



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

DEPARTMENT OF INFORMATION TECHNOLOGY PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Master of Computer Application | Academic Year: 2019-20

PROGRAM OUTCOMES

- [PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
- [PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- [PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- [PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- [PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- [PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- [PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

- [PSO.1.] To work productively as IT professional both at supportive and leadership roles
- [PSO.2.] To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.
- [PSO.3.] To build their profession adaptable to the changes in the technology with lifelong learning

PROGRAM ARTICULATION MATRIX

SEMESTER	COURSE CODE	PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES									
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
I	MA 6117	2	2	-	3	2	2	3	-	1	-
	CA 6101	3	3	3	2	1	-	1	1		
	CA 6102	2	3	2	3	1	3	3	1		
	CA 6103	3	3	3	2	1	1	1	-		-
	CA 6104	3	3	-	-	-	-	-	-	-	1
	CA 6130	3	3	3	2	3	-	-	3		
	CA 6131	-	-	1	2	-	-	2			
	CA 6132	2	3	2	3	1	3	3	1		



MANIPAL UNIVERSITY JAIPUR

School of Basic Science

Department of Computer Applications

Course Hand-out

Web Technologies| CA 6101 | 4 Credits | 3 | 0 4

Session: Jul 19 – Dec 19 | Faculty: Dr. Vaibhav Bhatnagar | Class: MCA I Semester

A. Introduction: This course is offered by Department of Computer Application as a compulsory subject, targeting the students of BCA who wish to pursue job in Industries or higher studies in the field of Web Technologies. This is industry-oriented subject. After the completion of this course, students will be able to design a static as well as dynamic responsive website.

B. Course Outcomes: At the end of the course, students will be able to:

[6101.1]. Learn to design web pages with complete understanding of the process. Learn to use HTML tags to structure the content and Styling using CSS.

[6101.2]. Plan, design and develop web pages using responsive design. Understand issues with the help of case studies and solving those issues.

[6101.3]. Understand JavaScript syntax and design interactive website using JavaScript.

[6101.4]. Ability to analyse the requirements and create Interactive design using PHP with the use of Database technologies.

C. Program Outcomes:

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes

[PSO1]. To work productively as IT professional both at supportive and leadership roles.

[PSO2]. To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

[PSO3]. To build their profession adaptable to the changes in the technology with lifelong learning.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed.	

E. SYLLABUS

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol : Request and response, Web browser and Web servers, Features of Web 2.0, Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation, JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and JavaScript, Events and buttons, XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT, PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP, PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs. Introduction to Angular JS4.

F. TEXT BOOKS

1. R. Moseley & M. T. Savaliya, Developing Web Applications, (2e) Wiley-India, 2013
2. Team at Kogent Learning Solutions Inc., Web Technologies, Black Book, (1e) Dreamtech Press, 2009

G. REFERENCE BOOKS

1. Team at Kogent Learning Solutions Inc., HTML 5, Black Book, (2e) Dreamtech Press, 2011
2. J. Sklar, Web Design Principles, (5e) Cengage Learning, 2012
3. Harwani, Developing Web Applications in PHP and AJAX, (1e) McGrawHill, 2010

H. Lecture Plan:

Lectur es	Major Topics	Topics	Session outcome	Delivery Mode	Correspond ing CO	Mode of Assessing CO
1.	Concept of Internet	Introduction of WWW	Introduction of Web Internet	Lecture	6101.1	Mid Term I, Quiz & End Term
2.		Concept of Internet	Introduction of Web Internet	Lecture	6101.1	Mid Term I, Quiz & End Term
3.	Basic Web Designing and JavaScript	HTTP Protocol	Introduction of Web Internet	Lecture	6101.1	Mid Term I, Quiz & End Term
4.		Web browser and Web Server	Introduction of Web Internet	Lecture	6101.1,	Mid Term I, Quiz & End Term
5.		Features of Web 2.0	Introduction of Web Internet	Lecture	6101.1	Mid Term I, Quiz & End Term

6.		Concept of Effective Web Designing	Plan and Design of Website	Lecture	6101.2	Mid Term I, Quiz & End Term
7.		Bandwidth, cache and Display Resolution	Plan and Design of Website	Lecture	6101.2	Mid Term I, Quiz & End Term
8.		Tutorial	Plan and Design of Website	Tutorial	6101.2	Mid Term I, Quiz & End Term
9.		Feel of interactive website , Page layout	Plan and Design of Website	Activity	6101.2	
10.		User centric design, Sitemap, Planning and Publishing of Website	Plan and Design of Website	Lecture	6101.2	Mid Term I, Quiz & End Term
11.		Introduction to JavaScript	JavaScript	Lecture	6101.3	Mid Term I, Quiz & End Term
12.		Condition, loop and repetition.	JavaScript	Lecture	6101.3	Mid Term I, Quiz & End Term
13.		Popup Boxes	JavaScript	Lecture	6101.3	Mid Term I, Quiz & End Term
14.	Advanced JavaScript and XML	DOM of Java Script	JavaScript	Tutorial	6101.3	Mid Term I, Quiz & End Term
15.		Tutorial	JavaScript	Tutorial	6101.3	Mid Term I, Quiz & End Term
16.		Validation in JavaScript	JavaScript	Lecture	6101.3	Mid Term I, Quiz & End Term
17.		Validation in JavaScript	JavaScript	Flipped Classroom	6101.3	Mid Term I, Quiz & End Term
18.		Tutorial	JavaScript	Tutorial	6101.3	
19.		Introduction to XML, use of XML	XML	Lecture	6101.2	Mid Term I, Quiz & End Term
20.		DTD and Schema	XML	Lecture	6101.3	Mid Term I, Quiz & End Term
21.		Transforming XML using XSL	XML	Lecture	6101.3	Mid Term I, Quiz & End Term
22.		Transforming XML using XSLT	XML	Lecture	6101.3	Mid Term II, Quiz & End Term
23.		Tutorial	XML	Tutorial	6101.4	Mid Term II, Quiz & End Term
24.	Basic of PHP	Introduction to PHP	PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
25.		Basic Syntax of PHP	Creating web Page PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
26.		Decision and Looping in PHP	Creating web Page PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
27.		Form processing in PHP	Creating web Page PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
28.		File Handling in PHP	Creating web Page PHP	Activity	6101.4	Mid Term II, Quiz & End Term
29.		Handling Session in PHP	Handling Web pages in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
30.		Cookies in PHP	Handling Web pages in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term

31.		Tutorial	Handling Web pages in PHP	Tutorial	6101.4	Mid Term II, Quiz & End Term
32.		Object oriented Programming in PHP	Handling Web pages in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
33.		In built Functions in PHP	Handling Web pages in PHP	Flipped Classroom	6101.4	Mid Term II, Quiz & End Term
34.	Advanced PHP	Introduction of Database	Handling Database in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
35.		Introduction of MySQL and PHPmyadmin	Handling Database in PHP	Tutorial	6101.4	Mid Term II, Quiz & End Term
36.		Basic commands of SQL	Handling Database in PHP	Activity	6101.4	Mid Term II, Quiz & End Term
37.		Tutorial	Handling Database in PHP	Tutorial	6101.4	Mid Term II, Quiz & End Term
38.		Connecting PHP through MYSQL	Handling Database in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
39.		Creating database in MYSQL through PHP	Handling Database in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
40.		Selecting Database in PHP	Handling Database in PHP	Tutorial	6101.4	Mid Term II, Quiz & End Term
41.	Database handling in PHP	Listing database and Creating a Table	Handling Database in PHP	Lecture	6101.4	Mid Term II, Quiz & End Term
42.		Tutorial	Handling Database in PHP	Tutorial	6101.4	Quiz & End Term
43.		Inserting rows in Database	Handling Database in PHP	Lecture	6101.4	Quiz & End Term
44.		Updating Rows in Database	Handling Database in PHP	Lecture	6101.4	Quiz & End Term
45.		Deleting Rows in Database	Handling Database in PHP	Lecture	6101.4	
46.	Angular JS	Tutorial	Handling Database in PHP	Tutorial	6101.4	Quiz & End Term
47.		Advance PHP myAdmin	PHP Myadmin	Lecture	6101.4	Quiz & End Term
48.		Database bug	PHP Myadmin	Lecture	6101.4	Quiz & End Term
49.		Introduction to Angular JS	Other technolgies	Lecture	6101.4	Quiz & End Term
50.		Implementation of Angular JS	Other technolgies	Lecture	6101.4	Quiz & End Term
51.		Tutorial	PHP	Tutorial	6101.4	Quiz & End Term
52.		Tutorial	PHP	Tutorial	6101.4	Quiz & End Term

I. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CA 6101.1	Learn to design web pages with complete understanding of the process. Learn to use HTML tags to structure the content and Styling using CSS.	0	0	0	0	1	0	2	0	0	0	0	0	1	0	0	0
CA 6101.2	Plan, design and develop web pages using responsive design. Understand issues with the help of case studies and solving those issues.	2	0	1	0	0	0	1	0	0	0	0	0	1	2	1	0
CA 6101.3	Understand JavaScript syntax and design interactive website using JavaScript.	2	0	0	0	0	0	1	0	0	0	0	0	2	0	2	0
CA 6101.4	Ability to analyse the requirements and create Interactive design using PHP with the use of Database technologies.	1	0	0	0	0	0	3	0	0	0	0	0	3	0	3	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Basic Science

Department of Computer Applications

Course Hand-out

CA 6102 SOFTWARE ENGINEERING & PROJECT MANAGEMENT [3 1 0 4]

Session: July- Dec 2019 | Faculty: Devershi Pallavi Bhatt | Class: MCA- Sem I

Introduction: Overview of Software Engineering, Project Management Concepts, Software Process & Project Metrics, Software Project Planning, Project Evaluation, Cost Estimation, Software Re-Engineering, Reverse Engineering, Selection of an appropriate project approach, Software site, effort and cost Estimation, Risk Analysis & Management, Project Scheduling & Tracking, Activity Planning, Resource Allocation, Project Monitoring & Control, Managing Contracts, Managing People and Organizing teams, Software Quality Assurance, Software Configuration Management, Project Management Knowledge Areas and Processes.

A. Course Objectives: At the end of the course, students will be able to

- [6102.1] Annotate the fundamentals and requirement of Software Engineering. (Understanding)
- [6102.2] Determine the models of software developing life cycle. (Applying)
- [6102.3] Relate the Requirement Engineering Process. (Understanding)
- [6102.4] Describe data models, object models, context models and behavioural models. Understanding of different software architectural styles. (Understanding)
- [6102.5] Apply various Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration. (Applying)
- [6102.6] Evaluate the importance of Project management. (Evaluating)

B. Program Outcomes and Program Specific Outcomes

PROGRAM OUTCOMES

- [PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
- [PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
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- [PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

[PSO.1.] To work productively as IT professional both at supportive and leadership roles

[PSO.2.] To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

[PSO.3.] To build their profession adaptable to the changes in the technology with lifelong learning

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Open Book)	20
	Sessional Exam II (Open Book)	20
	In class Quizzes and Assignments, Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Open Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

C. Syllabus:

Introduction to Software Engineering: Software Components, Software Characteristics, Software Crisis, Software Engineering Processes; **Software Development Life Cycle (SDLC) Models:** Water Fall Model, Prototype Model, Spiral Model, Agile; **Requirement Engineering Process:** Analysis, Documentation, Review and Management of User Needs, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS; Basic Concept of Software Design, **Architectural Design**, Low Level Design Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures; **Design Strategies:** Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design; **Categories of Maintenance:** Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, **Software Re-Engineering, Reverse Engineering;** The Management spectrum- (The people, the product, the process, the project), **Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration**, Constructive Cost Models (COCOMO) and its types, SEI capability maturity model, Verification and Validation, SQA Plans, **Software Quality Frameworks**, ISO 9000 Models. **Basics of Project Management:** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, **The Project Life Cycle**, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, **Project Management Principles.**

D. Text / Reference Books:

1. R. S. Pressman, *Software Engineering: A Practitioners Approach*, (3e) McGraw Hill, 2009.
2. R. Mall, *Fundamentals of Software Engineering*, (4e) PHI Publication, 2014.
3. K. K. Aggarwal and Y. Singh, *Software Engineering*, (3e) New Age International Publishers, 2008.
4. P. Jalote, *Software Engineering*, Wiley, (1e) 2010.
5. Sommerville, *Software Engineering*, Addison Wesley, (10e) 2013.

E. Lecture Plan:

Lecture No	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction to Software Engineering	Introduction and Course handout briefing	Understand POs, PSOs and COs	Lecture	NA	
2.		Elements of System	Understand System	Lecture	CO1	In Class Quiz (Not Accounted)
3.		Characteristics of System	Understand Characteristics	Lecture	CO1	In Class Quiz End Term
4.		Types of System, System Concepts	Define system concept	Lecture	CO1	Home Assignment End Term
5.		Case studies/Tutorial	Discuss Case study	Lecture	CO1	In Class Quiz End Term
6.		Introduction in Software Engineering	Understand Software Engineering	Lecture	CO1	Class Quiz Mid Term I End Term
7.		Need for software Engineering,	Identify the need of Software Engineering	Lecture	CO1	Class Quiz Mid Term I End term
8.		Software Characteristics, Software Qualities (McCall's Quality Factors)	Explain Software Characteristics, Software Qualities	Lecture	CO1	Home Assignment Class Quiz Mid Term I End Term
9.		Communication, Requirement Gathering, Feasibility Study	Relate the feasibility study with requirement gathering	Lecture	CO1	Class Quiz Mid Term I End Term

10.	Software Development Life Cycle (SDLC)	System Analysis, Software Design, Coding,	Understand System Analysis and Design	Lecture	CO2	Class Quiz Mid Term I End Term
11.		Testing, Integration, Implementation, Operation and Maintenance, Disposition	Analyse the code and find for bug or error to rectify it to implement, deploy and maintain	Lecture	CO2	Class Quiz Mid Term I End Term
12.	(SDLC) Models	Water-Fall Model	Understand the basic model	Lecture	CO2	Class Quiz Mid Term I End Term
13.		Prototype Model	Classify the sample before the actual running system	Lecture	CO2	Class Quiz Mid Term I End Term
14.		Spiral Model	Classify the spiral model which is a advance model	Lecture	CO2	Class Quiz Mid Term I End Term
15.		Agile	Classify the hybrid model i.e. agile	Lecture	CO2	Class Quiz Mid Term I End Term
16.		Analysis, Documentation	Value to keep the record of the work done	Lecture	CO2	Class Quiz Mid Term II End Term
17.	Requirement Engineering Process	Review and Management of User Needs	Describe the work to the team	Tutorial	CO3	Class Quiz End Term
		Data Flow Diagrams, Entity Relationship Diagrams	Display the data and flow of information with standard diagrams	Tutorial	CO3	Class Quiz End Term
18.		Decision Tables	Display the entire decision	Tutorial	CO3	Class Quiz End Term

		SRS Document	Illustrate the software requirement specification	Tutorial	CO3	Class Quiz End Term
19.		IEEE Standards for SRS, Basic Concept of Software Design	Explain the understanding of SRS	Tutorial	CO3	Class Quiz End term
		IEEE Standards for SRS, Basic Concept of Software Design	Explain the concepts of SRS	Tutorial	CO3	Class Quiz
20.		Low Level Design	Explain the concepts of SRS	Tutorial	CO3	Class Quiz Mid Term II End Term
21.	Architectural Design	Modularization	Organize the independent and interdependent parts of project as modules	Tutorial	CO4	Class Quiz Mid Term II End Term
22.		Design Structure Charts	Sketching the software design	Tutorial	CO4	Class Quiz Mid Term II End Term
23.		Pseudo Codes	Understand the logic with simple English	Tutorial	CO4	Class Quiz Mid Term II End Term
24.		Flow Charts	Display the flow of information	Tutorial	CO4	Class Quiz Mid Term II End Term
25.		Coupling and Cohesion Measures	Relate the measures of various modules	Tutorial	CO4	Class Quiz Mid Term II End Term
26.		Function Oriented Design	Articulate the design based on its functionality	Tutorial	CO4	Class Quiz Mid Term II End Term
27.	Design Strategies	Object Oriented Design	Understand the difference between structured and object oriented design	Tutorial	CO4	Class Quiz Mid Term II End Term

28.		Top-Down and Bottom-Up Design	Understand different design approaches	Tutorial	CO4	Class Quiz Mid Term II End Term
29.		Preventive, Corrective	Understand different design approaches	Tutorial	CO4	Class Quiz Mid Term II End Term
30.	Categories of Maintenance	Perfective Maintenance	Relating Maintenance	Flip Class	CO4	End Term
31.		Cost of Maintenance	Calculate the cost of maintenance	Lecture	CO4	End Term
32.		The Management spectrum- (The people, the product, the process, the project)	Understand the management spectrum	Lecture	CO4	End Term
33.	Software Re-Engineering, Reverse Engineering	Reverse Engineering	Explain reverse engineering		CO3, CO5	End Term
34.		Constructive Cost Models (COCOMO) and its types	Calculating cost for the models	Flip Class	CO5	End Term
35.	Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration	SEI capability maturity model, Verification and Validation	Assessing verification and validation	Lecture	CO5	End Term
36.		SQA Plans	Explain SQA plan	Tutorials	CO5	End Term
37.	Software Quality Frameworks, ISO 9000 Models.	ISO 9000 Models, TQM	Discuss ISO models	Flip Class	CO5	End Term
		Introduction, Need for Project Management	Understand Project Management	Lecture	CO6	End Term
38.		Project Management Knowledge Areas and Processes.	Outlining Project Management areas	Lecture	CO6	End Term

39.	Basics of Project Management	The Project Manager (PM)	Discuss the roles and responsibilities of Project Manager	Lecture	CO6	End Term
40.	The Project Life Cycle	Phases of Project Management Life Cycle	Understand the Project Management Life Cycle	Tutorial	CO6	End Term
41.		Project Management Processes	Explain Process of Project Management	Tutorial	CO6	End Term
42.		Impact of Delays in Project Completions	Judge the impact of Project Completion	Flip Class	CO6	End Term
43.		Essentials of Project Management Philosophy	Understand philosophy of Project	Flip Class	CO6	End Term
44.	Project Management Principles	Six Principles: Principle 1: Vision and Mission. ... Principle 2: Business Objectives. ... Principle 3: Standards of Engagement. ... Principle 4: Intervention and Execution Strategy. ... Principle 5: Organisational Alignment. ... Principle 6: Measurement and Accountability.	Under the six principles of project	Tutorial	CO6	End Term

F. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
6102.1	Annotate the fundamentals and requirement of Software Engineering. (Understanding)	3	0	0	1	0	0	1	1	2	3
6102.2	Determine the models of software developing life cycle. (Applying)	1	1	1	0	1	0	1	2	2	1
6102.3	Relate the Requirement Engineering Process. (Understanding)	0	1	3	0	2	1	0	1	2	3
6102.4	Describe data models, object models, context models and behavioural models. Understanding of different software architectural styles. (Understanding)	2	1	0	0	0	1	0	1	2	2
6102.5	Apply various Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration. (Applying)	1	1	0	0	2	0	0	1	2	3
6102.6	Apply the importance of Project management. (Applying)	3	1	3	1	0	0	0	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Applications
Course Hand-out

Formal Language and Automata Theory | CA 6103 | 4 Credits | 3 1 0 4

Session: July '19 – December '19 | Faculty: Dr. Pradeep Kumar Tiwari | Class: MCA I SEM

A. Introduction: This course is offered by Dept. of Computer applications as a core course, targeting students who wish to pursue research & development in field of theory of computation. Automata Theory is an exciting, theoretical branch of computer applications. It established its roots during the 20th Century, as mathematicians began developing - both theoretically and literally - machines which imitated certain features of man, completing calculations more quickly and reliably. The word automaton itself, closely related to the word "automation", denotes automatic processes carrying out the production of specific processes. Simply stated, automata theory deals with the logic of computation with respect to simple machines, referred to as automata. Through automata, computer scientists are able to understand how machines compute functions and solve problems and more importantly, what it means for a function to be defined as computable or for a question to be described as decidable.

A. Course Outcomes: At the end of the course, students will be able to

[CA6103.1] Develop abstract models such as finite automata, finite automata with outputs, pushdown automata, linear bounded automata and Turing machines based on any problem specified in formal language.

[CA6103.2] Compare the characteristics of different types of formal languages and grammars as mentioned in Chomsky Hierarchy.

[CA6103.3] Determine the type of computational problems and examine the decidability of them by constructing Turing machines.

[CA6103.4] Propose an optimal abstract model as well as developing skills which can be applied to a suitable real life problem.

B. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO.1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO.2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

PO.3: Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

PO.4: Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO.5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

PO.6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO.7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program specific outcomes

PSO.1: To work productively as IT professional both at supportive and leadership roles.

PSO.2: To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

PSO.3: To build their profession adaptable to the changes in the technology with lifelong learning.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Written Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Mathematical Preliminaries and Notation: Three basic concepts, Some Applications, Deterministic Finite Accepters, Nondeterministic Finite Accepters, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata; Regular Expressions, Identifying Non-regular Languages; Context-Free grammars: Parsing and Ambiguity, Context-Free Grammars and Programming Languages, Methods for Transforming Grammars, Two important Normal Forms; Nondeterministic Pushdown Automata, Pushdown Automata and Context-Free Languages, Deterministic Pushdown Automata and Deterministic Context-Free Languages; The Standard Turing Machine: Linear Bounded Automata, Recursive and Recursively Enumerable Languages, Unrestricted Grammars, Context Sensitive grammars and Languages, The Chomsky Hierarchy.

E. Text Books

T1. An Introduction to Formal Languages and Automata – Peter Linz, Jones and Bartlett Student Edition, Fifth Edition, 2010.

T2. Introduction to Languages and the Theory of Computation, J. Martin, (3e) McGraw Hill, 2002.

T4. Introduction to Automata Theory, Languages and Computation, . J. Hopcroft, R. Motwani, (3e) Pearson Education, 2006.

F. Reference Books

- R1.** Introduction to the Theory of Computation – Michael Sipser, Cengage Learning, Third Edition, 2012.
- R2.** Introduction to Languages and the Theory of Computation – John Martin, Tata McGraw Hill, Fourth Edition, 2010.
- R3.** Compilers : Principles, Techniques and Tools – A. Aho, J. Ullman, M. S. Lam, R. Sethi, Pearson Education, 2nd Edition, 2007.

G. Lecture Plan:

Lec. No	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to Theory of Computation	Mathematical Preliminaries and Notation	Understand basics of set theory, groups, relations, functions.	Lecture	6103.1	In Class Quiz Mid Term I End Term
2-3		Three Basic Concepts (Languages, Grammars and Automata)	Understand basics of Automata Theory i.e., languages, grammars etc.	Lecture	6103.1	In Class Quiz Mid Term I End Term
4		Some Applications	Understanding the applications of Automata	Lecture	6103.1	In Class Quiz Mid Term I End Term
5	Finite Automata and its types	Deterministic Finite Automata/ Accepters (DFA)	Introduction to DFA and its designing	Lecture, Practice questions	6103.1	Home Assignment Mid Term I End Term
6-7		Nondeterministic Finite Accepters (NFA)	Construction of NFA using different approaches for different type of problems	Lecture, Practice questions	6103.1	In Class Quiz Home Assignment Mid Term I End Term
8-9		Equivalence of DFA and NFA	Understanding the basic difference between DFA and NFA and realising the importance of NFA	Lecture, Practice questions	6103.1	In Class Quiz Home Assignment Mid Term I End Term
10		Reduction of the number of states in Finite Automata	Understanding the algorithm for minimizing the DFA	Lecture, Practice questions	6103.1	In Class Quiz Home Assignment Mid Term I End Term
11-12		FA with output: Mealy and Moore machine	Understand the design principles of Mealy and Moore machines	Lecture, Practice questions	6103.1	In Class Quiz Home Assignment Mid Term I End Term
13-14		Equivalence between Mealy machine and Moore machine	Compare Mealy machines with Moore machines and understand the algorithm to convert Mealy machine into Moore machine and vice-versa.	Lecture, Flipped class room	6103.1	In Class Quiz Home Assignment Mid Term I End Term
15	Languages and Grammars	Grammar and Formal Languages	Understand the notations and properties of formal languages and grammar	Lecture	6103.2	In Class Quiz Home Assignment Mid Term II End Term

16		Chomsky Hierarchy	Understand the properties of formal languages and to compare properties of different languages of Chomsky Hierarchy	Lecture	6103.2	In Class Quiz Home Assignment Mid Term II End Term
17-18		Regular Expressions and Finite Automata	Construct regular expressions	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
19		Regular Grammar	Construct regular grammar	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
20	Properties of Regular Languages	Properties of Regular Languages	Study the properties of regular languages	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
21		Identifying Non-Regular Languages	Compare and identify the non-regular languages	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
22-23		Pumping Lemma for Regular Languages	Understand Pumping lemma for regular languages and applying this lemma to prove a given language is not regular	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
24	Context Free Languages	Context Free Languages	Study the properties of context free languages	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
25		Leftmost and Rightmost Derivations	Deriving a string from CFL using either leftmost or rightmost derivations	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
26		Derivation trees	Deriving language from CFGs and constructing derivation trees from it	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
27		Parsing and Ambiguity	Determine whether a grammar is ambiguous or not by deriving a parse tree from CFL	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term I End Term

28		Context Free Grammars	Understanding the concept of CGF, designing of CFG for CFL	Lecture, Practice questions		In Class Quiz Home Assignment Mid Term II End Term
29-31		Simplification of Context Free Grammars and Normal Forms, Methods for Transforming Grammars	Simplify a given CFG using three transformation method	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
32		Chomsky Normal Form (CNF)	Normalize a CFG into CNF	Flipper Classroom	6103.2	In Class Quiz Home Assignment Mid Term II End Term
33-34		Greibach Normal Form (GNF)	Normalize a CFG into GNF	Lecture, Practice questions	6103.2	In Class Quiz Home Assignment Mid Term II End Term
35	Push Down Automata (PDA)	Pushdown Automata (PDA) and Context-Free Languages	Construction of PDA using different approaches for different type of problems	Lecture	6103.1	In Class Quiz Home Assignment Mid Term II End Term
36		Deterministic Pushdown Automata, Nondeterministic Pushdown Automata	Understanding acceptability of PDAs and categorizing the PDAs into DPDA and NPDA	Lecture, Practise questions	6103.1	In Class Quiz Home Assignment Mid Term II End Term
37-39		Design of DPDA, NPDA, Conversion between PDA and CFG	Differentiate DPDA from NPDA and understanding equivalence of them	Flipped Classroom	6103.1	In Class Quiz Home Assignment Mid Term II End Term
40		Linear Bounded Automata and Context-Sensitive Languages	Understanding basic concepts of LBA and CSL	Lecture, Practice questions	6103.1	In Class Quiz Home Assignment Mid Term II End Term
41	Turing Machine	Turing Machine and Recursive, Recursive Enumerable Languages	Understanding principles of Turing machines, halting problems and the languages of Turing machine	Lecture, Practise questions	6103.1 6103.3	In Class Quiz Home Assignment End Term
42-44		The Standard Turing Machine and variants of Turing Machine, Solving Some Problems by using Turing Machine, Problems that cannot be solved by Turing Machine. Halting Turing machine, PCP Problem, etc.	Understanding variants of Turing machine and applying these to solve problems	Lecture, Practice questions	6103.3	In Class Quiz Home Assignment End Term

45-48		Design of DTM, NTM	Design different DTM, NTM for different problems	Lecture, Practise questions	6103.1 6103.2	In Class Quiz Home Assignment End Term
49-50		Recursive and Recursively Enumerable Languages, Unrestricted Grammars, Context Sensitive Grammars and Languages, The Chomsky Hierarchy revisited	Understanding the Chomsky hierarchy in detail and revision of the same	Lecture, Practise questions	6103.3 6103.4	In Class Quiz Home Assignment End Term

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CA 6103.1	Develop abstract models such as finite automata, finite automata with outputs, pushdown automata, linear bounded automata and Turing machines based on any problem specified in formal language.	2	0	1	0	1	0	0	0	0	1
CA 6103.2	Compare the characteristics of different types of formal languages and grammars as mentioned in Chomsky Hierarchy.	0	2	0	0	0	0	1	0	1	0
CA 6103.3	Determine the type of computational problems and examine the decidability of them by constructing Turing machines.	1	0	0	0	0	1	0	0	0	0
CA 6103.4	Propose an optimal abstract model as well as developing skill which can be applied to a suitable real life problem.	0	0	0	1	0	0	1	1	0	0
CA 6103.5	Develop abstract models such as finite automata, finite automata with outputs, pushdown automata, linear bounded automata and Turing machines based on any problem specified in formal language.	0	1	0	0	0	0	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Application

Course Hand-out

Object Oriented Programming Using JAVA | CA 6104 | 3 Credits | 3 1 0 4

Session: July 19 – Dec 19 | Faculty: Linesh Raja | Class: MCA (I Sem)

A. Introduction: Object oriented techniques have revolutionized the software development process and are used tremendously in IT industry to develop software products of various kinds. The course is designed to give students an in-depth understanding of the basic concepts of object-oriented programming such as encapsulation, inheritance and polymorphism using Java programming language. The course curriculum and structure has been divided into eight basic modules which covers the programming aspects related with object oriented domain such as exception handling, multithreading, GUI programming, event handling etc. The course will be taught with the help of several teaching aides such as power point presentation and via live debugging and execution demonstrations of several programming problems using Eclipse tool.

The main objective of the course is as follows:

- To teach students about the basics of classes and objects using Java programming language
- To enable the students to properly use the basic object oriented pillars such as encapsulation, inheritance and polymorphism.
- To enable the students to understand the basic difference between a class and an interface.
- To teach students about the implementation aspect of various basic data structures such as Linked Lists and Arrays using object oriented techniques
- To teach students how to provide various types of inheritance and polymorphism using classes and interfaces
- To introduce students about the role of modern programming constructs such as exceptions in modern programming languages
- To teach students about the basic of Multithreading, GUI Programming and Event handling

B. Course Outcomes: At the end of the course, students will be able to

[6104.1]. Understand object oriented programming and learn how to compile and execute a simple as well as complex Java Application using Command Based Interface and other tools.

[6104.2]. Learn and apply the concepts of encapsulation and abstraction using class, objects and interfaces.

[6104.3]. Describe and Implement various inheritance and polymorphism forms using Java Classes and Interfaces.

[6104.4]. Learn and Implement various collection data structure such as linked lists, queues, stacks using Java's collection framework

[6104.5]. Understand, Learn and finally Implement the use of advanced programming constructs/features such as exception handling, multithreading and event handling in real-life programming domains for improving employability.

[6104.6]. Visualize a real world problem in the form of various collaborating classes and objects or skill development.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1]. To work productively as IT professional both at supportive and leadership roles.

[PSO.2]. To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

[PSO.3]. To build their profession adaptable to the changes in the technology with lifelong learning.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	A student who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. Syllabus

The History and Evolution of java: The Creation of Java, how java changed the internet, Java's Magic, Servlets, The java Buzzwords; An Overview of Java, arrays; **Introduction to classes:** Class fundamentals, declaring objects, Assigning Object reference variables, Introduction to methods, Constructors, this keyword, Garbage collection, finalize() method, Overloading, objects as parameters, argument passing, returning objects, recursion, access control, final, nested and inner classes, string class; **I/O Basics:** Reading Console Input, Writing Console Output, Files, Applet fundamentals; **Inheritance:** basics, super, multilevel hierarchy, overriding, abstract classes, final with inheritance; Packages and Interfaces, Exception Handling, Multithreaded programming; **String Handling,** Applet Class, **Event Handling; Introduction to AWT:** Classes, component, Container, Panel, Window, frame, Canvas, working with frame, working with Graphics, using AWT Controls.

F. Text Books

T1. The Complete Reference (9th Edition), By Herbert Schildt, McGraw Hill Education, ISBN-10:0071808558, ISBN-13: 978-0071808552

G. Reference Books

R1. Core Java Volume I - Fundamentals (10th Edition), By Cay Horstmann, Prentice Hall, ISBN-10:0134177304, ISBN-13: 978-0134177304, Year (2006)

R2. Object Oriented Programming in Java: A Graphical Approach (Preliminary Edition), By KE Sanders and AV Dam, Pearson Education, ISBN-10:0321245741, ISBN-13:978-0321245748, Year (2015)

R3. Java Concepts (4th Edition), By Cay horstmann, Wiley India, ISBN-10:0471697044, ISBN-13:978-0471697046, Year (2005)

H. Lecture Plan:

Lec No	Major Topics	Topics	Session outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to Java	Introduction and Course Hand-out briefing	Course objective	Lecture	NA	NA
2		The Creation of Java	About Java	Lecture	6104.1	In Class Quiz (Not Accounted)
3		How java changed the internet	Java and Internet	Lecture	6104.1	In Class Quiz End Term
4		Java's Magic, The java Buzzwords	About Java	Guided Self-Study	6104.1	Home Assignment End Term
5		An Overview of Java	About Java	Lecture	6104.2	In Class Quiz End Term
6		Arrays	Array and their initialization	Activity	6104.2	Class Quiz Mid Term I End Term
7-8	Class & Objects	Class fundamentals, Class fundamentals, Declaring objects	Class & Object	Lecture	6104.2	Class Quiz Mid Term I End term
9		Assigning Object reference variable	Object referencing	Lecture	6104.2	Home Assignment Class Quiz Mid Term I End Term
10		Introduction to methods	Member methods	Activity	6104.2	Class Quiz Mid Term I End Term
11		Constructors	Initialization and their use	Lecture	6104.2	Class Quiz Mid Term I End Term
12		this keyword	Various aspects of this keyword	Lecture	6104.2	Class Quiz End Term
13		Garbage collection	De-allocation of memory	Lecture	6104.4	Class Quiz Mid Term II End Term
14		finalize() method	Uses of method	Lecture	6104.4	Class Quiz Mid Term II End Term
15		Overloading	Concept of overloading	Lecture	6104.4	Class Quiz Mid Term II End Term

16-17		Objects as parameters, Argument passing, Returning objects	Object passing	Lecture	6104.4	Class Quiz Mid Term II End Term
18		Recursion	Use of recursion in class & object	Lecture	6104.4	Class Quiz End Term
19	Java Concepts and their applications	Access control, Final	Use of various access and final keyword	Lecture	6104.4	Class Quiz End Term
20		Nested and inner classes	Uses and their applications	Lecture	6104.4	Class Quiz End Term
21		String class	Uses and their applications	Lecture	6104.4	Class Quiz End Term
22		Reading Console Input, Writing Console Output, Files	Uses and their applications	Lecture	6104.5	Class Quiz End Term
23-24		Applet fundamentals	Introduction	Lecture	6104.5	Class Quiz End term
25-26		Inheritance Basic, super, multilevel hierarchy	Uses and their applications	Lecture	6104.5	Class Quiz
27-28		Overriding, abstract classes, final with inheritance, Packages and Interfaces	Uses and their applications	Lecture	6104.5	Class Quiz Mid Term II End Term
29		Exception Handling	Uses and their applications	Lecture	6104.3 6104.5	Class Quiz Mid Term II End Term
30-31		Multithreaded programming; String Handling, Applet Class, Event Handling	Uses and their applications	Lecture	6104.3 6104.5	Class Quiz Mid Term II End Term
32-33		AWT and their classes	Uses and their applications	Lecture	6104.3 6104.5	Class Quiz End Term
34		Swing classes, component, Container	Uses and their applications	Lecture	6104.4 6104.6	Class Quiz End Term
35-36		Panel, Window, frame, Canvas, working with frame	AWT based application development	Lecture	6104.6	Class Quiz End Term
37-38		Working with Graphics	Application development	Lecture	6104.6	Class Quiz End Term
39-41		Swing Controls	Application development	Lecture	6104.6	Class Quiz End Term
42		Revision	Discussion of course outcome	Lecture	NA	NA
LAB SESSIONS		Lab sessions based on object oriented programming concepts. Applets, AWT and Swing based application development		Lab Sessions	6104.1 - 6104.6	Experimental results 14 lab sessions End Term Practical End Term Theory

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CA 6104.1	Understand object oriented programming and learn how to compile and execute a simple as well as complex Java Application using Command Based Interface and tools.	3						1			2
CA 6104.2	Learn and apply the concepts of encapsulation and abstraction using class, objects and interfaces.		2	2							2
CA 6104.3	Describe and Implement various inheritance and polymorphism forms using Java Classes and Interfaces.				2	2			3		
CA 6104.4	Learn and Implement various collection data structure such as linked lists, queues, stacks using Java's collection framework.						2		3		
CA 6104.5	Understand, Learn and finally Implement the use of advanced programming constructs/features such as exception handling, multithreading and event handling in real-life programming domains for improving employability.			1					3	2	
CA 6104.6	Visualize a real world problem in the form of various collaborating classes and objects or skill development.	3	2	2	2				3	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES THRESHOLD VALUE: 40%							ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CA 6104.1	Understand object oriented programming and learn how to compile and execute a simple as well as complex Java Application using Command Based Interface and tools.										
CA 6104.2	Learn and apply the concepts of encapsulation and abstraction using class, objects and interfaces.										
CA 6104.3	Describe and Implement various inheritance and polymorphism forms using Java Classes and Interfaces.										
CA 6104.4	Learn and Implement various collection data structure such as linked lists, queues, stacks using Java's collection framework.										
CA 6104.5	Understand, Learn and finally Implement the use of advanced programming constructs/features such as exception handling, multithreading and event handling in real-life programming domains for improving employability.										
CA 6104.6	Visualize a real world problem in the form of various collaborating classes and objects or skill development.										

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Applications

Course Hand-out

Discrete Mathematics | MA 6117 | 4 Credits | 3 | 0 4

Session: Aug 1 – November 30 | Faculty: Dr. Garima Agarwal | Class: MCA I Semester

A. Introduction: This course is offered by Dept. of Computer Application, targeting students who wish to pursue research & development in industries or higher studies. The aim of the department of Computer Application is to produce highly, well qualified and motivated graduates possessing fundamental knowledge of Computer Application and research of software who can provide leadership and service to our nation and world. The main focus of the department of Computer Application is to be recognized as a trendsetter of its undergraduate programme through focus on core competencies, multidisciplinary collaborations, and quality in education. This course provides the Basic concept of statistic and central tendency and measure of dispersion. Student will find the permutation and combination as well. Basic concept of probability is also incorporated in this course.

B. Course Outcomes: At the end of the course, students will be able to

[6117.1]. To understand the concept of Set theory

[6117.2]. To understand the concept of Lattices

[6117.3]. To understand the concept of Boolean algebra

[6117.4]. To understand the concept of Group Theory

[6117.5]. To understand the concept of Logic

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAM SPECIFIC OUTCOMES

PSO1: To work productively as IT professional both at supportive and leadership roles.

PSO2: To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

PSO3: To build their profession adaptable to the changes in the technology with lifelong learning.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	In class Quizzes	20
End Term Exam (Summative)	End Term Exam (Open Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

A. SYLLABUS

Set Theory: sets, subsets, set operation, Cartesian product, relation (properties, equivalence relation, and partition) and function (different types of functions and composite function). Principal of inclusion and exclusions (statement only and simple problems), Generating Functions recurrence relation. Order relation and Structures: Partially order, algebraic structures and POSET, Lattices, distributive, and complemented lattices, Boolean Lattice, Uniqueness of Boolean Lattices Boolean expression & function. Semi group & Group: Binary operation, semi- groups, product and quotients, groups products and quotients, Bernside theorem (statement only and simple problems) coding & decoding. Mathematical Logic: Statement and notations, connectives, normal forms, well-formed formulas, implication, Tautology, Predicate calculus.

References:

1. C.L. Lui, *Elements of Discrete Mathematics*, (4e) Houghton Mifflin, 2017
2. J.P.Tremblay & R. Manohar, *Discrete Mathematical Structure with Applications to Computer*

Science, (1e) McGraw Hill Education – 2017

A. Lecture Plan:

S.No	Major Topic	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing COs
1.	SET AND RELATION	Introduction and course handout briefing	Understand POS, PSO and COS	Lecture	NA	NA
2.		Set and set operations, Venn diagram	Introduce Set	Lecture	6117.1	Mid Term I, quiz and end term
3.		subsets	Understand subsets	Lecture	6117.1	Mid Term I, quiz and end term
4.		Cartesian product of set	Lean Set	Lecture	6117.1	Mid Term I, quiz and end term
5.		relation	Introduce relation	Lecture	6117.1	Mid Term I, quiz and end term
6.		Examples	Practice Questions	Lecture	6117.1	Mid Term I, quiz and end term
7.		type of relations	Understand relations	Lecture	6117.1	Mid Term I, quiz and end term
8.		equivalence relation	Understand relation	Lecture	6117.1	Mid Term I, quiz and end term
9.		properties of relation	Implementation of relation	Lecture	6117.1	Mid Term I, quiz and end term
10.		partition	Introduce partition	Lecture	6117.1	Mid Term I, quiz and end term

11.		Illustrative examples	Practice Questions	Lecture	6117.1	Mid Term I, quiz and end term
12.		Illustrative examples	Practice Questions	Lecture	6117.1	Mid Term I, quiz and end term
13.		Tutorial	Tutorial	Activity	6117.1	Mid Term I, quiz and end term
14.	FUNCTION	function	Introduce function	Lecture	6117.2	Mid Term I, quiz and end term
15.		Related examples	Practice Questions	Lecture	6117.2	Mid Term I, quiz and end term
16.		types of functions	Learn types of functions	Lecture	6117.2	Mid Term I, quiz and end term
17.		Related examples	Practice Questions	Lecture	6117.2	Mid Term I, quiz and end term
18.		composite function	implementation of composite function	Lecture	6117.2	Mid Term I, quiz and end term
19.		Related examples	Practice Questions	Lecture	6117.2	Mid Term I, quiz and end term
20.		Principal of inclusion and exclusions	implementation of Functions	Lecture	6117.2	Mid Term I, quiz and end term
21.		Related examples	Practice Questions	Lecture	6117.2	Mid Term I, quiz and end term
22.		Generating Functions	Learn Generating Functions	Lecture	6117.2	Mid Term I, quiz and end term
23.		recurrence relation	Understand recurrence relation	Lecture	6117.2	Mid Term I, quiz and end term
24.		Order relation	Introduce Order relation	Lecture	6117.2	Mid Term I, quiz and end term
25.		Related examples	Practice Questions	Lecture	6117.2	Mid Term I, quiz and end term
26.		Structures	Learn Structures	Lecture	6117.2	Mid Term I, quiz and end term
27.		Partially order functions	Learn Partially order functions	Lecture	6117.2	Mid Term I, quiz and end term
28.		Related examples	Practice Questions	Activity	6117.2	Mid Term I, quiz and end term
29.		algebraic structures	Introduce algebraic structures	Lecture	6117.2	Mid Term II quiz and end term
30.		Related examples	Practice Questions	Lecture	6117.2	Mid Term II quiz and end term

31.	POSET AND LATTICES	POSET	Introduce POSET	Lecture	6117.3	Mid Term II quiz and end term
32.		Related examples	Practice Questions	Lecture	6117.3	Mid Term II quiz and end term
33.		Lattices	Learn Lattices	Lecture	6117.3	Mid Term II quiz and end term
34.		Related examples	Practice Questions	Lecture	6117.3	Mid Term II quiz and end term
35.		distributive Lattices	Type of Lattices	Activity	6117.3	Mid Term I, quiz and end term
36.		Related examples	Practice Questions	Lecture	6117.3	quiz and end term
37.		complemented lattices,	Type of Lattices	Lecture	6117.3	quiz and end term
38.		Related examples	Practice Questions	Lecture	6117.3	quiz and end term
39.		Boolean Lattice	Understand Boolean Lattice	Lecture	6117.3	quiz and end term
40.		Related examples	Practice Questions	Lecture	6117.3	quiz and end term
41.		Boolean expression & function	Learn Boolean expression	Lecture	6117.3	quiz and end term
42.		Tutorial	Tutorial	Activity	6117.3	Mid Term I, quiz and end term
43.	Group Theory	Group	Introduce Group	Lecture	6117.4	
44.		Binary operation on group	Learn Group Theory	Lecture	6117.4	
45.		Related examples	Practice Questions	Lecture	6117.4	
46.		definition on semi-groups	Understanding semi- groups	Lecture	6117.4	
47.		groups products and quotients	Implementation of Group	Lecture	6117.4	
48.		Related examples	Practice Questions	Lecture	6117.4	
		Bernside theorem	Implementation of Group	Lecture	6117.4	
49.		Mathematical Logic	Introduce Logic	Lecture	6117.5	
50.		notations of Mathematical Logic	Implementation of Logic	Lecture	6117.5	
51.		normal forms of Mathematical Logic	Understanding Logic	Lecture	6117.5	

B. Course Articulation Matrix: (Mapping of COs with POs)
1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA 6117.1	To understand the concept of Set theory	1													1	
MA 6117.2	To understand the concept of Lattices			1							1		1	1		
MA 6117.3	To understand the concept of Boolean algebra					1									1	
MA 6117.4	To understand the concept of Group Theory				1									1		
MA 6117.5	To understand the concept of Logic			1					1						1	

0- No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Applications

Course Hand-out

Relational Database Management Systems| CA 6201 | 4 Credits | 3 | 0 | 4

Session: Jan '20 – May '20 | Faculty: Dr. Vanita Jaitly | Class: MCA II Semester

A. Introduction: This course introduces the concepts of Relational Database Management Systems. More emphasis will be given to understanding the internal working of database management systems and development of database application. Database Management System will be taught using MySQL and ERD plus.

B. Course Outcomes: At the end of the course, students will be able to

CS 6201.1: Classify, Compare & recall different file-based system, Data Model.

CS6201.2: Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.

CS6201.3: Interpret different query language SQL, Relation Algebra, calculus and acquire the skill apply the techniques and rules in different real-life problems.

CS6201.4: Understand different normalization technique for optimizing database and analyse database design.

CS6201.5: Understand and summarize transaction processing, concurrency and recovery techniques.

CS6201.6: Explain different database storage structure and access technique.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes (PSOs)

PSO1: To work productively as IT professional both at supportive and leadership roles.

PSO2: To advance successfully in their chosen career path utilizing technical abilities, leadership

qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

PSO3: To build their profession adaptable to the changes in the technology with lifelong learning.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	5 Quizzes (Open Book Mode), I MOOC, Video Assignments (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction: Data, data processing requirement, traditional file based system, Def of database, database management system, 3-schema architecture, Benefits of DBMS. Database system applications, Purpose of database systems, Different database users. DBMSs, data driven development, OLAP, OLTP. **Data Modelling and ER/EER diagrams:** Conceptual data model, Conceptual data modelling using E-R data model, entities, attributes, relationships, Generalization, specialization, specifying constraints. **Relational Algebra and Calculus:** Selection and projection set operations, renaming - Joins – Union, intersection, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus. **Relational Model, ER mapping to corresponding relational models & Relational Algebra:** the relational data model, relational constraints and the relational algebra, relational model concepts, relational constraints and relational database schemas, update operations and dealing with constraints violations, basic relational algebra operations, additional relational operations, examples of queries in relational database design using ER-to-Relational Mapping. **SQL:** Data definition, Constraints and schema changes in SQL2, Basic queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, Views (Virtual tables) in SQL, Specifying General Constraints as assertion, Additional features of SQL. **Database Design & Normalisation :** Def of relation, relational model operators, Keys, relational model integrity rules, Functional dependencies and normalization for relational databases :Informal design guidelines for schemas, functional dependencies, Normal forms based on Primary keys, General definitions of second and third normal forms, Boyce-Codd normal form, Relational database algorithms and further dependencies: Algorithms for relational database schema

design, multivalued dependencies and fourth normal form. **Transaction Processing & Management:** Transaction concept & State, Concurrency Control: Lock Based Protocols, Multiple granularity, Deadlocks. **Recovery:** Recovery & Atomicity, Log based Recovery. **Concurrency control mechanisms:** concurrency control techniques: Locking techniques for concurrency control techniques, concurrency control based on Timestamp ordering, multiversion concurrency control techniques, validation (optimistic) concurrency for concurrency control in indexes, some other concurrency control issues.

F. TEXT BOOKS

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", TMH, New Delhi, 2006
2. R. Elmasri, S. B. Navathe, "Fundamentals of Database Systems", Addison & Weisely, New Delhi, 2008

G. REFERENCE BOOKS

1. C. J. Date, "Database Systems", Prentice Hall of India, New Delhi, 2012
2. Raghu Ramakrishnan, "Database Management Systems (2nd Ed)", McGraw Hill, 2000.
3. Ivan Bayross, "Introduction to SQL", Tata McGraw, 2010.

H. Lecture Plan

Lecture s	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introducti on	Introduction to Data, data processing requirement, desirable characteristics of an ideal data processing system.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	6201.1	N. A.
2.		Traditional file based system, its drawback, File processing systems versus database management systems.	Compare file systems and DBMS	PPT, Lecture, Class Notes	6201.1	Mid Term I, Quiz & End Term
3.		Data Models, Schemas and Instances. Categories of Data Models.	Classify and Compare different Data Model.	PPT, Lecture, Class Notes	6201.1	Mid Term I, Quiz & End Term
4.		Three Schema Architecture, Data Independence (Logical & Physical).	Classify and Compare various architectures and data independence.	PPT, Lecture, Class Notes	6201.1	Mid Term I, Quiz & End Term
5.		Benefits of DBMS. Database system applications, Purpose of database systems, Different database users.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	6201.1	Mid Term I, Quiz & End Term
6.	Data Modelling and	Conceptual data model, Conceptual data modelling using E-R data model.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
7.		Entity Types, Entity Sets, Attributes, Keys and Weak Entity type.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
8.		Relationship Types, Relationship Sets, Roles, and Structural Constraints.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term

9.	ER/EER diagrams	Enhanced Entity-Relationship (EER) Model: Subclass, Super classes and Inheritance.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
10.		Specialization and Generalization, Constraints and characteristics of Specialization and Generalization Hierarchies.	Understand the concepts of generalization and specialization and various constraints associated.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
11.		Relational Model Concepts: Domain, Attributes, Tuples and Relations.	Understand the concepts of relational model	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
12.		Relational Model Constraints and Relational Database Schema: Domain Constraints, Key Constraints and Constraints on NULL Values.	Understand and design Entity Relationship Model and illustrate the concept of NULL values.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
13.		Entity Integrity, Referential Integrity and Foreign Keys.	Understand various concepts of key constraints.	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
14.		Relational database design using ER-to-Relational Mapping.	Understand mapping of ER models into relations	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
15.		Mapping EER Model constructs to Relations.	Understand mapping of EER models into relations	PPT, Lecture, Class Notes	6201.1 & 6201.2	Mid Term I, Quiz & End Term
16.		Relational Algebra: Unary Relational Operations SELECT and PROJECT.	Understand unary relational operations like SELECT and PROJECT	PPT, Lecture, Class Notes	6201.3	Mid Term I, Quiz & End Term
17.		Sequences of Operations and the RENAME Operation.	Understand the sequences of operations and the RENAME Operation.	PPT, Lecture, Class Notes	6201.3	Mid Term I, Quiz & End Term
18.		Relational Algebra Operation from Set Theory: UNION, INTERSECTION, CARTESIAN PRODUCT (CROSS PRODUCT) Operations.	Interpret different Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term I, Quiz & End Term

19.	Relational Algebra and Calculus	Binary Relational Operations: JOIN and DIVISION Operation	Interpret JOIN and DIVISION operations and apply the techniques and rules in different problems.	PPT, Lecture, Class Notes	6201.3	Mid Term I, Quiz & End Term
20.		Variations of JOIN: THETA JOIN, EQUI JOIN, NATURAL JOIN, INNER JOIN and OUTER JOIN	Interpret different types of JOIN operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term I, Quiz & End Term
21.		Additional Relational Operations: Generalized Projection, Aggregate Functions and Grouping.	Interpret additional Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
22.		Tuple Relational Calculus: Tuple Variable and Range Relations, Expressions and Formulas in tuple relational calculus.	Interpret different Relational Calculus operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
23.		The Existential and Universal Quantifiers, Safe Expressions.	Understand existential and universal and existential quantifiers.	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
24.		Domain Relational Calculus.	Understand concepts of domain relational calculus.	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
25.		SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema change statements in SQL.	Understand fundamentals of SQL	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
26.		Basic queries in SQL, More complex SQL queries: Comparisons involving NULL and Three-Valued Logic, Nested Queries, Tuples, and Set/Multiset Comparisons.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
27.		Correlated Nested Queries, EXISTS and UNIQUE functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term

28.		Joined tables in SQL and Outer Joins, Aggregate functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
29.		GROUP BY, HAVING Clauses, INSERT, DELETE, AND UPDATE Statements in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
30.		Views (Virtual tables) in SQL, Specifying General Constraints as assertion and Triggers, Additional features of SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	6201.3	Mid Term II, Quiz & End Term
31.	Database Design & Normalisation	Database Design: Redundant information in tuples and update anomalies, insertion anomalies, deletion anomalies and modification anomalies.	Understand the concepts of different anomalies and how they can be removed	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
32.		Properties of Relational Decompositions: Dependency preservation and Lossless join property of a decomposition.	Understand concepts of relational decompositions	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
33.		Functional Dependencies: Definition of functional dependencies, Inference rules for functional dependencies.	Understand concepts of functional dependencies	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
34.		Equivalence of sets of functional dependencies, Minimal sets of functional dependencies.	Understand the process of finding out equivalence among given sets of FDs and finding out minimal sets of functional dependencies	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
35.		Normal forms based on Primary keys, Normalization of relations, Definition of Super Key and Candidate Key. Definition of Prime and Non-Prime Attribute.	Understand different normalization techniques for optimizing database and analyse database design	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term

36.		Normal Forms: First normal form, Second normal form.	Understand 1NF and 2NF	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
37.		Third normal form and Boyce-Codd normal form.	Understand 3NF and BCNF	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
38.		Multivalued dependencies and fourth normal form.	Understand concepts of multivalued dependencies	PPT, Lecture, Class Notes	6201.4	Mid Term II, Quiz & End Term
39.	Transacti on Processin & Managem ent	Introduction to transaction processing, Desirable properties of transactions.	Understand and summarize transaction processing	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
40.		Characterizing schedules based on recoverability.	Understand and summarize concepts of recoverability of schedules	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
41.		Characterizing schedules based on Serializability: Serial, Nonserial and conflict serializable schedules.	Understand and summarize concepts of schedules	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
42.		View equivalence and View Serializability.	Understand and summarize concepts of serializability	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
43.		Concurrency control techniques: Two Phase locking Techniques (Binary Lock, Shared/Exclusive Lock).	Understand and summarize concurrency control techniques.	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
44.		Basic 2PL, Strict 2PL, Rigorous 2PL.	Understand the concepts of locking for concurrency control	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
45.		Deadlock prevention protocol (Wait-Die, Wound-Wait), Deadlock detection and starvation.	Understand different strategies of deadlock prevention and detection strategies	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
46.		Concurrency control based on Timestamp Ordering (Basic TO, Strict TO and Thomas's Write Rule.	Understand concurrency control based on timestamp ordering.	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
47.	Concurre ncy control mechanis ms:	Granularity of Data items and Multiple Granularity Locking.	Understand concepts of multiple granularity locking	PPT, Lecture, Class Notes	6201.5	Quiz & End Term

48.	Recovery	Database Recovery Techniques: Recovery Concepts, Recovery Technique based on Deferred Update.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	6201.5	Quiz & End Term
49.		Recovery Technique based on Immediate Update, Recovery Systems Check pointing and Shadow paging.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	6201.5	Quiz & End Term

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CA6201.1:	Classify, Compare & recall different file-based system, Data Model	1							1		
CA6201.2:	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints	2	2	2	2	2			2	2	
CA6201.3:	Interpret different query language SQL, Relation Algebra, calculus and acquire the skill apply the techniques and rules in different real-life problems.	2		1	2	2			2	2	
CA6201.4:	Understand different normalization technique for optimizing database and analyse database design	2		2			2		2	2	
CA6201.5:	Understand and summarize transaction processing, concurrency and recovery technique.	2	2	1		2	1		2	2	
CA6201.6:	Explain different database storage structure and access technique	1		1		1			2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Applications

Course Hand-out

Design and Analysis of Algorithms | CA 6202 | 4 Credits | 3 | 0 4

Session: Jan –May 2020| Faculty: Dr. Shilpa Kulkarni Sharma | Class: MCA II SEMESTER

A. Introduction: This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness.

B. Course Objectives: At the end of the course, students will be able to

6202.1 To analyze and design algorithms and to appreciate the impact of algorithm design in practice.
6202.2 Define tree data structure and related methods.

6202.3 Understand divide and conquer and greedy algorithms and application.

6202.4 Define the dynamic programming and graph traversal techniques; its impact and implementation.

6202.5 Comprehend the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems and randomized algorithms

C. Program Outcomes and Program Specific Outcomes

- [PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- [PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology
- [PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings
- [PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- [PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them
- [PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSO1: To work productively as IT professional both at supportive and leadership roles.

PSO2: To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

PSO3: To build their profession adaptable to the changes in the technology with lifelong learning.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes	20
End Term Exam (Summative)	End Term Exam (Closed Book)	50
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed.	

E. Syllabus:

Introduction and mathematical preliminaries: Algorithm Analysis: A priori and a posteriori Analysis, Time Space Tradeoff, Asymptotic Notations, Properties of asymptotic notations, Recurrence equations, Solving recurrence equations using Substitution method and Master's method; Trees: B-Tree, Red Black Tree; Divide and Conquer: Binary Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Matrix Multiplication; Greedy Algorithms: Knapsack Problem, Job Sequencing with deadline, Optimal Merge Pattern, Single Source Shortest Path, Minimum Cost Spanning tree; Dynamic Programming: Multistage Graphs, Matrix Chain Multiplication, All Pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Travelling salesperson problem, Graph Traversals, Connected Components, Spanning Trees, Bi-connected components; Complexity Classes: Introduction to NP-Hard and NP-Completeness; Approximation Algorithm, Randomized Algorithm.

F. Text Book(s):

1. Horowitz and Sahni, Fundamental of Computer Algorithms, (2e) Galgotia Publications, 2008.

G. Reference(s):

1. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, (2e), University Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, Introduction to Algorithms, (3e), MIT press, 2009.

H. Lecture Plan:

Lecture	Major Topic	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Algorithm Analysis	A priori and a posteriori Analysis, Time Space Tradeoff	To familiarize with algorithms and notations	Lecture	6202.1	Class Quiz Mid Term I
2.		Asymptotic Notations		Lecture	6202.1	
3-4		Properties of asymptotic notations		Lecture	6202.1	
5-7		Recurrence equations		Lecture	6202.1	End Term
8-12		Solving recurrence equations using Substitution method and Master's method		Lecture	6202.1	
				Lecture	6202.1	
13-17	Trees	B-Tree, Red Black Tree	To learn advance tree concepts and algorithms.	Lecture	6202.2	Class Quiz Mid Term I End Term
				Lecture	6202.2	
				Lecture	6202.2	
				Lecture	6202.2	
				Handouts	6202.2	
				Lecture	6202.2	
				Lecture	6202.2	
				Lecture	6202.2	
18-19	Divide and Conquer	Binary Search,	Understand divide and conquer methods and its application	Lecture	6202.3	Class Quiz Mid Term II End Term
20-23		Finding Maximum and Minimum		Lecture	6202.3	
24-25		Merge Sort		Lecture	6202.3	
26-27		Quick Sort,		Lecture	6202.3	
28-30		Matrix Multiplication		Lecture	6202.3	
				Lecture	6202.3	

31-38	Greedy Algorithms	Knapsack Problem, Job Sequencing with deadline, Optimal Merge Pattern, Single Source Shortest Path, Minimum Cost Spanning tree	Illustrate the various greedy algorithms	Lecture	6202.3	Class Quiz Mid Term II End Term
39-46	Dynamic Programming and Graphs	Multistage Graphs, Matrix Chain Multiplication, All Pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Travelling salesperson problem, Graph Traversals, Connected Components, Spanning Trees, Bi-connected components	Identify	Lecture	6202.4	
47-48		Graph Traversals, Connected Components, Spanning Trees, Bi-connected components			6202.4	
49-52	Complexity Classes	Introduction to NP-Hard and NP-Completeness; Approximation Algorithm, Randomized Algorithm.	Introduce the classes P, NP and NP-complete problems and randomized algorithms	Lecture	6202.5	Class assignments End Term

I. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES						CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PSO 3	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CC 6202.1	To analyze and design algorithms and to appreciate the impact of algorithm design in practice.	2			2	3			1		
CC 6202.2	Define tree data structure and related methods.		2		3	2				1	1

CC 6203.3	Understand greedy algorithms and application.	2	3	2		1	1		1	1	
CC 6204.4	Define the dynamic programming and its impact and implementation				2		1			1	
CC 6205.5	Comprehend the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems and randomized algorithms	3		3			2	1	2	1	1



MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Computer Applications

Course Hand-out

Computer Networks & Protocols | CA 6203 | 4 Credits | 3104

Session: Jan- June 2020 | Faculty: Devershi Pallavi Bhatt | Class: MCA- Sem II

Introduction: The main objective of this course is to familiarize students with computer networks of today which are based on the TCP/IP model and its layered structure.

A. Course Outcomes: At the end of the course, students will be able to

[CA 6203.1]: Understand and learn basic concept of TCP/IP model, IPV4, class full addressing, sub netting and classless addressing.

[CA 6203.2]: Analysis and Implement the Routing and its types.

[CA 6203.3]: Demonstrate the Internet control protocols, IPV6 transitions.

[CA 6203.4]: Analyse the Transport Layer and Its protocols, congestion control.

[CA 6203.5]: Describe the Application Layer, its protocols and Network Security.

B. Program Outcomes and Program Specific Outcomes

PROGRAM OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

[PSO.1.] To work productively as IT professional both at supportive and leadership roles

[PSO.2.] To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

[PSO.3.] To build their profession adaptable to the changes in the technology with lifelong learning

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Open Book)	20
	Sessional Exam II (Open Book)	20
	In class Quizzes and Assignments, Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Open Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Network introduction: Classful addressing, other issues, Subnetting Classless addressing, variable length blocks, Subnetting, address allocation, Network Address Translation. Encapsulation, operation Data Link Layer: ARP package & RARP- Introduction, packet format Encapsulation, RARP server datagram, fragmentation, options, checksum, Network Layer: IP Package Types of messages, message format, error reporting, Query, Checksum, Debugging tools; Transport Layer: Process to process communication, User datagram, checksum, UDP operation UDP package Introduction, TCP services, TCP features, segment, TCP connection, State transition diagram, Flow control, Error control, Congestion control, TCP timers, options, TCP package; TCP Variants: SCTP services, SCTP features, packet format, association, state transition diagram, flow control, error control, congestion control, TCP RENO, Dynamic routing protocols : RIP,OSCF & BGP; Domain name Space (Application Layer): Name space, distribution of name space, DNS in the internet, resolution, DNS messages, controlling the server, out of band signaling, escape character. Transition from IPv4 to IPv6. Introduction to VLAN concept, Wireless Network protocols: WAP Architecture introduction. Introduction to MANET & VANET

TEXT BOOKS:

1. A S Tanenbaum, Computer Networks, 5th Ed., Pearson, 2010.
2. B.A. Forouzan, TCP/IP Protocol Suite, 4th Ed., TMH, 2010.

REFERENCE BOOK:

1. W.R. Stevens, TCP/IP illustrated, Volume 1: The Protocols, 2nd Ed., Addison-Wesley, 2015.
2. D E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture, 6th Ed., Pearson, 2013.

E. Lecture Plan:

Lecture No	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Network introduction	Introduction to the subject	Understand POs, PSOs and COs	Lecture	6203.1	Mid Term I, Quiz & End Term
2		Introduction to network Layer: Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service	Understand Network Layer and its functions	Lecture	6203.1	Mid Term I, Quiz & End Term
3		Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service	Understand Characteristics of Network Layer	Lecture	6203.1	Mid Term I, Quiz & End Term
4	Routing Algorithms	Routing Algorithms; Characteristics and Types, The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing,	Define Routing Algorithm	Lecture	6203.2	Mid Term I, Quiz & End Term

5		Routing Algorithms; Characteristics and Types, The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing,	Define Routing Algorithm	Lecture	6203.2	Mid Term I, Quiz & End Term
6		Routing Algorithms; Characteristics and Types, The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing,	Discuss routing algorithms	Lecture	6203.2	Mid Term I, Quiz & End Term
7		Routing Algorithms; Characteristics and Types, The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing,	Discuss routing algorithms	Lecture	6203.2	Mid Term I, Quiz & End Term
8	Internetworking	Internetworking; IP Addresses, Subnets, CIDR—Classless InterDomain Routing, NAT—Network Address Translation	Explain Internetworking	Lecture	6203.2	Mid Term I, Quiz & End Term
9		Internetworking; IP Addresses, Subnets, CIDR—Classless InterDomain Routing, NAT—Network Address Translation	Explain Internetworking and Routing	Lecture	6203.2	Mid Term I, Quiz & End Term
10		Internetworking; IP Addresses, Subnets, CIDR—Classless InterDomain Routing, NAT—Network Address Translation	Find Route through CIDR	Lecture	6203.2	Mid Term I, Quiz & End Term
11		Internetworking; IP Addresses, Subnets, CIDR—Classless InterDomain Routing, NAT—Network Address Translation	Find Route through Classless routing	Lecture	6203.3	Mid Term I, Quiz & End Term

12		Internetworking; IP Addresses, Subnets, CIDR—Classless InterDomain Routing, NAT—Network Address Translation	Analyse NAT	Lecture	6203.3	Mid Term I, Quiz & End Term
13	Network Layer Protocols	DHCP, ARP, RARP, ICMP, IPV4 and IPV6 header format	Classify various routing protocols	Lecture	6203.3	Mid Term I, Quiz & End Term
14		DHCP, ARP, RARP, ICMP, IPV4 and IPV6 header format	Classify various routing protocols	Lecture	6203.3	Mid Term I, Quiz & End Term
15		Fragmentation	Explain Fragmentation	Lecture	6203.2	Mid Term I, Quiz & End Term
16		RIP, OSPF, BGP	Classify various routing protocols	Lecture	6203.2	Mid Term I, Quiz & End Term
17		RIP, OSPF, BGP	Classify various routing protocols	Tutorial	6203.2	Mid Term I, Quiz & End Term
18	Congestion Control	Congestion Control Algorithms; General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets	Understand Congestion Control Algorithms	Tutorial	6203.1	Mid Term I, Quiz & End Term
19		Congestion Control Algorithms; General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets	Understand General Principles of Congestion Control	Tutorial	6203.1	Mid Term I, Quiz & End Term
20		Congestion Control Algorithms; General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets	Illustrate the Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets	Tutorial	6203.1	Mid Term I, Quiz & End Term

21	Quality of Service	Quality of Service; Requirements, Techniques for Achieving Good Quality of Service (till Packet Scheduling as per Tannenbaum)	Explain Quality of Service	Tutorial	6203.1	Mid Term I, Quiz & End Term
22		Quality of Service; Requirements, Techniques for Achieving Good Quality of Service (till Packet Scheduling as per Tannenbaum)	Explain techniques for Achieving Good Quality of Service	Tutorial	6203.1	Mid Term I, Quiz & End Term
23		Quality of Service; Requirements, Techniques for Achieving Good Quality of Service (till Packet Scheduling as per Tannenbaum)	Explain techniques for Achieving Good Quality of Service	Tutorial	6203.2	Mid Term I, Quiz & End Term
		First Sessional Examination		Tutorial		
24	Transport Layer	Transport Layer; Introduction to Transport Layer, Transport Service Primitives	Understand Transport Layer	Tutorial	6203.4	Mid Term II, Quiz & End Term
25		Elements of Transport Protocols; Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing	Understand Transport Layer Protocols	Tutorial	6203.4	Mid Term II, Quiz & End Term
r26		Elements of Transport Protocols; Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing	Discuss the process of connection	Tutorial	6203.4	Mid Term II, Quiz & End Term
27		Elements of Transport Protocols; Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing	Understand flow control and buffering	Tutorial	6203.4	Mid Term II, Quiz & End Term

28		Elements of Transport Protocols; Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing	Articulate buffering and Multiplexing	Tutorial	6203.4	Mid Term II, Quiz & End Term
29	Transport Layer Protocols	UDP; UDP Header; Introduction to TCP	Understand UDP	Tutorial	6203.4	Mid Term II, Quiz & End Term
30		The TCP Service Model, The TCP Protocol, The TCP Segment Header,	Understand TCP Service Model	Tutorial	6203.4	Mid Term II, Quiz & End Term
31		The TCP Service Model, The TCP Protocol, The TCP Segment Header,	Understand TCP Segment header and its each field	Tutorial	6203.4	Mid Term II, Quiz & End Term
32		TCP Connection Establishment, TCP Connection Release	Understand TCP Connection	Flip Class	6203.4	Mid Term II, Quiz & End Term
33		TCP Transmission Policy; Window Management, Connection Control, Timer Management	Identify TCP window and Timer Management	Lecture	6203.4	Mid Term II, Quiz & End Term
34		TCP Transmission Policy; Window Management, Connection Control, Timer Management	Describe the Connection Control, Timer Management	Lecture	6203.4	Mid Term II, Quiz & End Term
35		TCP Transmission Policy; Window Management, Connection Control, Timer Management	Describe the Connection Control, Timer Management		6203.4	Mid Term II, Quiz & End Term
36	Application Layer	Introduction to Application Layer; DNS—The Domain Name System	Explain Application Layer	Flip Class	6203.5	Mid Term II, Quiz & End Term
37		Introduction to Application Layer; DNS—The Domain Name System	Recognize DNS	Lecture	6203.5	Mid Term II, Quiz & End Term
38	Application Layer Protocols	Electronic Email; SMTP, POP, IMAP, MIME	Illustrate Email	Tutorials	6203.5	Mid Term II, Quiz & End Term
39		Electronic Email; SMTP, POP, IMAP, MIME	Illustrate Email and its protocols	Flip Class	6203.5	Mid Term II, Quiz & End Term

40		HTTP, HTTPS	Understand Hypertext protocols	Lecture	6203.5	Mid Term II, Quiz & End Term
41		HTTP, HTTPS	Compare HTTP and HTTPS	Lecture	6203.5	Mid Term II, Quiz & End Term
42		SNMP	Discuss Network Management Protocol	Lecture	6203.5	Mid Term II, Quiz & End Term
		Second Sessional Examination				
43	Introduction to VLAN concept	Wireless Network protocols	Explain Wireless Protocols	Tutorial	6203.5	Quiz & End Term
44		WAP Architecture introduction.	Understand WAP architecture	Flip Class	6203.5	Quiz & End Term
45		Introduction to MANET & VANET	Understand MANET and VANET	Flip Class	6203.5	Quiz & End Term

F. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CA6203.1	Understand and learn basic concept of TCP/IP model, IPV4, class full addressing, sub netting and classless addressing.	3		1				3	3	2	2
CA6203.2	Implement the Routing and its types	1		1				2	3	1	3
CA6203.3	Demonstrate the Internet control protocols, IPV6 transitions.	1						1	2	2	1
CA6203.4	Analyse the Transport Layer and Its protocols, congestion control.	1						3	2	2	1
CA6203.5	Describe the Application Layer, its protocols and Network Security.	2	1	1			3	2	3	1	2



MANIPAL UNIVERSITY JAIPUR

School of Basic Science

Masters of Computer Application

Course Hand-out

Data Science | CA 6240 | 3 Credits | 3 1 0 4

Session: Jan – May 2020 | Faculty: Dr. Vaibhav Bhatnagar | Class: MCA II SEMESTER

Introduction: This course will introduce students to the fundamental concepts Data Science. Main objective of the course is to familiarize students about core concepts data, data mining and its implementation through python. This course has broad insight, understanding and intuition of the whole process line of extracting knowledge from data. It also has solid knowledge in a broad range of methods based on statistics and informatics and can use these for data management, analysis and problem solving. After completion of course of Students will have experience in deriving theoretical properties of methods involved in Data Science and implementation/modification of methods involved in Data Science.

A. Course Outcomes: At the end of the course, students will be able to

[6240.1] Understanding basic concepts of data, data science, types of data, source of data and APIs

[6240.2] Illustrate and practice of Statistical and Data mining techniques

[6240.3] Understand the basic concepts, tools & techniques of Data visualization

[6240.4] Implementation of data science techniques and algorithm through Bokeh/Python

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes

[PSO1] To work productively as IT professional both at supportive and leadership roles.

[PSO2] To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication and interpersonal skills with high regard to legal and ethical responsibilities.

[PSO3] To build their profession adaptable to the changes in the technology with lifelong learning.

B. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

C. SYLLABUS

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. Data collection and management (ETL): Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources, Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Applications of Data Science: Technologies for visualization, Bokeh (Python) Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

D. TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline, .O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1 , Cambridge University Press

E. REFERENCE BOOKS

1. Chun, W. (2001). *Core python programming* (Vol. 1). Prentice Hall Professional.

Lecture Plan:

LEC NO	Major Topic	TOPICS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Accessing CO
1	Introduction about Data	Subject Introduction	Understanding CO & PO	Lecture	6240 .1	Mid Term I, Quiz & End Term
2		Introduction about data and processing	Basic concepts of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
3	Nature of Data	Data Science process	Basic concepts of Data Science	Lecture	6240 .1	Mid Term I, Quiz & End Term
4		Toolkit of data science	Basic concepts of Data Science	Lecture	6240 .1	Mid Term I, Quiz & End Term
5		Types of Data	Data Types	Lecture	6240 .1	Mid Term I, Quiz & End Term
6		Examples of data processing application	Data Types	Lecture	6240 .1	Mid Term I, Quiz & End Term
7	Tutorial	Tutorial	Tutorial	Tutorial	6240 .1	Mid Term I, Quiz & End Term
8	Data Collection	Data Collection and Management	Source of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
9		Sources of Data	Source of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
10		Data Collections Techniques	Source of Data	Flipped Class	6240 .1	Mid Term I, Quiz & End Term
11		APIs of Data	Source of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
12		Exploring of Data	Source of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
13		Fixing of Data	Source of Data	Lecture	6240 .1	Mid Term I, Quiz & End Term
14	Data Storage	Data Storage	Data Storage	Lecture	6240 .1	Mid Term I, Quiz & End Term
15		Data Storage and Management	Data management	Lecture	6240 .1	Mid Term I, Quiz & End Term

16		Multiple Data Sources	Data management	Lecture	6240 .1	Mid Term I, Quiz & End Term
17	Statistical Techniques	Introduction to Data Analysis and Statistics	Introduction to Statistical Technique	Lecture	6240 .2	Mid Term I, Quiz & End Term
18		Central Tendency and Distributions	Practice of Statistical Technique	Lecture	6240 .2	Mid Term I, Quiz & End Term
19		Variance and Distribution Properties	Practice of Statistical Technique	Lecture	6240 .2	Mid Term I, Quiz & End Term
20		Samples/CLT	Practice of Statistical Technique	Lecture	6240 .2	Mid Term I, Quiz & End Term
21	Machine Learning	Basic Machine Learning Algorithms	Machine Learning	Lecture	6240 .2, 6240 .3	Mid Term I, Quiz & End Term
22	Statistical Techniques	Linear Regression	Practice of Statistical Technique	Lecture	6240 .2	Mid Term II, Quiz & End Term
23	Data Mining Algorithm	SVM	Understanding Data mining Algorithm	Lecture	6240 .2	Mid Term II, Quiz & End Term
24		Naïve Bayes	Understanding Data mining Algorithm	Lecture	6240 .2	Mid Term II, Quiz & End Term
25	Data visualization	Introduction to Data Visualization	Data visualization	Lecture	6240 .2, 6240 .3	Mid Term II, Quiz & End Term
26		Data for visualization: Data types, Data encodings	Types of Data visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
27		Retinal variables, mapping variables to encodings	Techniques of Data Visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
28		Visual encodings	Techniques of Data Visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
29		Introduction to Applications of Data Science	Techniques of Data Visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
30		Technologies for visualization	Techniques of Data Visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
31		II-Technologies for visualization	Techniques of Data Visualization	Lecture	6240 .3	Mid Term II, Quiz & End Term
32	Application Development	Implementation of Analysis Techniques through Python	Data Science through Python	Lecture	6240 .4	Mid Term II, Quiz & End Term

33	Methods done through Python	Implementation of Visualization Techniques through Python	Data Science through Python	Lecture	6240 .4	Mid Term II, Quiz & End Term
34		Application development methods used in Data Science	Data Science through Python	Flipped Class	6240 .4	Mid Term II, Quiz & End Term
35		Implementation through Python	Data Science through Python	Lecture	6240 .4	Mid Term II, Quiz & End Term
36	Tutorial	Tutorial	Tutorial	Tutorial	6240 .1,2,3,4	Mid Term II, Quiz & End Term
37		Tutorial	Tutorial	Tutorial	6240 .1,2,3,4	Mid Term II, Quiz & End Term

F. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CA 6240.1	Understanding basic concepts of data, data science, types of data, source of data and APIs	3		1	2			2						1		
CA 6240.2	Illustrate and practice of Statistical and Data mining techniques		2	3		3		1							3	
CA 6240.3	Understand the basic concepts, tools & techniques of Data visualization	1		1	1	3								3		
CA 6240.4	Implementation of data science techniques and algorithm through Bokeh/Python		1		2		3	2								2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Basic Science

Department of Computer Applications

Course Hand-out

Graph Theory and Applications | MA 6206 | 3 Credits | 3 0 0 3

Session: Jan 20 – Jun 20 | Faculty: Garima Agarwal | Class: MCA II SEMESTER

- A. **Introduction:** This course aims to discuss basic concept of Graph theory. Course is intended to provide the students the experience in Graph Theory and to emphasize the practical aspects of this theory.
- B. **Course Outcomes:** At the end of the course, students will be able to :

[6206.1]. Identify the types of Graph.

[6206.2]. Demonstrate the concepts of Trees, connectivity and Planarity of Graph

[6206.3]. Understand Matrices, Coloring and Directed Graph

[6206.4]. Find the Permutations and combinations

C **Program Outcomes:**

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes

PSO1 Prepare professionally trained in the areas of programming, databases, software engineering, web- designing and networking and other computer application areas to acquire knowledge in various domain-based prospects

PSO2 Encourage to communicate effectively and to improve their competency skills to solve real time problems

PSO3 Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies

C. **Assessment Plan:**

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed.	

D. SYLLABUS

Graphs: Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler graphs, Hamiltonian paths and circuits, Trees, Properties of trees, Distance and canisters in tree, Rooted and binary trees. **Trees, Connectivity & Planarity** Spanning trees, Fundamental circuits, Spanning trees in a weighted graph, cut sets, Properties of cut set, all cut sets, Fundamental circuits and cut sets, Connectivity and separability, Network flows: Isomorphism, Combinational and geometric graphs, Planer graphs, Different representation of a planer graph. **Matrices, Coloring and Directed Graph.** Chromatic number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four color problem, Directed graphs, Types of directed graphs, Digraphs and binary relations, Directed paths and connectedness, Euler graphs. **Permutations & Combinations:** Fundamental principles of counting, Permutations and combinations, Binomial theorem, combinations with repetition, Combinatorial numbers, Principle of inclusion and exclusion, Derangements, Arrangements with forbidden positions.

E. TEXT BOOKS

1. N. Deo, *Graph Theory: With Application to Engineering and Computer Science*, (New Edition) Prentice Hall of India, 2003.

F. REFERENCE BOOKS

1. R.P. Grimald *Discrete and Combinatorial Mathematics: An Applied Introduction*, (5e) Addison Wesley, 2003.

G. Lecture Plan:

Lectures	Major Topics	Topics	Session outcome	Delivery Mode	Corresponding CO	Mode Of Assessing CO
1.	Graphs	Introduction to COS, PSO	Understand PO,CO,PSO	Lecture	NA	Mid Term I, Quiz & End Term
2.		Introduction to Graph Theory	concept of Graph Theory	Lecture	6206.1	Mid Term I, Quiz & End Term
3.		Types of Graph	understanding Graphs	Lecture	6206.1	Mid Term I, Quiz & End Term
4.		Isomorphism of Graph	Types of graph	Lecture	6206.1	Mid Term I, Quiz & End Term
5.		Sub graphs	understanding Sub Graphs	Lecture	6206.1	Mid Term I, Quiz & End Term
6.		Walks, Paths, Circuits of Graph	different types of graph	Lecture	6206.1	Mid Term I, Quiz & End Term
7.		Connectedness & Components of Graph	understanding properties of Graph	Lecture	6206.1	Mid Term I, Quiz & End Term
8.		Euler graphs	Special case of graph	Lecture	6206.1	Mid Term I, Quiz & End Term
9.		Hamiltonian paths and circuits of Graph	basic concept	Lecture	6206.1	Mid Term I, Quiz & End Term
10.		QUIZ-1	evaluation	Activity	6206.1	Mid Term I, Quiz & End Term
11.	Trees, Connectivity & Planarity	Trees of Graph	basic concept of Trees	Lecture	6206.2	Mid Term I, Quiz & End Term
12.		Properties of Trees	understanding Trees	Lecture	6206.2	Mid Term I, Quiz & End Term

13.		Introduction of cut set	basic concept of cut set	Lecture	6206.2	Mid Term I, Quiz & End Term
14.		properties of cut set	understanding properties of	Lecture	6206.2	Mid Term I, Quiz & End Term
15.		Connectivity and seperability	types of cut set	Lecture	6206.2	Mid Term I, Quiz & End Term
16.		Introduction of Network flows	basic concept of Network	Lecture	6206.2	Mid Term I, Quiz & End Term
17.		Properties and type of Network flows	understanding Network flows	Lecture	6206.2	Mid Term I, Quiz & End Term
18.		Planer graphs	basic concept of Planer	Lecture	6206.2	Mid Term II, Quiz & End Term
19.		Properties of Planer graphs	use of planer graph	Lecture	6206.2	Mid Term II, Quiz & End Term
20.		QUIZ-2	evaluation	Activity	6206.2	Mid Term II, Quiz & End Term
21.	Matrices, Coloring and Directed Graph	Introduction of Chromatic number	basic concept of Chromatic number	Lecture	6206.3	Mid Term II, Quiz & End Term
22.		Introduction of Chromatic polynomials	introduction of Chromatic polynomials	Lecture	6206.3	Mid Term II, Quiz & End Term
23.		Four color problem	concept of color problems	Lecture	6206.3	Mid Term II, Quiz & End Term
24.		Introduction of Directed graphs	basic concept of Directed	Lecture	6206.3	Mid Term II, Quiz & End Term
25.		Types of directed graphs	understanding directed	Lecture	6206.3	Mid Term II, Quiz & End Term
26.		Directed paths	introduction of Directed paths	Lecture	6206.3	Mid Term II, Quiz & End Term
27.		connectedness of Directed paths	types of Directed paths	Lecture	6206.3	Mid Term II, Quiz & End Term
28.		QUIZ-3	evaluation	Activity	6206.3	Mid Term II, Quiz & End Term
29.	Permutations & Combinations	Fundamental principles of counting	introduction of counting	Lecture	6206.4	Mid Term II, Quiz & End Term
30.		Introduction of Permutations	understanding of Permutations	Lecture	6206.4	Mid Term II, Quiz & End Term
31.		Introduction of combinations	Basic concept of combinations	Lecture	6206.4	Mid Term II, Quiz & End Term
32.		Binomial theorem	understanding of combinations	Lecture	6206.4	Mid Term II, Quiz & End Term
33.		combinations with repetition	understanding of combinations	Lecture	6206.4	Mid Term II, Quiz & End Term
34.		Combinatorial numbers	concept of Combinatorial	Lecture	6206.4	Mid Term II, Quiz & End Term
35.		Principle of inclusion and exclusion	Basic properties	Lecture	6206.4	Quiz & End Term
36.		Derangements	concept of Derangements	Lecture	6206.4	Quiz & End Term
37.		Arrangements with forbidden positions	concept of forbidden	Lecture	6206.4	Quiz & End Term
38.		Virtual Constructor & virtual destructor	properties	Lecture	6206.4	Quiz & End Term
39.		QUIZ-4	evaluation	Activity	6206.4	Quiz & End Term

I. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
MA 6206.1	Identify the types of Graph.	1					1		2						1		
MA 6206.2	Demonstrate the concepts of Trees, connectivity and Planarity of Graph			2		1									2		1
MA 6206.3	Understand Matrices, Coloring and Directed Graph	2					1									1	
MA 6206.4	Find the Permutations and combinations		1											1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation