculation will be zero if they have been with the company for less than two years, 10% of their salary for more than two but less than five years, and 25% for five to ten years, 35% for ten years or more. The interface will not allow a negative value to be input, but it will allow a zero to be input. **Demonstrate** how many equivalence partitions are needed to test the calculation of the bonus?	Apply	2
14	An automated air-conditioner is programmed to turn its heating unit on when the temperature falls below 17 Deg. C and to turn its refrigeration unit on when the temperature exceeds 26 Deg. C. The air-conditioner is designed to operate at temperatures between -10 Deg. C and +40 Deg. C. Given the above specification, **Calculate** which of the following sets of values shows that the equivalence partition test design technique has been used correctly?	Apply	2
15	An employee's bonus is to be calculated. It cannot become negative, but it can be calculated to zero. The bonus is based on the duration of the employment. An employee can be employed for less than or equal to 2 years, more than 2 years but less than 5 years,5 to 10 years, or longer than 10 years. Depending on this period of employment, an employee will get either onus or a bonus of 10%, 25% or 35%.**Calculate** how many equivalence partitions are needed to test the calculation of the onus?	Apply	2
16	**Illustrate** the advanced scripting techniques for test execution tools?	Apply	2
17	**Discuss** the potential benefits from using tools in general to support testing?	Understand	2
18	**Explain** the goal for a proof-of-concept or pilot phase for tool evaluation?	Understand	1

GFDGFDHDFHCOMPUTER SCIENCE AND ENGINEERINGTUTORIAL

QUESTION BANK

2020 - 2021

Course Name	:	**DESIGN AND ANALYSIS OF ALGORITHMS**
Course Code	:	CS603PC
Class	:	II B. Tech II Semester
Branch	:	**Computer Science and Engineering**
Year	:	2020 – 2021
Course Faculty	:	D SHIVA RAMA KRISHNA

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner"s learning process.

PART – A (SHORT ANSWER QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT – I		
1	**Define** the term algorithm and state the criteria the algorithm should satisfy.	Remember	1
2	**Define** order of an algorithm and the need to analyze the algorithm.	Remember	2
3	**Define** asymptotic notations: big „Oh", omega and theta?	Remember	2
4	**List** the two different types of recurrence	Remember	4
5	**State** the best case and worst case analysis for linear search	Remember	2
6	If $f(n)=5n^2 + 6n + 4$, then **prove** that f(n) is $O(n^2)$	Remember	3
7	**Give** the recurrence equation for the worst case behavior of merge sort.	Remember	3
8	**Compute** the average case time complexity of quick sort	Remember	4
9	**Define** algorithm correctness	Remember	4
10	**Describe** best case, average case and worst case efficiency of an algorithm?	Remember	3
11	**Explain** the term amortized efficiency	Understand	3
S. No	**Question**	**Blooms Taxonomy Level**	**Program Outcome**
12	**Define** order of growth	Remember	2

13	**How** do you measure the algorithm running time?	Understand	1
14	**Describe** the role of space complexity and time complexity of a program are necessary?	Understand	1
15	**Explain** algorithm design technique?	Understand	3
16	**Use** step count method and analyze the time complexity when two n×n matrices are added	Apply	3
17	**What** is meant by divide and conquer? Give the recurrence relation for divide and conquer.	Understand	2
18	**Define** Control Abstraction and write the computing time of divide and conquer.	Remember	1
19	**List** out any two drawbacks of binary search algorithm.	Remember	2
20	**List** out the drawbacks of Merge Sort algorithm.	Remember	3
UNIT – II			
1	**Describe** union operation on sets	Remember	4
2	**Describe** find operation on sets	Remember	4
3	**Define**a spanning tree and minimal spanning tree	Remember	3
4	**Define** depth first search	Remember	2
5	**Define** breadth first search	Remember	2
6	**Differentiate** Breadth first search and depth first search	Remember	1
7	**Describe** AND/OR graph	Remember	3
8	**Explain** game tree	Remember	2
9	**Define** an articulation point?	Remember	4
10	**Define** aconnected and bi-connected component.	Remember	1
UNIT – III			
1	**Define** greedy method	Remember	2
2	**Define** job sequencing with deadlines problem	Remember	2
3	**Define** minimum cost spanning tree	Remember	3
4	**State** the principle of optimality	Remember	1
5	**Define** prims algorithm	Remember	1
6	**Define**kruskal algorithm	Remember	4
7	**Define** single source shortest path problem	Remember	4
8	**Define** dynamic programming.	Remember	2
9	**List** the features of dynamic programming	Remember	3
10	**Distinguish** greedy method and dynamic programming	Remember	4
UNIT – IV			
1	**State** the principle of Backtracking	Remember	4
2	**Write** control abstraction for backtracking	Apply	4
3	**List** the applications of backtracking?	Remember	3
4	**Define** a dead node	Remember	2
5	**Differentiate** live node and dead node	Remember	1
6	**Define** state space tree	Remember	1

S. No	Question	Blooms Taxonomy Level	Program Outcome
7	**Define** is solution space	Remember	2
8	**Define** solution states and answer state?	Remember	3
9	**Explain** 8 – Queens problem	Apply	1
10	**Explain** Sum of Subsets problem	Apply	1
	UNIT – V		
1	**Define** class P	Remember	2
2	**Compare** NP-hard and NP-completeness	Remember	1
3	**Define** NP- hard problem	Remember	1
4	**Define** NP-complete problem	Remember	2
5	**Define** deterministic problem?	Remember	4
6	**Define** non-deterministic problem	Remember	4
7	**Define** a decision problem?	Remember	3
8	**Explain** optimization problem	Understand	2
9	**Explain** maxclique problem?	Understand	2
10	**Define** halting problem	Remember	1

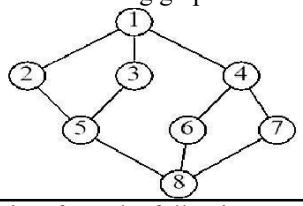
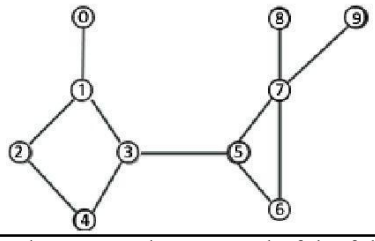
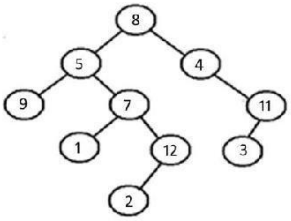
PART – B (LONGANSWER QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT - I		
1	**Discuss** various the asymptotic notations used for best case average case and worst case analysis of algorithms.	Understand	1
2	**Differentiate** between priori analysis and posteriori analysis.	Understand	3
3	**Discuss**binary search algorithm and analyze its time complexity	Understand	4
4	**Explain** quick sort algorithm and simulate it for the following data 20, 35, 10, 16, 54, 21, 25	Understand	4
5	**Explain** Iterative binary search algorithm	Understand	2
6	**Illustrate**merge sort algorithm and discuss time complexity	Understand	2
7	**Describe**strassen"s matrix multiplication.	Understand	4
8	**Discuss**amortized analysis	Understand	3
9	**Explain** probabilistic analysis	Understand	3
10	**Sort** the list of numbers using merge sort: 78, 32, 42, 62, 98, 12, 34, 83	apply	4
	UNIT - II		
1	**Explain** breadth first search algorithm with example	Understand	2
2	**Explain** depth first search algorithm with example	Understand	2
3	**Discuss** various tree traversal techniques with examples	Understand	1
4	**Compare** and contrast BFS and DFS.	Understand	3
5	**Explain** in detail about AND/OR graphs	Understand	3
6	**Explain** waiting rule for finding UNION of sets and collapsing rule	Understand	2

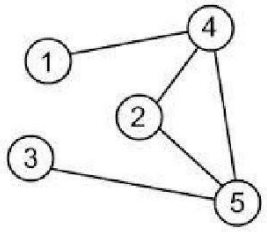
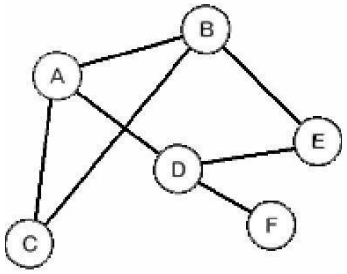
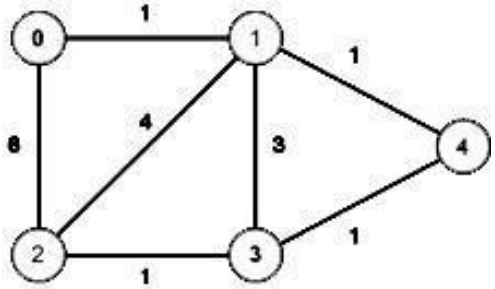
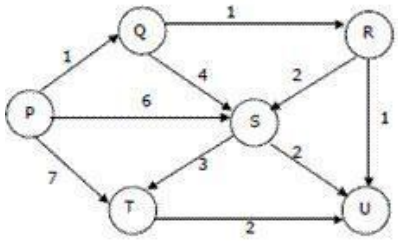
7	**Differentiate** divide and conquer and greedy method	Understand	1
8	**Discuss** game trees	Understand	1

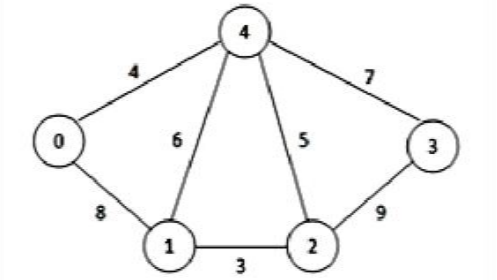
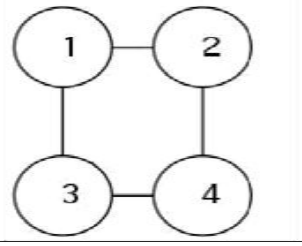
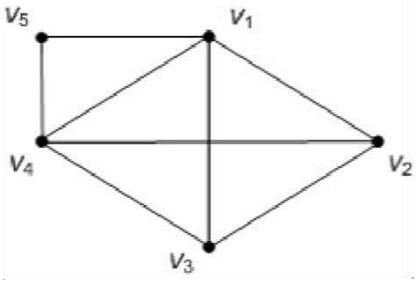
	UNIT - III		
1	**Explain** in detail job sequencing with deadlines problem with example	Apply	2
2	**Explain** single source shortest path problem with example	Apply	2
3	**Explain** knapsack problem with example	Apply	1
4	**Explain** prims algorithm with example	Understand	3
5	**Explain** kruskal algorithm with example	Understand	4
6	**Explain** the concept multistage graphs with example.	Understand	4
7	**Explain** optimal binary search tree algorithm with example	Understand	2
8	**Explain** 0/1 knapsack problem with example	Understand	2
9	**Explain** all pairs shortest path problem with example	Understand	1
10	**Describe** the travelling salesman problem and discuss how to solve it using dynamic programming?	Understand	3
	UNIT – IV		
1	**Write** an algorithm for N-queens problem using backtracking	Apply	1
2	**Explain** subset-sum problem and discuss the possible solution strategies using backtracking.	Apply	1
3	**Describe** graph coloring problem and write an algorithm for m-coloring problem	Understand	2
4	**Write** an algorithm for Hamiltonian cycle with an example	Apply	2
5	**Explain** properties of LC search	Apply	3
6	**Describe** control abstraction for LC Search	Understand	4
7	**Explain** principle of FIFO branch and bound	Apply	3
8	**Explain** principle of LIFO branch and bound	Apply	3
9	**Explain** the method of reduction to solve travelling sales person problem using branch and bound	Apply	3
10	**Explain** TSP using branch and bound method with example	Apply	4
	UNIT – V		
1	**State** and prove cook‟s theorem	Remember	2
2	**Explain** deterministic and non-deterministic algorithms	Apply	1
3	**Write** non deterministic algorithm for sorting and searching	Apply	1
4	**Write** a non-deterministic knapsack algorithm	Apply	3
5	**Explain** how P and NP problems are related	Apply	4
6	**Distinguish** NP- hard and NP-complete problems	Understand	4
7	**Explain** decision problem with an example	Apply	2
8	**Explain** chromatic number decision problem and clique decision problem	Apply	1
9	**Explain** the strategy to prove that a problem is NP-hard	Apply	2
10	**Explain** intractable problems with examples	Apply	4

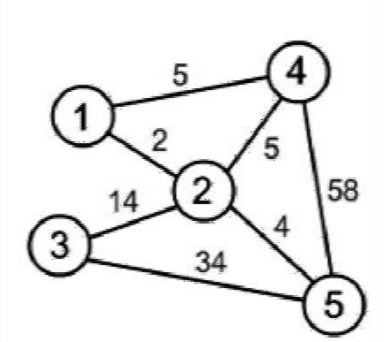
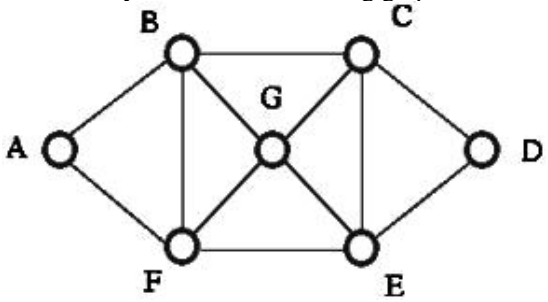
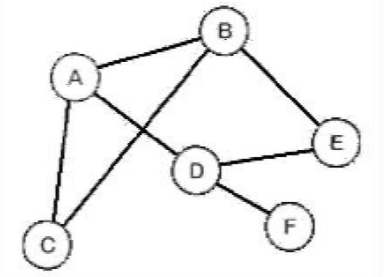
PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT – I		
1	**Solve** the following recurrence relation $= 2 \frac{}{2} + , \quad 1 = 2$	Understand	4
2	**Solve** the following recurrence relation $T(n) = 7T(n/2)+cn^2$	Understand	4
3	**Solve** the recurrence relation $= 1$ $3 \frac{}{} + , \quad > 1, \quad 2$	Understand	4
4	**Explain** quick sort algorithm and simulate it for following data sequence: 3 5 9 7 1 4 6 8 2	Apply	2
5	**Sort** the list of numbers using merge sort 33, 44, 2, 10, 25, 79, 86, 47, 14, 36	Understand	3
6	**Show** that the average case time complexity of quick sort is O(nlogn)	Apply	3
7	**Understand** merge sort on letters H, K, P,C,S,K,R,A,B,L	Understand	4
8	**Understand**strassen"s matrix multiplication on following matrices $\begin{bmatrix} 4 & 5 \\ 5 & 9 \end{bmatrix}, \begin{bmatrix} 2 & 10 \\ 1 & 6 \end{bmatrix}$	Understand	2
9	**Write** and solve recurrence relation for strassen"s matrix multiplication	Apply	2
10	**Solve** the following recurrence relation $= \quad 2 \frac{}{2} + 1, \quad 1 = 2$	Understand	1
	UNIT - II		
1	**Illustrate** BFS traversal of following graph 	Understand	4
2	**List** the articulation points from the following graph 	Understand	1
3	**Write**inorder, preoreder, post order traversal of the following tree 	Understand	3

S. No	Question	Blooms Taxonomy Level	Program Outcome
4	**Illustrate** DFS and BFS traversals of following graph	Understand	3
5	**Illustrate** DFS traversal of following graph	Understand	2
6	**Illustrate** BFS traversal of following graph	Understand	1
7	**List** the articulation points from the following graph	Understand	2
8	**Write**inorder, preorder, post order traversal of the following tree	Understand	2

S. No	Question	Blooms Taxonomy Level	Program Outcome
9	**Illustrate** BFS and DFS traversals of following graph 	Understand	4
10	**Illustrate** DFS traversal of following graph 	Understand	4
	UNIT - III		
1	**Compute** the optimal solution for job sequencing with deadlines using greedy method. N=4, profits (p1,p2,p3,p4) = (100,10,15,27), Deadlines (d1,d2,d3,d4) = (2,1,2,1)	Understand	3
2	**Compute** the optimal solution for knapsack problem using greedy methodN=3, M= 20, (p1,p2,p3)= (25,24,15), (w1,w2,w3) =(18,15,10)	Understand	2
3	**Construct** minimum cost spanning tree using a) prims algorithm b) kruskal algorithm 	Understand	2
4	**Apply** single source shortest path algorithm for the following graph 	Apply	3
5	**Use** optimal binary search tree algorithm and compute wij, cij, rij, 0<=i<=j<=4,p1=1/10, p2=1/5, p3=1/10, p4=1/120, q0=1/5, q1=1/10, q2=1/5, q3=1/20,q4=1/20.	Understand	4
6	**Construct** optimal binary search for (a1, a2, a3, a4) = (do, if,int, while), p(1 : 4) = (3,3,1,1) q(0 : 4)= (2,3,1,1,1)	Understand	4

S. No	Question	Blooms Taxonomy Level	Program Outcome
7	**Solve** the solution for 0/1 knapsack problem using dynamic programming(p1,p2,p3, p4) = (11, 21, 31, 33), (w1, w2, w3, w4) = (2, 11, 22, 15), M=40, n=4	Apply	1
8	**Solve** the solution for 0/1 knapsack problem using dynamic programming N=3 , m=6 profits (p1,p2,p3) = (1,2,5) weights (w1,w2,w3) = (2,3,4)	Apply	1
9	**Find** the shortest tour of traveling sales person for the following cost matrix using dynamic Programming $\begin{bmatrix} \infty & 12 & 5 & 7 \\ 11 & \infty & 13 & 6 \\ 4 & 9 & \infty & 18 \\ 10 & 3 & 2 & \infty \end{bmatrix}$	Understand	2
10	**Calculate** shortest distances using all pairs shortest path algorithm 	Understand	2
	UNIT - IV		
1	**Sketch** the state space tree degenerated by 4 queens problem	Understand	3
2	**Apply** the backtracking algorithm to solve the following instance of the sum of subsets problem S={5,10,12,13,15,18} and d=30	Understand	3
3	**Sketch** the state space tree generated all possible 3-color,4-node graph 	Understand	4
4	**Identify** Hamiltonian cycle from the following graph 	Understand	4

S. No	Question	Blooms Taxonomy Level	Program Outcome
5	**Solve** the following instance of travelling sales person problem using Least Cost Branch Bound $\begin{bmatrix} \infty & 12 & 5 & 7 \\ 11 & \infty & 13 & 6 \\ 4 & 9 & \infty & 18 \\ 10 & 3 & 2 & \infty \end{bmatrix}$	Understand	1
6	**Draw** the portion of state space tree generated by LCBB by the following knapsack problem n=5 , (p1,p2,p3,p4,p5) =(10,15,6, 8, 4), (w1,w2,w3,w4,w5)=(4,6,3,4,2) and m=12	Understand	1
7	**Draw** the portion of state space tree generated by FIFO knapsack for the instance N=4 , (P1, P2, P3, P4)= (10, 10, 12, 18) , (w1, w2,w3,w4) = (2, 4, 6, 9) , m=15	Understand	2
8	**Solve** the following instance of travelling sales person problem using Least Cost Branch Bound 	Understand	3
9	**Identify** Hamiltonian cycle from the following graph 	Understand	3
10	**Apply** the backtracking algorithm to color the following graph 	Understand	3

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT - V		
1	**Show** that satisfiability is at most three literals reduces to chromatic number	Remember	4
2	**Prove** Hamiltonian cycle is in NP	Understand	1
3	**Prove** circuit-SAT is in NP	Understand	1
4	**List** two problems that have polynomial time algorithms justify your answer	Understand	3
5	**Explain** 3CNF satisfiability problem	Remember	2
6	**Explain** P type problems with examples	Remember	1

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY & MANAGEMENT
(Approved by AICTE-New Delhi, Accredited by NAAC with 'A' & Affliated to JNTU, Hyderabad)
Recognised Under Section 2(f) & 12(B) of The UGC act, 1956

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Regulation:R18
Year:III-II
Sub:DESIGN AND ANALYSIS OF ALGORITHMS

Course code:CS603PC

Prerequisites:-

SYLLABUS

UNIT-I

Introduction: Algorithm,PerformanceAnalysis-Spacecomplexity,Timecomplexity,AsymptoticNotations- Big oh notation, Omega notation, Theta notation and Little oh notation.

Divideandconquer:Generalmethod,applications-Binarysearch,Quicksort,Mergesort,Strassen's matrix multiplication.

UNIT-II

DisjointSets:Disjointsetoperations,unionandfindalgorithms

Backtracking:Generalmethod,applications,n-queen'sproblem,sumofsubsetsproblem,graph coloring

UNIT-III

Dynamic Programming: General method, applications-Optimal binary search trees,0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT-IV

Greedy method: General method,applications-Job sequencing with deadlines,knapsackproblem, Minimum cost spanning trees, Single source shortest path problem.

UNIT-V

Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

COURSE OUTCOMES:

At the end of the course the student will develop ability to

CO	Course outcome	Blooms taxonomy level
C323.1	Analyze the performance of algorithms	Analyze
C323.2	Choose appropriate data structures and algorithm design methods for a specified application	understand
C323.3	Understand how the choice of data structures and the algorithm design methods impact the performance of programs	Understand
C323.4	Describes how to evaluate and compare different algorithms using worst-, average-, and bestcase analysis	Evaluate
C323.5	Write the notations for analysis of the performance of algorithms	Apply

Mapping of key competencies of POs to each CO:

	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C323.1	1,2,3	1,2,3,4,5,6,7,8,9,10	4,5,6,9	1,3,5,8,9,10,11		3						2,3	1,2	1,2,3	2
C323.2	1,2,3	1,2,3,4,5,6,7,8,9,10	4,5,6,9	1,3,5,8,9,10,11		3						2,3	1,2	1,2,3	2
C323.3	1,2,3	1,2,3,4,5,6,7,8,9,10	4,5,6,9	1,3,5,8,9,10,11		3						2,3	1,2	1,2,3	2
C323.4	1,2,3	1,2,3,4,5,6,7,8,9,10	4,5,6,9	1,3,5,8,9,10,11		3						2,3	1,2	1,2,3	2
C323.5	1,2,3	1,2,3,4,5,6,7,8,9,10	4,5,6,9	1,3,5,8,9,10,11		3						2,3	1,2	1,2,3	2

NUMBER OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	3	10	10	11	1	5	3	3	12	5	12	8	2	3	2
C323.1	3	10	4	7		1						2	2	3	1
C323.2	3	10	4	7		1						2	2	3	1
C323.3	3	10	4	7		1						2	2	3	1
C323.4	3	10	4	7		1						2	2	3	1
C323.5	3	10	4	7		1						2	2	3	1

PERCENTAGE OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	3	10	10	11	1	5	3	3	12	5	12	8	2	3	2
C323.1	100	100	40	63.64	0	20	0	0	0	0	0	25	100	100	50
C323.2	100	100	40	63.64	0	20	0	0	0	0	0	25	100	100	50
C323.3	100	100	40	63.64	0	20	0	0	0	0	0	25	100	100	50
C323.4	100	100	40	63.64	0	20	0	0	0	0	0	25	100	100	50
C323.5	100	100	40	63.64	0	20	0	0	0	0	0	25	100	100	50

COURSE ARTICULATION MATRIX (CO - PO / PSO MAPPING):

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C323.1	3	3	1	3	0	1	0	0	0	0	0	1	3	3	2
C323.2	3	3	1	3	0	1	0	0	0	0	0	1	3	3	2
C323.3	3	3	1	3	0	1	0	0	0	0	0	1	3	3	2
C323.4	3	3	1	3	0	1	0	0	0	0	0	1	3	3	2
C323.5	3	3	1	3	0	1	0	0	0	0	0	1	3	3	2
Total	15	15	5	15	0	5	0	0	0	0	0	5	15	15	10
Average	**3**	**3**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**2**

COs and POs and COs and PSOs on the scale of 0 to 3, 0 being no correlation,

1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 – ≤ ≤ 5% – No correlation; 1 – 5 < ≤ 40% – Low / Slight;

2 − 40 % << 60% – Moderate. 3 – 60% ≤ < 100% – Substantial / High

FRESHMAN ENGINEERING

COURSE DESCRIPTION FORM

CourseTitle	**ENVIRONMENTAL SCIENCES**			
CourseCode	**MC609**			
Regulation	**R18– JNTUH**			
CourseStructure	Lectures	Tutorials	Practicals	Credits
	4		-	4
Course Faculty	Mr. VIJAY			

I. COURSEOVERVIEW:

Environmentalstudyisinterconnected;interrelatedandinterdependentsubject.Hence,itismultidisciplinaryin nature.ThepresentcourseisframedbyexpertcommitteeofUGCunderthedirectionofHonorableSupremeCour ttobeasacoremodulesyllabusforallbranchesofhighereducationandtobeimplementedinalluniversitiesoverIn dia.Thecourseisdesignedtocreateenvironmentalawarenessandconsciousnessamongthepresentgeneration tobecomeenvironmentalresponsiblecitizens.Thecoursedescriptionis:multidisciplinarynatureofenvironmen talstudies,NaturalResources:Renewableandnonrenewableresources;Ecosystems;Biodiversityanditsconse rvation;EnvironmentalPollution;SocialIssuesandtheEnvironment;HumanPopulationandtheEnvironment; pollutioncontrolactsandFieldWork.Thecourseisdividedintofivechaptersforconvenienceofacademicteachi ngfollowedbyfield visits.

II. PREREQUISITE(S):

Level	Credits	Periods/Week	Prerequisites
UG	4	4	Knowledge of basic sciences

III. MARKSDISTRIBUTION:

SessionalMarks	UniversityEnd Exam Marks	Total Marks
MidtermTest Thereshallbetwomidtermexaminations.Eachmidtermexaminationconsistsof essaypaper,objectivepaperandassignment. Theessaypaperisfor10marksof60minutesdurationandshallcontain4question s.Thestudenthastoanswer2questions,each carrying5 marks.	75	100

SessionalMarks	UniversityEnd Exam Marks	Total Marks
Theobjectivepaperisfor10marksof20minutesduration.Itconsistsof10multiplechoiceand10fill-in theblankquestions,thestudenthastoanswerallthequestionsandeachcarries halfmark.Firstmidtermexaminationshallbeconductedforthefirsttwoandhalfunitsofsyllabusandsecondmidtermexaminationshall be conductedfor theremainingportion.Fivemarksareearmarkedforassignments.Thereshallbetwoassignmentsineverytheorycourse.Assignmentsareusuallyissuedatthetimeofcommencementofthesemester.Theseareofproblemsolvinginnaturewithcriticalthinking.Marksshallbeawardedconsideringtheaverageoftwomidtermtests in eachcourse.		

IV. EVALUATIONSCHEME:

S. No	Component	Duration	Marks
1.	IMid Examination	80 minutes	20
2.	I Assignment	-	5
3.	IIMid Examination	80 minutes	20
4.	IIAssignment	-	5
5.	External Examination	3 hours	75

V. COURSEOBJECTIVES:

Atthe end ofthe course,the students willbe ableto:

I. DeterminetheNaturalresourcesonwhichthestructureofdevelopmentisraisedforsustainabilityofthesocietythroughequitablemaintenanceofnaturalresources.

II. Illustrateaboutbiodiversitythatraisesanappreciationanddeeperunderstandingofspecies,ecosystemsandalsotheinterconnectednessofthelivingworldandtherebyavoids the mismanagement, misuse and destruction ofbiodiversity.

III. Summarizeamethodologyforidentification,assessmentandquantificationofglobalenvironmentalissuesinordertocreateawarenessabouttheinternationalconventions formitigating global environmental problems

IV. Sustainabledevelopmentthataimstomeetraisinghumanneedsofthepresentandfuturegenerationsthrough preservingtheenvironment.

V. Outlinegreenenvironmentalissueprovidesanopportunitytoovercomethecurrentglobalenvironmental issuesbyimplementingmoderntechniqueslikeCDM, greenbuilding,green computingetc.

VI. COURSEOUTCOMES:

Based on this course, the Engineering graduate will understand / evaluate /developtechnologies on the basis of ecological princoples and environmenta regulations which inturn helps in

Sustainable development..

VII. HOW PROGRAMOUTCOMES AREASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering	S	Assignments, Tutorials
	to the solution of complex engineering problems specialization		
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex		
	engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Mini Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	H	Tutorials,Exams
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--

PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	H	Future scope or projects discussion
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Projects

N = None **S = Supportive** **H = Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Applications of Computing**: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	H	Lectures, Assignments
PSO2	**Programming Skills**: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	H	Projects

VIII. SYLLABUS:

UNIT-I

Ecosystems:Definition,ScopeandImportanceofecosystem.Classification,structureandfunctionofanecosystem,Foodchains,foodwebsandecologicalpyramids.Flowofenergy,Biogeochemicalcycles,Bioaccumulation,Biomagnifications,ecosystemvalue,servicesand carryingcapacity,Field visit.

UNIT-II

NaturalResources:ClassificationofResources:LivingandNonLivingresources,waterresources:useandoverutilizationofsurfaceandgroundwater,floodsanddroughts,Dams:benefitsandproblems.Mineralresources:useandexploitation,environmentaleffectsofextractingandusingmineralresources,Landresources:Forestresources,Energyresources:growingenergyneeds,renewableandnonrenewable energysources, use ofalternate energysource, casestudi

UNIT-III

BiodiversityandBioticResources:Introduction,Definition,genetic,speciesandecosystemdiversity.Valueofbiodiversity;consumptiveuse,productiveuse,social,ethical,aestheticandoptionalvalues.Indiaasamegadiversitynation,Hotspotsofbiodiversity.Fieldvisit.Threatstobiodiversity:habitatloss,poachingofwildlife,man-wildlifeconflicts;conservationofbiodiversity:In-SituandEx-situconservation.National Biodiversityact.

UNIT-IV

EnvironmentalPollutionandControlTechnologies:EnvironmentalPollution:Classificationofpollution,AirPollution:Primaryandsecondarypollutants,AutomobileandIndustrialpollution,Ambientairquality standards.Waterpollution:Sourcesandtypesofpollution,drinkingwaterqualitystandards.SoilPollution:Sourcesandtypes,Impactsofmodernagriculture,degradationofsoil.NoisePollution:SourcesandHealthhazards,standards,Solidwaste:MunicipalSolidWastemanagement,compositionandcharacteristicsofe-Wasteanditsmanagement.Pollutioncontroltechnologies:WastewaterTreatmentmethods:Primary,secondaryandTertiary.Overviewofairpollutioncontroltechnologies,Conceptsofbioremediation.GlobalEnvironmentalProblemsandGlobalEfforts:Climatechangeandimpactsonhumanenvironment.Ozonedepletion andOzonedepletingsubstances(ODS).Deforestationanddesertification.Internationalconventions/Protocols:Earthsummit, Kyoto protocol and MontréalProtocol.

UNIT-V

EnvironmentalPolicy,Legislation&EIA:
EnvironmentalProtectionact,LegalaspectsAirAct,WaterAct,ForestAct,WildlifeAct,Municipalsolidwastemanagementandhandlingrules,biomedicalwastemanagementandhandlingrules,hazardouswastemanagementandhandlingrules.EIA:EIAstructure,methodsofbaselinedataacquisition.OverviewonImpactsofair,water,biologicalandSocio-economicalaspects.Strategiesforriskassessment,ConceptsofEnvironmentalManagementPlan(EMP).TowardsSustainableFuture:ConceptofSustainableDevelopment,Populationanditsexplosion,CrazyConsumerism,EnvironmentalEducation,UrbanSprawl,Humanhealth,EnvironmentalEthics,ConceptofGreenBuilding,Ecological Foot Print, Life Cycleassessment (LCA),Lowcarbonlifestyle

Text Books:

1. BennyJoseph (2005)., *EnvironmentalStudies*, New Delhi,TataMcGrawHillPublishingco.Ltd
2. ErachBharucha(2005).,*Textbook of Environmental Studies for UndergraduateCourses*, Hyderabad, Universities Press.

Reference Books:

1. Anji Reddy.M (2007),*Textbook of EnvironmentalSciences and Technology*,Hyderabad,BS Publications.
2. Y Anjaneyulu.(2004),Introduction to*EnvironmentalSciences*,BSPublications.
3. AnubhaKaushik(2006).,*Perspectives in Environmental Science*,3rdEdition, NewDelhi,New age international.

IX. COURSEPLAN:

Attheendofthecourse,thestudentsareabletoachievethefollowingcourselearningoutcomes:

Lecture No.	CourseLearningOutcomes	Topicstobecovered	Reference
1	Summarizeabout environment anditsimportance	Definition.Scope,importanceandneedforPublicAwareness.	T2:1-12
2	Summarize about environment andimportanceofecosystem	**Ecosystem**: Definition, scope andimportanceofecosyste	T1:17-20
3	Provides information regardingecosystemandapp	Structureandfunctionofecosystem	T1:17-26
4-5	Tounderstandhowalltheanimalsarecompetingwiththeirfoodrequirementsandalsounderstandsthevarioustrophiclevelsinthefood chain.	Food chain,Food weband pyramids	T1:28-39
6	Explaintheflowofenergythroughthevariouscomponentsofecosystem	Flowofenergy	TI:48-57
7	Tounderstandtheimportanceofnutrientsandflowofnutrientsinecosystem	Biogeochemicalcycles.	T1:57-64
8	Explainstheconceptofgaseouscyclesandtheirimportanceintheecosystem	Gaseouscycles	T1:64-68
9	Explainstheconceptofsedimentarycyclesandtheirimportanceintheecosystem	.Sedimentarycycles	T2:48-49
10	Torecognize thetoxicityofheavymetalsonthebioticandabioticcomponents.Explainsthedifferentservicesprovidedbytheecosystems	Bioaccumulation andBiomagnifications and Valuesofecosystem	T2:51-55
11	Distinguishaboutdifferenttypesofnaturalresourcesandtheirapplicabilityand Illustratetheutilityofrenewableresourcesefficiency	**Energy resources**: Living andnonlivingresources	T1:76-78T2:59
12	Describe theimpactofover utilizationofundergroundandsurfacewater	**Water resources**: use and overutilizationofsurfaceandgro	T1:85-88
13	. Discussthe disaster managementalplans	FloodsandDrought	T1:88-90T2:71-
14	Describethebenefitsandpropertydams	Dams:befitandproblems.	T1:94-100
15	illustratetheusesofmineralresources	. **Mineral resources:** use andexploitation	T2:86-88
16	Enumeratetheapplication ofthesolarenergyinmodernways	**Energy resources:**introduction andimportance	T2:101-106
		Solarenergyanditsapplication	T2:108-124
17	Describethesolarcollectors	Solarcollectors	T2:124-138
18	Enumeratetheapplicationofthewindenergyinmodernways	Windenergyanditsapplication.	T2:139-150
19	Discussthemerits and limitationofwindenergy	Meritsanddemeritsofwindenergy	T2:151-156
20	Enumeratetheapplicationofthewindenergyinmodernways	Biomassanditsapplication	T2:158-161
21	Illustratethedefinitionandimportanceofbiodiversity	**Biodiversity and Biotic resources**:introductionand	T2:162-166
22	Explainthegenetic diversity,speciesandecosystemdiversity	Classification of biodiversity andNationalbiodiversity	T2:176-182
23	Describe theecologicalvalues andconsumptivevaluesofecosystem	Valuesofbiodiversity	T1:254-256

Lecture No.	CourseLearningOutcomes	Topicstobecovered	Reference
24	Providesinformationregardingindirectvalueofbiodiversity	Indirectvaluesofbiodiversity.	T1:257-262T1:288-
25	Discussthehotspot centerinandaroundthecountry	Hotspotsofbiodiversity.	T2:187-192
26	Providesinformationregardingdifferentcausesforlossofbiodiversity	Threatstobiodiversity	T2:192-205
27	Analyzevariousreasonsforconflictofspecies	Manwildlifeconflict	R1:179-189
28	Illustratedifferent methods to protectbiodiversity,Preventpollution	Conservationofbiodiversity	R1:204-216R3-213-
29	Explainthe meaningof environmentalpollutionandclassification.	**Environmental pollution:** introductionandclassification.	T1:257
30	Describe thenaturaland manmadepollutantthatcausesairpollution	Airpollution:primarypollutantssourcesandeffects	T1
	Discussthesecondarypollutantsourceandeffects.	Secondarypollutantssourceandeffects	T2
32	Illustratetheautomobilepollution.	Automobileandindustrialpollution	T2
33	Tounderstandthepermissiblelevelsofpollutant.	Airqualitystandards	R1
34	Explainthesourcesandeffectsofwaterpollution	Water pollution: sources of waterpollution	T2
35	Enumeratethedifferenttypesofwaterpollutants.	Typesofwaterpollution.	T1
36	Distinguishthe sourcesand typesofwaterpollution	Soilpollution:sourcesandtypesofsoilpollution	T2
37	To understand modern agriculturepractices	Impactofmodernagricultureonsoil	T1
38	Toactivitiestodegradethesoil	Degradationofsoil,	T1
39	Toidentifythesourcesandhealthhazard	Noise pollution: sources andhealthhazards	T2
40	Tohaveintroduction noisequalityp	Noisequalitystandards	T1
41	Explainthevariousmethodscommonlyemployedforthedisposalofsolidwaste.	Solid waste:Municipal solid wastemanagement	T2
42	Tounderstandthe recenttrends in e-wastemanagementpractices.	E-waste: characteristics and itsmanagement	T1
43	Suggestvariousremedial and controlmeasurestominimizewaterpollutio	Pollution control technologies:wastewatertr	T2
44	Tounderstandtherecenttrendsin bio remediation	Conceptofbioremediation	T1
45	To understandconcept ofclimatechangeandimpacts.	Globalenvironmentalproblems:climatechangeandimpactonhuman	T1
46	Describe theremedialmeasures ofozonedepletion.	Ozonedepletionandconsequences.	T2
47	Toevolvestrategiesto environmentalissues.	Internationalprotocols	T1
48	Describe therole of governmentandlegalaspectsinenvironmen	**Environmentalpolicy,legislationandEIA**	T2
49	Discussthesalientfeaturesoftheairandwaterpollutionact	Airpollutionandpreventionact,Waterpollutionandpreventionact.	T1
50	Summarizedifferentacts inprotectingenvironmentand	Municipalsolidwastemanagementandhandlingrules,Biomedicalwastemanagementandhandlingrules	T2
51	Discussthesalientfeaturesof thehazardouswastemanagement	Hazardous waste management andhandlingrules.	T1

Lecture No.	CourseLearningOutcomes	Topicstobecovered	Reference
52	Tounderstandtheimportanceofeiafordevelopmentalactivities.	Eiastructure	T2
53	Discussthe various data collectionmethods.	Methodsofbaselinedataacquisition	T1
54-56	Discussvariousimpactsofindustriesontheenvironment	Impactsofdevelopmental activities onenvironmentalcomponents	T2
57-58	Discussthe different managementalplansforprotectionofenviro	Environmentalmanagementalplans	T1
59	States the aim and objectives ofsustainabledevelopment.	Towards sustainable features:conceptsofsustainabledevelopme	T2
60-62	States the aim and objectives ofsustainabledevelopment.	Crazyconsumerismsandurbansprawl	T1
63-65	Explainthe environmental ethicsandobjectivesofgreenbuildings	Environmentalethics andconcepts ofgreenbuildings	T2

IX. MAPPINGCOURSE OBJECTIVESLEADINGTO THE ACHIEVEMENT OFPROGRAM OUTCOMES ANDPROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	N							H				N	S	S
II		N								S			N	S
III				N				S			S		N	S
IV			S		S							N		S
V	N			S										

S–SupportiveN-NONE H-HighlyRelated

X. MAPPINGCOURSEOUTCOMESLEADINGTO THE ACHIEVEMENT OFPROGRAM OUTCOMES ANDPROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	H	S	S			H	H							

S–SupportiveN-NONE H-HighlyRelated

Prepared by :

FRESHMAN ENGINEERING

ASSIGNMENT QUESTION BANK

Course Name	:	**ENVIRONMENTAL SCIENCES**
Course Code	:	**MC609**
Class	:	III B.Tech II Semester
Branch	:	CSE
Year	:	2020 - 2021
Course Faculty	:	VIJAY Y Asst.Prof

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

S No.	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT – 1 ECOSYSTEM		
1	Describe any two forest ecosystems in India. What are the current threats to forest ecosystems and how can they be conserved.	Remember	1
2	Describe five ecosystems goods and services that human benefits from.	Understand	1
3	Discuss the structure and function of desert ecosystem	Remember	1
4	Explain phosphate and sulphate cycles.	Understand	1
5	Explain briefly about indicators of the quality of ecosystem.	Remember	1
	UNIT – II NATURAL RESOURCES		
1	Describe the merits and demerits of nuclear power energy and discuss the major concern regarding its use for electricity generation in India	Remember	1
2	Explain the solar energy; also discuss about the solar cells with a diagram and enumerate its applications	Understand	1
3	Discuss droughts and floods with respect to their occurrence and impacts.	Remember	1
4	How can you prevent the depletion of ground water resources?	Understand	1
5	Explain growing energy needs?	Remember	1
	UNIT –III BIODIVERSITY AND BIOTIC RESOURCES		
1	Identify and explain the present day major threats to the biodiversity of India?	Remember	1
2	Discuss the various strategies of conservation of biodiversity?	Understand	1
3	Enumerate five important biosphere reserves, national parks and wild life sanctuaries of India.	Understand	1
4	Explain the the hot spots of biodiversity	Remember	1
5	Explain national biodiversity act.	Understand	1
	UNIT – IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES		
1	Define soil pollution and write the sources and types.	Remember	1
2	Explain the Impacts of modern agriculture on soil.	Understand	

3	Define soil degradation and discuss the major causes of soil degradation	Remember	1
4	Define noise pollution and write the sources and health hazards	Understand	1
5	Explain the concepts of bioremediation	Remember	1
UNIT-V ENVIRONMENTAL POLICIES, LEGISLATIONS, RULES AND REGULATIONS			
1	Differentiate direct impact and indirect impact.	Remember	1
2	Discuss the basic characteristics of green buildings.	Understand	1
3	Explain climate change and consequences with reference to human being.	Remember	1
4	Discuss the importance of an environmental awareness campaign? Share your experience on a attending/conducting such programs.	Understand	1
5	Explain the term environmental degradation and discus the role of advanced technology in the protection of the environment.	Remember	1

FRESHMAN ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**ENVIRONMENTAL STUDIES**
Course Code	:	**MC609**
Class	:	III B.Tech II Semester
Branch	:	CSE
Year	:	2020 - 2021
Course Faculty	:	VIJAY Asst.Prof

OBJECTIVES

Environmental study is interconnected; interrelated and interdependent subject. Hence, it is multidisciplinary in nature. The present course is framed by expert committee of UGC under the direction of Honourable Supreme Court to be as a core module syllabus for all branches of higher education and to be implemented in all universities over India. The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course description is: multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources; Ecosystems; Biodiversity and its conservation; Environmental Pollution; Social Issues and the Environment; Human Population and the Environment; pollution control acts and Field Work. The course is divided into five chapters for convenience of academic teaching followed by field visits.

1. GROUP - A (SHORT ANSWER QUESTIONS)

S. No	Questions	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT – 1 ECOSYSTEM		
1	Define ecology and ecosystem.	Remember	1
2	Differentiate between food chain and food web.	Understand	1
3	Briefly explain the importance of ecological pyramids	Remember	1
4	Define biogeochemical cycles? Explain their importance.	Understand	1
5	List the factors make a desert ecosystem	Remember	1
6	Briefly discuss about grassland ecosystem	Understand	1
7	Explain few important characteristics of a forest ecosystem.	Remember	1
8	Explain why there are only 4 to 5 tropic levels in any ecosystem.	Understand	1
9	Briefly discuss an aquatic ecosystem.	Remember	1
10	Define biomagnifications	Understand	1
11	Define bioaccumulation	Remember	1
12	Define carrying capacity?	Understand	1
13	Define primary production and secondary production.	Remember	1

14	Define ecological pyramids.	Understand	1
15	Define pyramid of energy.	Remember	1
16	Differentiate between grazing food chain detritus food chain.	Understand	1
17	List the different tropic levels of ecosystem?	Remember	1
18	Define decomposers?	Understand	1
19	Define photosynthesis process.	Remember	1
20	List the types of grasslands in India and two animal species found in this grass land .	Understand	1
UNIT – II NATURAL RESOURCES			
1	Discuss some of the water resources problems in India.	Remember	1
2	Discuss the problems of over exploitation of ground water.	Understand	1
3	Explain the causes for floods.	Remember	1
4	Discuss the methods of flood control.	Understand	1
5	Define desertification?	Remember	1
6	Define aquifer?	Understand	1
7	Enlist different surface and ground water resources.	Remember	1
8	List the environmental effects of using of mineral resources?	Understand	1
9	define mineral? What is its use?	Remember	1
10	Name the non renewable resources?	Understand	1
11	Define water logging?	Remember	1
12	Define soil erosion?	Remember	1
13	List the effects of soil pollution?	Understand	1
14	Differentiate soil texture and structure	Remember	1
15	Define green fuels?	Understand	1
16	Outline the role of geo thermal energy in India?	Remember	1
17	List the different type‟s energies which can be derived from the ocean?	Understand	1
18	Define solar cells.	Remember	1
19	Define pesticides? Mention it types.	Understand	1
20	List the different types of natural resources	Remember	1
UNIT –III BIODIVERSITY AND BIOTIC RESOURCES			
1	Enumerate the biogeographical classification of India.	Remember	1
2	define hot spots of biodiversity? Mention the three hot spots in India	Understand	1
3	Differentiate between endanger and endemic species.	Understand	1
4	Define national park? Name few such parks in India.	Remember	1
5	Define red data book?	Understand	1
6	Outline in situ and ex situ conservation of biodiversity?	Remember	1
7	What does NBPGR AND NBAGR stand for? Where are they located?	Understand	1
8	List the major causes of man-wild life conflict?	Remember	1
9	List the major threats to biodiversity?	Understand	1
10	Define endemic species? Name some endemic species in India.	Remember	1
11	List the national wildlife sanctuaries?	Understand	1
12	List the indirect values of biodiversity.	Remember	1
13	Define biological diversity.	Understand	1
14	Differentiate genetic and species diversity.	Remember	1
15	Define national biodiversity act.	Understand	1

16	Underline India as a nation of mega diversity nation?	Remember	1
17	Define threatened species?	Understand	1
18	Define onsite conservation	Remember	1
19	Define bio piracy.	Understand	1
20	Define the term genetic banks.	Remember	1
UNIT – IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES			
1	Define environmental pollution.	Remember	1
2	Define air pollution?	Understand	
3	Mention two important controlling devices of air pollution used in industries.	Remember	1
4	Mention the major sources of primary air pollutants.	Understand	1
5	Define water pollution.	Remember	1
6	List the various types of water pollution?	Understand	1
7	List the main stages of treatment of domestic sewage?	Remember	
8	Mention the main treatment methods meant for industrial effluents.	Understand	1
9	List the chemical treatments for industrial effluents?	Remember	1
10	Differentiate between aerobic oxidation and anaerobic oxidation.	Understand	1
11	Mention some of the water borne diseases and the name of the pathogenic organisms involved in it.	Remember	1
12	Define eutrophication.	Understand	1
13	Define Bod and Cod	Remember	1
14	Differentiate between blue baby syndrome and itai-itai disease.	Understand	1
15	Define soil pollution.	Remember	1
16	Enumerate the various effects of soil pollution.	Understand	1
17	Underline the monitoring of soil pollution made?	Remember	1
18	Define noise pollution.	Understand	1
19	List the physical, physiological and psychological effects of noise?	Remember	1
20	Describe an account of decibel scale for the measurement of sound.	Understand	1
UNIT-V ENVIRONMENTAL POLICIES, LEGISLATIONS, RULES AND REGULATIONS			
1	List the objectives of Air pollution act.	Remember	1
2	Explain the necessity of wild life protection act.	Understand	1
3	Explain the necessity of various environmental legislations.	Remember	1
4	Mention the objectives of environmental protection act.	Understand	1
5	Discribe water cess and water pollution as defined by water pollution cess act, 1974.	Remember	1
6	List the bio-medical wastes? What are the rules to manage and handle them?	Understand	1
7	Name the governmental organization/deportment responsible for the protection of the environment.	Remember	1
8	Name the role assigned to central pollution and state pollution control board under the water pollution and prevention act.	Understand	1
9	Define environmental impact assessment?	Remember	1
10	Define Environmental Impact Assessment and Environmental Management Plan	Understand	1

2. GROUP - B (LONG ANSWER QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-I ECOSYSTEM		
1	Explain energy flow pattern in different types of ecosystem	Remember	1
2	Discuss the major characteristics features of a river ecosystem different from lake ecosystem	Understand	1
3	List the main components of ecosystem and briefly describe the functions of each.	Remember	1
4	Explain the role of producers, consumers and decomposers in an ecosystem with practical example.	Understand	1
5	What would happen to an ecosystem if all its decomposer and detritus feeder were eliminate.	Remember	1
6	List the food chain and food web? give example and discuss their significance.	Understand	1
7	List the biogeochemical cycles? Explain nitrogen cycle with help of a diagram.	Remember	1
8	Define the ecological pyramids? Explain why some of these pyramids are upright while others are inverted in different ecosystem.	Understand	1
9	Explain energy flow of the ecosystem.	Remember	1
10	Name all the cycles that constitute the proper functioning of an ecosystem.	Understand	1
	UNIT – II NATURAL RESOURCES		
1	List the Natural resources and write the classification of resources.	Remember	1
2	Explain the Big dams - Benefits and problems.	Understand	1
3	List the Mineral Resources, uses and exploitation?	Remember	1
4	List the alternate energy sources? Explain their present status, merits and demerits.	Understand	1
5	Explain the environmental impacts of (i) Fertilizer – Pesticides (ii). Over grazing.	Remember	1
6	Define mining. Explain various environmental impacts of mineral extraction.	Understand	1
7	List the importance of forest resources for economic and ecological wealth of country?	Understand	1
8	Discuss about the soil texture, structure and its composition.	Remember	1
9	Write a short note on wind energy; also discuss its advantages and limitations.	Understand	1
10	List the different types of energies which can be derived from the ocean? Explain briefly along with their advantages and limitations.	Understand	1
	UNIT – III BIODIVERSITY AND BIOTIC RESOURCES		
1	Discuss the causes of man-wild life conflicts. Suggest suitable wild life conservation practices.	Remember	1
2	Define biodiversity? Explain different types of biodiversity	Understand	1
3	Explain in-situ and ex-situ conservation of biodiversity	Remember	1

4	Summarize consumptive use value, productive use value, social value and optional value of biodiversity?	Remember	1
5	How the study of biodiversity is beneficial to human life.	Remember	1
6	Explain the threats to biodiversity?	Understand	1
7	Define biodiversity; explain genetic biodiversity, species diversity and ecosystem diversity?	Remember	1
8	Discuss the status of India as a mega diversity nation of biodiversity.	Understand	1
9	List the different services that are contributed in various ways by biodiversity?	Remember	1
10	Explain endangered species of India?	Understand	1
UNIT – IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES			
1	Define environmental pollution and explain their types and effects.	Understand	1
2	Define air pollution and describe the technologies for the control of air pollution.	Remember	1
3	Explain primary and secondary sources of air pollution?	Understand	1
4	List the effects of air pollution on plants, animals and human beings	Remember	1
5	Explain automobile pollution and industrial pollution.	Understand	1
6	Describe National ambient air quality standards.	Remember	1
7	Define water pollution and explain point and non point sources of water pollution.	Understand	1
8	Explain sewage water treatment plants, effluent water treatment plants and common effluent treatment plants.	Remember	1
9	List the effects of water pollution and enumerate drinking water quality standards	Understand	1
10	Explain the methods for the control of water pollution.	Remember	1
UNIT – V ENVIRONMENTAL POLICIES, LEGISLATIONS, RULES AND REGULATIONS			
1	Discuss the salient features of Air Act	Understand	1
2	Explain Water Act.	Remember	1
3	Explain environmental protection Act	Understand	1
4	List the major provisions in Forest Conservation Act 1980	Remember	1
5	Discuss the salient features of Wild life protection Act	Understand	1
6	List the major municipal solid waste management and handling rules	Remember	1
7	Define biomedical wastes? What are the rules to manage and handle them	Understand	1
8	Define hazardous wastes? Discuss the rules to manage and handle them.	Remember	1
9	Discuss the various types of impacts caused by the developmental activities with suitable examples.	Understand	1
10	Explain the methodology for EIA	Remember	1

GROUP- C ANALYTICAL AND CRITICAL THINKING

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-I ECOSYSTEM		
1	List the different development activities, including construction of dams, affect the various ecosystems and what action need to be taken to conserve them.	Remember	1
2	Explain the impacts of pesticide and other agro chemicals on any ecosystem you have visited.	Understand	1
3	Explain with examples the links between the activities of man which are hazardous to human health and ecosystem.	Remember	1
	UNIT – II NATURAL RESOURCES		
1	Prepare a detailed report on the management of water and waste water in your town/city?	Understand	1
2	Discuss with the help of a case study, how big dams have affected forests and tribal?	Remember	1
	UNIT – III BIODIVERSITY AND BIOTIC RESOURCES		
1	Explain environmental hot spots of your city? Explain the possible factors observed by you for degradation of quality of hot spot. Suggest suitable engineering measure to restore their quality.	Understand	1
2	List the different developmental activities, including construction of dams, affect the biodiversity and action need to be taken to conserve them.	Remember	1
	UNIT – IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES		
1	List out the Sewage treatment plants, effluent treatment plants and common effluent treatment plants in your vicinity.	Understand	1
2	Explain the problems encountered in the disposal of solid waste from various sources?	Remember	1
3	Explain the e-waste can be effectively managed.	Understand	1
	UNIT – V ENVIRONMENTAL POLICIES, LEGISLATIONS, RULES AND REGULATIONS		
1	Environmental education necessary in the present context? What is your opinion about the environmental ethics?	Remember	1
2	Explain the role of remote sensing and GIS in environmental protection.	Understand	

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Regulation:R18
Year:III-II
Sub:**Environmental Science**

Course code:MC609

Prerequisites:-

SYLLABUS

UNIT-I

Ecosystems: Definition,ScopeandImportanceofecosystem.Classification,structure,andfunction of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surfaceand ground water,floodsand droughts, Dams: benefits andproblems.**Mineralresources:**useandexploitation,environmentaleffectsofextractingandusing mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity.Valueofbiodiversity;consumptiveuse,productiveuse,social,ethical,aestheticandoption al values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitatloss, poachingofwildlife,man-wildlifeconflicts;conservationofbiodiversity:In-SituandEx-situconservation.National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution,**AirPollution:**Primaryandsecondarypollutants,AutomobileandIndustrialpollution,Ambient airqualitystandards.**Waterpollution:**Sourcesandtypesofpollution,drinkingwaterqualitystandards. **SoilPollution:**Sourcesandtypes,Impactsofmodernagriculture,degradationofsoil.**NoisePollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental ProblemsandGlobalEfforts:C**limatechangeandimpactsonhumanenvironment. OzonedepletionandOzonedepletingsubstances(ODS). Deforestationanddesertification.Internationalconventions/ Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT-V

EnvironmentalPolicy,Legislation&EIA: EnvironmentalProtectionact,LegalaspectsAirAct-1981, WaterAct,ForestAct,WildlifeAct,Municipalsolidwastemanagementandhandlingrules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure,methodsofbaselinedataacquisition.OverviewonImpactsofair,water,biologicalandSocio- economicalaspects.Strategiesforriskassessment,ConceptsofEnvironmentalManagementPlan

(EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics,ConceptofGreenBuilding,EcologicalFootPrint,LifeCycleassessment(LCA), Low carbon life style.

COURSE OUTCOMES:

At the end of the course the student will develop ability to

CO	Course outcome	Blooms taxonomy level
C329.1	Understanding the importance of ecological balance for sustainable development.	Understand
C329.2	Understanding the impacts of developmental activities and mitigation measures	Create
C329.3	Understanding the environmental policies and regulations.	Analyse
C329.4	Evaluate technologies on the basis of Environmental regulations.	Analyse
C329.5	Analyze the problems related to environmental pollution and management.	Create

Mapping of key competencies of POs to each CO:

	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C329.1			1,5,10	3,5,8			1,2,3								
C329.2			1,5,10	3,5,8			1,2,3								
C329.3			1,5,10	3,5,8			1,2,3								
C329.4			1,5,10	3,5,8			1,2,3								
C329.5			1,5,10	3,5,8			1,2,3								

NUMBER OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	3	10	10	11	1	5	3	3	12	5	12	8	2	3	2
C329.1			3	3			3								
C329.2			3	3			3								
C329.3			3	3			3								
C329.4			3	3			3								
C329.5			3	3			3								

PERCENTAGE OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	3	10	10	11	1	5	3	3	12	5	12	8	2	3	2
C329.1	0	0	30	27.27	0	0	100	0	0	0	0	0	0	0	0
C329.2	0	0	30	27.27	0	0	100	0	0	0	0	0	0	0	0
C329.3	0	0	30	27.27	0	0	100	0	0	0	0	0	0	0	0
C329.4	0	0	30	27.27	0	0	100	0	0	0	0	0	0	0	0
C329.5	0	0	30	27.27	0	0	100	0	0	0	0	0	0	0	0

COURSE ARTICULATION MATRIX (CO - PO / PSO MAPPING):

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C329.1	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0
C329.2	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0
C329.3	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0
C329.4	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0
C329.5	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0
Total	0	0	5	5	0	0	15	0	0	0	0	0	0	0	0
Average	**0**	**0**	**1**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

COs and POs and COs and PSOs on the scale of 0 to 3, 0 being no correlation,

1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 – ≤ ≤ 5% – No correlation; 1 – 5 < ≤ 40% – Low / Slight;

2 − 40 % << 60% – Moderate. 3 – 60% ≤ < 100% – Substantial / High

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTERSCIENCE AND ENGINEERING

COURSEDESCRIPTIONFORM

CourseTitle	**MACHINE LEARNING**			
CourseCode	**CS601PC**			
Regulation	**R18-JNTUH**			
CourseStructure	Lectures	Tutorials	Practicals	Credits
	4	01	3	4
CourseFaculty	**Mr.K.LAKSHMINARAYANA**			

INDEX

MACHINE LEARNING (AY:2020-21)

Regulation:R18
Year:III-II
Sub:Machine Learning

Course code:CS601PC
Prerequisites:-

SYLLABUS

UNIT-I

Introduction -Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding amaximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias**.**

DecisionTreeLearning–

Introduction,decisiontreerepresentation,appropriateproblemsfordecision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT-II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT-III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computationallearningtheory–

Introduction,probablylearninganapproximatelycorrecthypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, *k*-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

ReinforcementLearning–Introduction,thelearningtask,*Q*–learning,non-deterministic,rewardsand actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT-V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

CombiningInductiveandAnalyticalLearning–Motivation,inductive-analyticalapproachesto learning, using prior knowledge to initialize the hypothesis.

Subject: Machine Learning
University Descriptive Questions

S.No.	Description	COs
1.	What factors contribute to the popularity of genetic algorithm? **JNTUH Dec-2019**	CO4
2.	With suitable example discuss a radial basis function network. **JNTUH Dec-2019**	CO4
3	Describe the representation of hypotheses and genetic algorithms used in this. **JNTUH Dec-2019**	CO4
4.	What is Q function? Write an algorithm for learning Q. **JNTUH Dec-2019**	CO4
5	Explain an algorithm for regressing a set of literals through a single horn clause. **JNTUH Dec-2019**	CO4
6	Discuss about First-Order rule learning in detail. **SEPT-2020**	CO4
7	How to learn a conjunction of horn clauses from membership, equivalence and also explain algorithm for it? **SEPT-2020**	CO4
8	What are the reasons for popularity of Genetic Algorithms. **MAR-2021**	CO4
9	Distinguish between active learning and reinforcement learning. **MAR-2021**	CO4
10	Explain about concept learning. List out its benefits. **MAR-2021**	CO4

Subject: Machine Learning
Assignment Questions

SNo	Questions	Taxonomy Level	Course Outcome
1	What factors contribute to the popularity of genetic algorithm?	TL2	CO4
2	With suitable example discuss a radial basis function network.	TL6	CO4
3	What is Q function? Write an algorithm for learning Q.	TL2	CO4
4	Distinguish between active learning and reinforcement learning.	TL4	CO4
5	Discuss about First-Order rule learning in detail.	TL4	CO4

Subject: Machine Learning
Seminar topics:

S.No	Seminar Topic
1.	Distinguish between active learning and reinforcement learning.
1.	Explain about radial basis function network?
2.	Explain about Genetic Algorithm.
3.	Explain Q-Learning Algorithm.
4.	Explain about First-Order rule learning.

NPTEL Reference Links:

1. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/15
2. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/16
3. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/31
4. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/32

Subject: Machine Learning

Learning Outcomes

1. Understand the Genetic algorithms and Genetic Programming.
2. Ability to use logic programming.
3. Understand the Reinforcement based learning.
4. Ability to Compare different learning to generate First Order Rules.

OBJECTIVE QUESTIONS UNIT-4

1. Genetic algorithms involve which of the following phenomena ?
A) Mutation B) Cross over C) Selection D) **ALL**

2. Which of the following is not true about fitness functions?
A) They perform similar role to an objective function
B) **Maximization of sum of squared residuals is an example of fitness function**
C) They help in optimization D) ALL

3. The accuracy of results obtained from Simulated Annealing depends on:
A Temperature schedule B Randomness of the search C Initial conditions
D **All of the above**

4. Small changes in the parameter vector independent of other parameter vectors
A) **Mutation** B) Cross over C) Selection D) ALL

5. The Fitness Function in Genetic Algorithms is
A **method to measure how fit a candidate solution is in solving the problem.**
B the objective function for the optimization problem being solved.
C a substitute to approximate the survival abilities of individuals in nature.
D a least squares approximation for a polynomial.

6. The basic idea behind Genetic Algorithms is to work with a population
- A of problem solvers that interact with each other through signs.
- B **of candidate solutions to try and create better candidates by mixing genes.**
- C of candidate solutions in which each candidate is heuristically refined.
- D of problem solvers each of which does an independent heuristic search.

7. There exist only two types of quantifiers, Universal Quantification and Existential Quantification. a) **True** b) False

8. First Order Logic is also known as _____
a) First Order Predicate Calculus b) Quantification Theory c) Lower Order Calculus d) **All**

9. Reinforcement learning is_____
A. Unsupervised learning B. Supervised learning C. **Award based learning** D. None

10. Which of the following is an application of reinforcement learning?
A. Topic modeling B. **Recommendation system** C. Pattern recognition D. Image classification

TEST PAPER

Short Answer Questions (2M)

1.Define Genetic algorithm.

2. Define Genetic programming.

3. Define reinforcement learning.

4. Define first order rule.

5. Define horn clause.

Essay Writing Questions (10M)

6. What factors contribute to the popularity of genetic algorithm?

7. With suitable example discuss a radial basis function network.

8. What is Q function? Write an algorithm for learning Q.

9. Explain an algorithm for regressing a set of literals through a single horn clause.

10. Discuss about First-Order rule learning in detail.

TUTORIAL QUESTIONS

S.No.	WEEK-1	Ref Chapter -9
1	What factors contribute to the popularity of genetic algorithm?	C 9.1
2	With suitable example discuss a radial basis function network.	C 9.2
3	Describe the representation of hypotheses and genetic algorithms used in this.	C 9.2

S.No.	WEEK – II	Ref
1	What is Q function? Write an algorithm for learning Q.	C 13.2
2	Explain an algorithm for regressing a set of literals through a single horn clause.	C 10.2
3	Discuss about First-Order rule learning in detail.	C 10.3

S.No.	WEEK – III	Ref
1	How to learn a conjunction of horn clauses from membership, equivalence and also explain algorithm for it?	C 10.4
2	What are the reasons for popularity of Genetic Algorithms.	C 9.3

S.No.	WEEK – IV	Ref
1	Distinguish between active learning and reinforcement learning.	C 13.3
2	Explain about concept learning. List out its benefits.	C 10.4

THINKING ABILTY

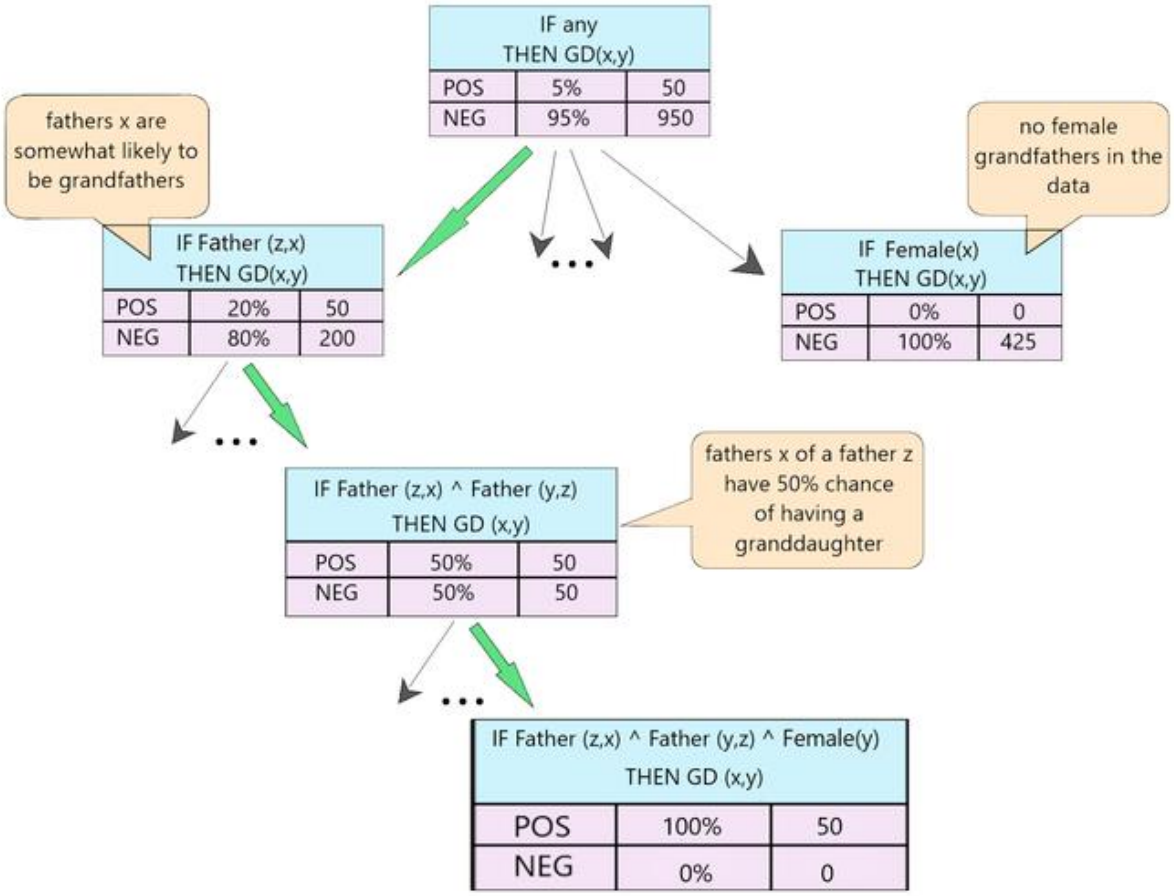
Source: https://www.geeksforgeeks.org/first-order-inductive-learner-foil-algorithm/
https://jmvidal.cse.sc.edu/talks/learningrules/allslides.xml

First Order Inductive Learner (FOIL)

In machine learning, first-order inductive learner (FOIL) is a rule-based learning algorithm. It is a natural extension of SEQUENTIAL-COVERING and LEARN-ONE-RULE algorithms. It follows a Greedy approach.

Inductive Learning:

Inductive learning analyzing and understanding the evidence and then using it to determine the outcome. It is based on Inductive Logic.



PLACEMENT QUESTIONS WITH KEY

1. What is Reinforcement Learning?

Reinforcement learning is different from the other types of learning like supervised and unsupervised. In reinforcement learning, we are given neither data nor labels. Our learning is based on the rewards given to the agent by the environment.

2. **What is the difference between a generative and discriminative model?**

A generative model learns the different categories of data. On the other hand, a discriminative model will only learn the distinctions between different categories of data. Discriminative models perform much better than the generative models when it comes to classification tasks.

3. **What is Pandas Profiling?**

Ans. Pandas profiling is a step to find the effective number of usable data. It gives us the statistics of NULL values and the usable values and thus makes variable selection and data selection for building models in the preprocessing phase very effective.

4. **What is the role of cross-validation?**

Ans. Cross-validation is a technique which is used to increase the performance of a machine learning algorithm, where the machine is fed sampled data out of the same data for a few times. The sampling is done so that the dataset is broken into small parts of the equal number of rows, and a random part is chosen as the test set, while all other parts are chosen as train sets.

5. **What is a voting model?**

Ans. A voting model is an ensemble model which combines several classifiers but to produce the final result, in case of a classification-based model, takes into account, the classification of a certain data point of all the models and picks the most vouched/voted/generated option from all the given classes in the target column.

6. **Differentiate between regression and classification.**

Regression and classification are categorized under the same umbrella of supervised machine learning. The main difference between them is that the output variable in the regression is numerical (or continuous) while that for classification is categorical (or discrete).

Example: To predict the definite Temperature of a place is Regression problem whereas predicting whether the day will be Sunny cloudy or there will be rain is a case of classification.

BLOOM'S TAXONOMY

Analyzing strengths and limitations of Reinforcement learning.

Difference between Reinforcement learning and Supervised learning:

Reinforcement learning	Supervised learning
Reinforcement learning is all about making decisions sequentially. In simple words we can say that the output depends on the state of the current input and the next input depends on the output of the previous input	In Supervised learning the decision is made on the initial input or the input given at the start
In Reinforcement learning decision is dependent, So we give labels to sequences of dependent decisions	Supervised learning the decisions are independent of each other so labels are given to each decision.
Example: Chess game	Example: Object recognition

Various Practical applications of Reinforcement Learning –

- RL can be used in robotics for industrial automation.
- RL can be used in machine learning and data processing
- RL can be used to create training systems that provide custom instruction and materials according to the requirement of students.

RL can be used in large environments in the following situations:

1. A model of the environment is known, but an analytic solution is not available;
2. Only a simulation model of the environment is given (the subject of simulation-based optimization)
3. The only way to collect information about the environment is to interact with it.

Types of Reinforcement: There are two types of Reinforcement:

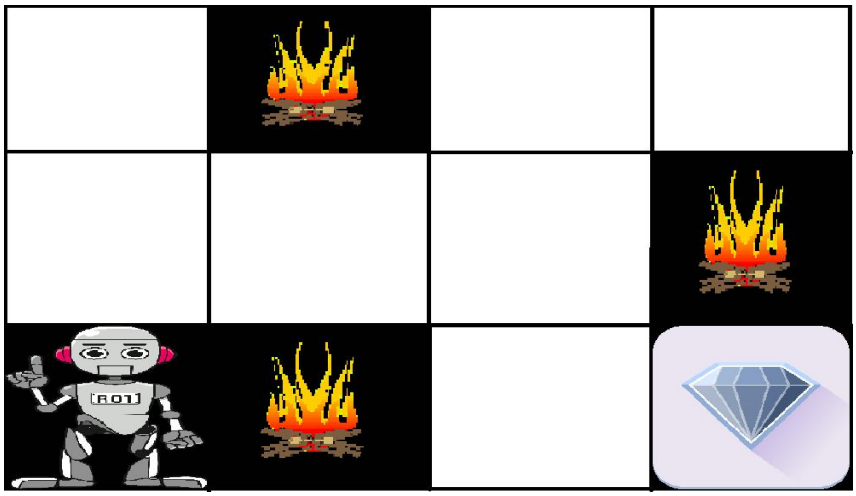
1. **Positive –**
   Positive Reinforcement is defined as when an event, occurs due to a particular behavior, increases the strength and the frequency of the behavior. In other words, it has a positive effect on behavior.

2. **Negative –**
   Negative Reinforcement is defined as strengthening of a behavior because a negative condition is stopped or avoided.

Active Learning

Reinforcement learning

Example: The problem is as follows: We have an agent and a reward, with many hurdles in between. The agent is supposed to find the best possible path to reach the reward. The following problem explains the problem more easily.



The above image shows the robot, diamond, and fire. The goal of the robot is to get the reward that is the diamond and avoid the hurdles that are fire. The robot learns by trying all the possible paths and then choosing the path which gives him the reward with the least hurdles. Each right step will give the robot a reward and each wrong step will subtract the reward of the robot. The total reward will be calculated when it reaches the final reward that is the diamond.

Main points in Reinforcement learning –

- Input: The input should be an initial state from which the model will start
- Output: There are many possible output as there are variety of solution to a particular problem
- Training: The training is based upon the input, The model will return a state and the user will decide to reward or punish the model based on its output.
- The model keeps continues to learn.
- The best solution is decided based on the maximum reward.

Applications of Genetic Algorithms

Genetic Algorithms are primarily used in optimization problems of various kinds, but they are frequently used in other application areas as well.

- **Optimization** − Genetic Algorithms are most commonly used in optimization problems wherein we have to maximize or minimize a given objective function value under a given set of constraints. The approach to solve Optimization problems has been highlighted throughout the tutorial.

- **Economics** − GAs are also used to characterize various economic models like the cobweb model, game theory equilibrium resolution, asset pricing, etc.

- **Neural Networks** − GAs are also used to train neural networks, particularly recurrent neural networks.

- **Parallelization** − GAs also have very good parallel capabilities, and prove to be very effective means in solving certain problems, and also provide a good area for research.

- **Image Processing** − GAs are used for various digital image processing (DIP) tasks as well like dense pixel matching.

- **Vehicle routing problems** − With multiple soft time windows, multiple depots and a heterogeneous fleet.

- **Scheduling applications** − GAs are used to solve various scheduling problems as well, particularly the time tabling problem.

- **Machine Learning** − as already discussed, genetics based machine learning (GBML) is a niche area in machine learning.

- **Robot Trajectory Generation** − GAs have been used to plan the path which a robot arm takes by moving from one point to another.

- **Parametric Design of Aircraft** − GAs have been used to design aircrafts by varying the parameters and evolving better solutions.

- **DNA Analysis** − GAs have been used to determine the structure of DNA using spectrometric data about the sample.

- **Multimodal Optimization** − GAs are obviously very good approaches for multimodal optimization in which we have to find multiple optimum solutions.

• Traveling salesman problem and its applications − GAs have been used to solve the TSP, which is a well-known combinatorial problem using novel crossover and packing strategies.

Subject: Machine Learning
Unit -5 Assignment Questions

SN	Questions	Taxonom	Course

o		y Level	Outco me
1	What is the essential difference between analytical and inductive learning methods?	TL2	CO5
2	What are the limitations of explanation based learning?	TL6	CO5
3	Describe the TANGENTPROP algorithm to train a neural network to fit both training values and training derivatives.	TL2	CO5
4	Explain PROLOG-EBG Algorithm..	TL4	CO5
5	Explain about KBANN Algorithm.	TL4	CO5

Subject: Machine Learning
Unit- 5 University Descriptive Questions

S.No.	Description	COs
1.	What is the essential difference between analytical and inductive learning methods? **JNTUH Dec-2019**	CO5
2.	What are the limitations of explanation based learning? **JNTUH Dec-2019**	CO5
3	Describe the TANGENTPROP algorithm to train a neural network to fit both training values and training derivatives. **JNTUH Dec-2019**	CO5
4.	Explain PROLOG-EBG Algorithm.. **JNTUH Dec-2019**	CO5

Subject: Machine Learning
Unit-5 Seminar topics:

S.No	Seminar Topic
1.	What are the essential difference between analytical and inductive learning methods?

1.	Explain about explanation based learning?
2.	Describe the TANGENTPROP algorithm to train a neural network to fit both training values and training derivatives.
3.	Explain PROLOG-EBG Algorithm.
4.	Explain about KBANN Algorithm.

Unit-5 NPTEL Reference Links:

1. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/18
2. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/31
3. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/29
4. https://freevideolectures.com/course/4195/nptel-machine-learning-ml/33

Subject: Machine Learning

Learning Outcomes UNIT-V

1. Understand the analytical and inductive learning problems.
2. Ability to use Domain theories in Inductive learning.
3. Understand the Explanation based learning.
4. Ability to Compare analytical and inductive learning..

OBJECTIVE QUESTIONS UNIT-5

1. Which combines inductive methods with the power of first-order representations?

a) Inductive programming b) Logic programming c) **Inductive logic programming**

d) Lisp programming

2. How many reasons are available for the popularity of ILP?

A) 1 B) 2 C) **3** D) 4

3. Which cannot be represented by a set of attributes?

a) Program b) **Three-dimensional configuration of a protein molecule**

c) Agents d) None

4. Which is an appropriate language for describing the relationships?

a) **First-order logic** b) Propositional logic c) ILP

d) None

5. Which produces hypotheses that are easy to read for humans?

a) **ILP** b) Artificial intelligence c) Propositional logic d) First-order logic

6. What need to be satisfied in inductive logic programming?

a) Constraint b) **Entailment constraint** c) Both d) None

7. How many literals are available in top-down inductive learning methods?

a) 1 b) 2 c) **3** d) 4

8. Which inverts a complete resolution strategy?

a) **Inverse resolution** b) Resolution c) Trilogy d) None

9. Which method can't be used for expressing relational knowledge?

a) Literal system b) Variable-based system c) **Attribute-based system** d) None

10. Which approach is used for refining a very general rule through ILP?

a) **Top-down approach** b) Bottom-up approach c) Both

d) None

TEST PAPER

Short Answer Questions (2M)

1.Define Inductive learning.

2. Define Analytical learning.

3. Define Knowledge level learning.

4.Define deductive learning.

5.Define explanation based learning.

Essay Writing Questions (10M)

6. What are the essential difference between analytical and inductive learning methods?

7. Explain about explanation based learning?

8. Describe the TANGENTPROP algorithm to train a neural network to fit both trainingvalues and training derivatives.

9. Explain about KBANN Algorithm.

10. Explain PROLOG-EBG Algorithm.

TUTORIAL QUESTIONS

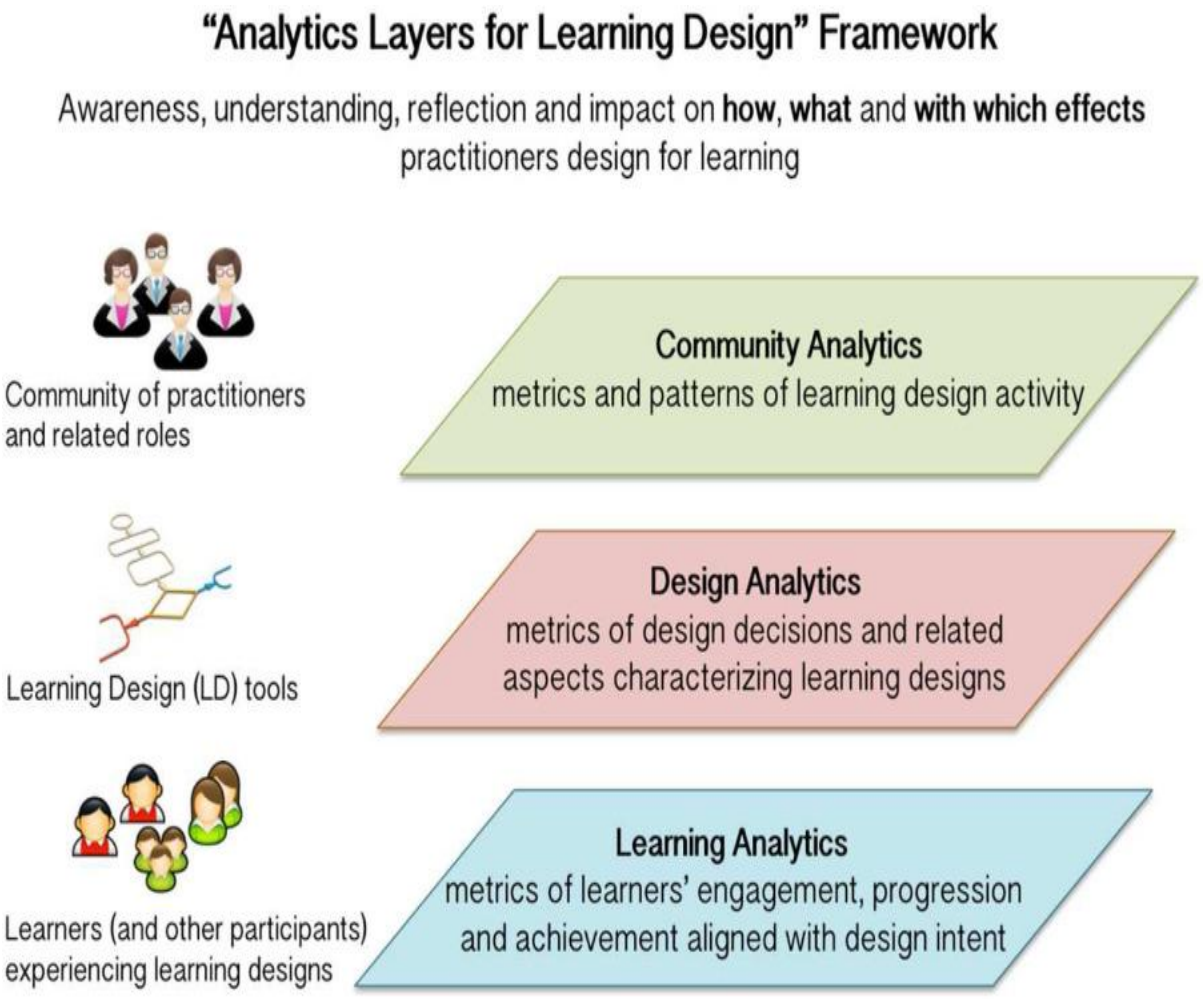
	WEEK-1	Ref Chapter -11
1	Explain Inductive learning?	C 11.1
2	Explain Analytical learning.	C 11.1
3	Discuss the relationship between Inductive and Analytical learning.	C 11.1

S. No.	WEEK – II	Ref Chaper-11
1	Explain PROLOG-EBG Algorithm?	C 11.2
2	Discuss about explanation based learning.	C 11.3
3	Remarks on explanation based learning.	C 11.4

S. No.	WEEK – III	Ref Chaper- 12
1	Motivation of combining inductive and analytical learning.	C 12.1
2	Discuss Inductive analytical approaches for learning.	C 12.2

S. No.	WEEK – IV	Ref Chaper- 12
1	Explain KBANN Algorithm.	C 12.3
2	Explain the TangentProp Algorithm.	C 12.4

THINKING ABILTY



PLACEMENT QUESTIONS WITH KEY

Source: https://www.mygreatlearning.com/blog/machine-learning-interview-questions/

1. **List down various approaches for machine learning?**
The different approaches in Machine Learning are

- Concept Vs Classification Learning
- Symbolic Vs Statistical Learning
- Inductive Vs Analytical Learning

2. **What is Inductive Logic Programming in Machine Learning?**
Inductive Logic Programming (ILP) is a subfield of machine learning which uses logical programming representing background knowledge and examples.

3. **What is PCA, KPCA and ICA used for?**
PCA (Principal Components Analysis), KPCA (Kernel based Principal Component Analysis) and ICA (Independent Component Analysis) are important feature extraction techniques used for dimensionality reduction.

4. **What is PAC Learning?**
PAC (Probably Approximately Correct) learning is a learning framework that has been introduced to analyze learning algorithms and their statistical efficiency.

5. **What are the different categories you can categorized the sequence learning process?**

- Sequence prediction
- Sequence recognition
- Sequence generation
- Sequential decision

6. **What is sequence learning?**
Sequence learning is a method of teaching and learning in a logical manner.

7. **Define and explain the concept of Inductive Bias with some examples.**
Inductive Bias is a set of assumptions that humans use to predict outputs given inputs that the learning algorithm has not encountered yet. When we are trying to learn Y from X and the hypothesis space for Y is infinite, we need to reduce the scope by our beliefs/assumptions about the hypothesis space which is also called inductive bias. Through these assumptions, we constrain our hypothesis space and also get the capability to incrementally test and improve on the data using hyper-parameters. Examples:

1. We assume that Y varies linearly with X while applying Linear regression.
2. We assume that there exists a hyperplane separating negative and positive examples.

BLOOM'S TAXONOMY

Analyzing strengths and limitations of Analytical learning.

What is an analytical learner?

Analytical learners tend to do best when information is presented in an orderly, step-by step fashion. They prefer to focus on learning the small details first and then move on to make sense of the whole concept. Analytical learners usually have long attention spans and work best by themselves, which allows them to focus on a single problem until it is solved to their satisfaction.

Strengths of analytical learners

Analytical learners tend to have good memories, so they excel at recalling facts, formulas, and names. They tend to be good at time management and are great at planning ahead and staying well organized. Since they learn in a sequential manner, traditional school settings are a good fit for them and they are often able to learn from traditional teaching methods without a lot of intervention needed.

These learners are often able to remember oral directions, independently take notes, and make sense of lecture style lessons at school. They are naturally reflective and can evaluate themselves and learn from their mistakes. Analytical learners tend to excel in math, science, and engineering courses since they can make sense of steps and formulas.

Challenges faced by analytical learners

While analytical learners love detail, they sometimes struggle with big picture concepts and reading comprehension since they can get caught up in the minutiae. Since they are so logical and reasonable, they may have trouble with humanities concepts like character traits and emotion since these concepts don't always make logical sense.

These learners can also sometimes become frustrated if a concept doesn't make immediate logical sense or if information is presented in an open-ended manner. If they are unable to get their "why" questions answered to their satisfaction, they may become disengaged or frustrated as well. Since analytical workers work so well alone, they can be frustrated by group work or easily distracted in chaotic or unstructured environments.

Active Learning

Explanation based generalization (EBG) is an algorithm for explanation based learning, described in Mitchell at al. (1986). It has two steps first, explain method and secondly, generalize method.

During the first step, the domain theory is used to prune away all the unimportant aspects of training examples with respect to the goal concept. The second step is to generalize the explanation as far as possible while still describing the goal concept. Consider the problem of learning the concept bucket. We want to generalize from a single example of a bucket. At first collect the following informations.

1. **Input Examples:**

$$\text{Owner (object, X)} \wedge \text{has part (object, Y)} \wedge \text{is(object, Deep)} \wedge \text{Color (Object, Green)}$$
$$\wedge \ldots \ldots \text{(Where Y is any thin material)}$$

2. **Domain Knowledge:**

$$\text{is (a, Deep)} \wedge \text{has part (a, b)} \wedge \text{is a(b, handle)} \rightarrow \text{liftable (a)}$$
$$\text{has part (a, b)} \wedge \text{is a (b, Bottom)} \wedge \text{is (b, flat)} \rightarrow \text{Stable (a)}$$
$$\text{has part (a, b)} \wedge \text{is a (b, Y)} \wedge \text{is (b, Upward} - \text{pointing)} \rightarrow \text{Open} - \text{vessel (a)}$$

3. **Goal:** Bucket B is a bucket if B is liftable, stable and open-vessel.

4. Description of Concept: These are expressed in purely structural forms like Deep, Flat, rounded etc.

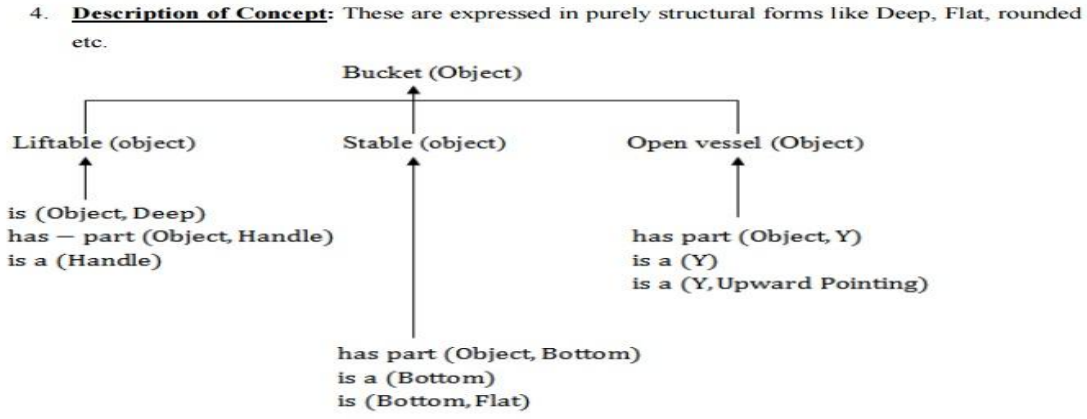


Figure An explanation of BUCKET Object

Given a training example and a functional description, we want to build a general structural description of a bucket. In practice, there are two reasons why the explanation based learning is important.

Applications of Analytical Learning

1) Educational data-mining

Through this approach we can build predictive models e.g., can identify at-risk learners (risk of dropping out the course) and can help teachers provide intervention to assist learners in achieving success.

2) Intelligent curriculum and adaptive content

Through student`s data We can develop as many curricula as many students We have. Based on their preferences (and skills) it is possible to develop a recommenders system where different students could, such as, follow different ways to learn the same content.

3) Adaptive learning

It is not only adaptive content, as mentioned above, but it is possible to offer learners support, offering them other opportunities of engagement (if engagement is a student problem).

4)Assisting management decisions

Data analytics in education can improve administrative decision-making and organizational resource allocation. For example, They can know which facilities In the school the students like more (or less). It also can provide feedback to school`s administrators.

5) Innovation

Learning analytics can transform models and pedagogical approaches. The general idea is to innovate i. e. to aggregate support to student`s success. It is not the goal of this approach substitute the teacher. It may assist faculty in tailoring their teaching to optimize learning resources and organizing courses that facilitate student`s engagement.

6) Providing learners resource relevant to them profile and learning goals

It can provide learners with insights into their own learning habits and can give recommendations for improvement.

7) Alternative to “end of course” assessment

Through data, teachers (with systems) can map knowledge domains of the students, i. e. it is more than know which question is or not correct in a determined exam, but the learners’ activity (data and more data) can be evaluated in relation to these maps i.e. We are not worried if a student remember a given definition of a concept, but we are interested if this student can apply this concept properly.

COURSE OUTCOMES:

At the end of the course the student will develop ability to

CO	Course outcome	Blooms taxonomy level
C321.1	Understand the concepts of computational intelligence like machine learning	Understand
C321.2	Gain skill to apply machine learning techniques to address the real time problems in different areas	Create
C321.3	Understand the Neural Networks and its usage in machine learning application.	Analyse
C321.4	Understand computational learning theory	Analyse
C321.5	Demonstrate the pattern comparison techniques	Create

Mapping of key competencies of POs to each CO:

	PROGRAM OUTCOMES												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C321.1	1,2,3	1,2,3,4,5,6,7,8,9	4,5,6,8,9	1,3,5,6,7,8,910,11	1							2,3	1,2	1,2,3	2
C321.2	1,2,3	1,2,3,4,5,6,7,8,9	4,5,6,8,9	1,3,5,6,7,8,910,11	1							2,3	1,2	1,2,3	2
C321.3	1,2,3	1,2,3,4,5,6,7,8,9	4,5,6,8,9	1,3,5,6,7,8,910,11	1							2,3	1,2	1,2,3	2
C321.4	1,2,3	1,2,3,4,5,6,7,8,9	4,5,6,8,9	1,3,5,6,7,8,910,11	1							2,3	1,2	1,2,3	2
C321.5	1,2,3	1,2,3,4,5,6,7,8,9	4,5,6,8,9	1,3,5,6,7,8,910,11	1							2,3	1,2	1,2,3	2

NUMBER OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	**3**	**10**	**10**	**11**	**1**	**5**	**3**	**3**	**12**	**5**	**12**	**8**	**2**	**3**	**2**
C321.1	3	9	5	9	1							2	2	3	1
C321.2	3	9	5	9	1							2	2	3	1
C321.3	3	9	5	9	1							2	2	3	1
C321.4	3	9	5	9	1							2	2	3	1
C321.5	3	9	5	9	1							2	2	3	1

PERCENTAGE OF KEY COMPETENCIES FOR CO – PO MAPPING:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
No.Key Components	3	10	10	11	1	5	3	3	12	5	12	8	2	3	2
C321.1	100	90	50	81.82	100	0	0	0	0	0	0	25	100	100	50
C321.2	100	90	50	81.82	100	0	0	0	0	0	0	25	100	100	50
C321.3	100	90	50	81.82	100	0	0	0	0	0	0	25	100	100	50
C321.4	100	90	50	81.82	100	0	0	0	0	0	0	25	100	100	50
C321.5	100	90	50	81.82	100	0	0	0	0	0	0	25	100	100	50

COURSE ARTICULATION MATRIX (CO - PO / PSO MAPPING):

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C321.1	3	3	2	3	3	0	0	0	0	0	0	1	3	3	2
C321.2	3	3	2	3	3	0	0	0	0	0	0	1	3	3	2
C321.3	3	3	2	3	3	0	0	0	0	0	0	1	3	3	2
C321.4	3	3	2	3	3	0	0	0	0	0	0	1	3	3	2
C321.5	3	3	2	3	3	0	0	0	0	0	0	1	3	3	2
Total	15	15	10	15	15	0	0	0	0	0	0	5	15	15	10
Average	**3**	**3**	**2**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**2**

COs and POs and COs and PSOs on the scale of 0 to 3, 0 being no correlation,

1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 – ≤ ≤ 5% – No correlation; 1 – 5 < ≤ 40% – Low / Slight;

2 − 40 % << 60% – Moderate. 3 – 60% ≤ < 1

Prepared by: **HOD, C SE**