



UNIVERSITY OF JAMMU

NOTIFICATION

(12/Sept/ADP/13)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, has been pleased to authorize adoption of the Syllabi and Courses of Study for B.Sc. Part II, BCA Part III of Three Year Degree (General) Course and MCA I & II of Master's Degree Programme in the subject of Computer Applications (given in annexure) for the examinations to be held in the years given below:

Course	For the examinations to be held in the year/s	%age of change
B.Sc.-II Computer Application	2013, 2014 & 2015	As per annexure 2
BCA-III	2013, 2014 & 2015	As per annexure 2
MCA-I	Dec. 2012, 2013 & 2014	As per annexure 2
MCA-II	May 2013, 2014 & 2015	As per annexure 2

Sd/-
REGISTRAR

No. F.Acd./II/12/ 9766-9820

Dated: 11-09-2012

Copy for information and necessary action to:

1. P.S. Vice-Chancellor
2. P.S. to Dean Academic Affairs
3. P.A. to Registrar
4. Sr. P.A. to Controller of Examinations
5. Dean, Faculty of Mathematical Sciences
6. Convener/All the members of the Board of Studies in Computer Applications
7. Director, Kishtwar Campus
8. C.A. to Controller of Examinations
9. I/c Deputy Registrar (Publication)
10. Asst. Registrar (Conf./Exams. P/G /Inf.)
11. S.O (Confidential)
12. Content Manager, University Website

(Vivek Slathici)
Deputy Registrar (Academics)

Department of Computer Science & IT,
University Of Jammu
New Scheme Of BCA III Course Structure Year 2012


Course Code	Title	Percentage of Change
BCA 301	English	No Change
BCA 302(A)	Numerical Methods	100 %
BCA 302(B)	Operations Research & Simulation	100 %
BCA 303(A)	Computer Graphics & Multimedia	100 %
BCA 303(B)	Programming in VB.Net	100 %
BCA 304	Project Work	No Change



Department of Computer Science & IT,
University Of Jammu

New Scheme Of Syllabus for BSc. Part II

%age of change in syllabus	
B.Sc Part - II	About 50%
Paper A	
Paper B	About 50%



New Scheme of Syllabus for BCA III

Course Code	Title
BCA-301	English
BCA 302(A)	Numerical Methods
BCA 302(B)	Operations Research & Simulation
BCA 303(A)	Computer Graphics & Multimedia
BCA 303(B)	Programming in VB.Net
BCA 304	Project Work

UNIVERSITY OF JAMMU

Syllabi of Courses of Study for B.C.A. Part-III (BCA 302 & BCA 303) for the examinations to be held in the years 2013, 2014 & 2015.

The proposed scheme for BCA 302 includes following:

- i) Two theory papers (a & b), each carrying one examination of 60 marks and of three hours duration.

Total marks 120

- ii) Theory paper shall carry internal assessment of 15 marks for each paper.

Total marks 30

The proposed scheme for BCA 303 includes following:

- iii) Two theory papers (a & b), each carrying one examination of 40 marks and of three hours duration.

Total marks 80

- iv) One practical examination of 25 marks (to be conducted by one external and one internal examiner) to be held in one day with a duration of 4 hours.

Total marks 25

- v) Theory paper shall carry internal assessment of 10 marks for each paper.

Total marks 20

- vi) Practical shall carry internal assessment of 25 marks. Internal assessment shall be awarded as per rules of the University on the subject.

Total marks 25

The proposed scheme for BCA 304 (Project Work) includes following components:

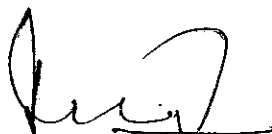
- i) Internal assessment which is comprised of Mid-Session Presentation & Evaluation of 25 marks and final Project Evaluation and Viva Voce of 25 marks.

Total marks 50

- ii) External Examination (Project Presentation, Evaluation and Viva Voce) to be conducted by one external and one internal examiner.

Total marks 100

The student will submit a synopsis at the beginning of the session for approval. The student will have to present the progress of the work through mid session presentation after two months duration. The date of midterm session presentation will be communicated by the college. The evaluation of midterm session presentation shall be internal, to be done at the college level.



BCA 302(a) - Numerical Methods

UNIT -1

Concept of Approximate Numbers, Significant Digits, scientific notation, representation of numbers in memory, Floating-Point Arithmetic, Errors (Truncation errors, round-off errors, computational errors), Measures of Accuracy (absolute & relative error), Error propagation.

UNIT-2

Non- Linear equations, Direct and iterative methods of finding solution, termination criterion of an iterative method, Methods: Bisection, False Position, Secant, Newton Raphson and their Convergence.

UNIT-3

Concept of non-homogeneous system of linear equations, direct methods of solution (Gauss elimination, Gauss Jordan), iterative methods (Jacobi's method, Gauss-Seidel).

UNIT-4

Introduction to Interpolation, Lagrangian Interpolation, Finite Differences & Difference tables (forward, backward, divided and central), Newton's Methods of interpolation

UNIT-5

Introduction to Numerical Integration, Newton- Cotes integration Formulae (Trapezoidal rule, Simpson's $1/3$ rule and Simpson $3/8$ rule)
Numerical solution of differential equations of the form $dy/dx=f(x,y)$ using Euler's method and Runge-Kutta methods.

Books Recommended

1. Introductory methods of Numerical Analysis -Prentice Hall of India - S.S. Sastry.
2. Computer Oriented Numerical Method- Prentice Hall of India - V. Rajaraman.
3. Numerical Methods - Tata Mc GrawHill publishing company - E Balagurusamy
4. Finite Difference and Numerical Analysis (S Chand & Comp Ltd.) - H.C. Saxena.
5. Computer Oriented Numerical Methods- Salaria Publications-R.S. Salaria.
6. Manual of Numerical methods - PHI- M.Y.H Bangash



BCA 302(b) - Operations Research & Simulation

UNIT -1:

Introduction, Definition and Characteristics of OR, Scope of operation Research, Models And Modelling in OR, An Overview of OR Techniques, Role Of Computers in Solving operation Research Problems, Limitation of Operation Research.

UNIT-2:

Introduction to Linear Programming, Formulation of LP Problems, Standard form of LP Problem, Graphical Solution of two variable LP Problems, Simplex Method: Computational Procedure, Special Cases: (Unbounded, Multiple Solutions, Non-feasible Solution), Degeneracy.

UNIT-3:

Mathematical formulation and tabular representation of Transportation problem, Initial Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method, Optimal Solution, Optimality Test, Stepping-Stone Method, MODI's Method, Degeneracy in Transportation Problem, Unbalanced Transportation Problem.

UNIT-4:

Introduction to the simulation, Simulation as a tool, advantages of Simulation, Areas of application, general steps followed in simulation experiment Discrete and Continuous Systems, Discrete-Event System Simulation, The Monte Carlo Method, Comparison of Simulation and Analytical Methods.

Unit -5:

Stochastic variables, Discrete and Continuous Probability functions, Uniformly Distributed Random Numbers, Properties of Random Numbers, Generation of Pseudo-Random Numbers, Techniques for generating Random numbers (Linear Congruential Method, Combined Linear Congruential Generators), Tests for Random numbers (Frequency Tests)

Books Recommended:

1. J K Sharma - "Operation Research Theory and Application", MacMillan
2. V.K. Kapoor- "Operation Research Techniques for Management", Sultan Chand & Sons
3. S.D. Sharma, "Operation Research", Kedar Nath & Co
4. Taha - "Operation Research", MacMillan, New York
5. S. Kalavathy-"Operation Research", PHI
6. Gordon, G. : "System Simulation", PHI
7. Narsingh Deo: "System Simulation and Digital Computer", PHI
8. Banks, Carson, Nelson, Nicol: Discrete-Event System Simulation, Pearson Education
9. Reitman, J.: Computer Simulation Application, Wiley



NOTE FOR PAPER SETTING:

The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit.

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Unit I
Overview of computer graphics, introduction to Computer Aided Design, Visualization, image processing, Graphical user interface Random-scan and raster scan monitors, Color CRT, Plasma panel displays, LCD Panels, Plotters, Film recorders, Graphics workstations, Display processors, Graphics software, Input Output Graphical Devices, software standards.

Unit II
Output Primitives: Points & Lines, Line Drawing Algorithms (DDA & Bresenham's line drawing), Properties of a circle, Circle Generating Algorithms (Mid Pt. Circle) Line attributes, line type, line width, Pen Brush options, line color, color and Gray scale levels.

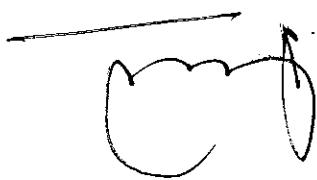
Unit III
Basic transformations: translation, rotation, scaling; Matrix representations, homogeneous coordinates, transformations between coordinate systems; reflection, shear, Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations: point clipping, line clipping, Cohen-Sutherland Line Clipping

Unit IV
Objects in Homogeneous Coordinates, Three-Dimensional transformations: Scaling, Translation, Rotation, Shear Transformations, Reflection, World Coordinates and Viewing Coordinates, Parallel Projection, Perspective Projection.

Unit V
Introduction to multimedia, major characteristics of multimedia, Concepts of hypertext & hypermedia, Multimedia applications: Education, video conferencing, training, Entertainment, and electronic encyclopedias etc, Image Formats, Graphics Format, File Format, Image Quality and Graphic Systems, Compression, Image Compression, Compression Requirement, Standards (JPEG, MPEG and H.261), latest Multimedia Hardware, Currently available multimedia software.

Text Books:

1. Hearn, Baker – "Computer Graphics" – Pearson Education
2. Z. Xiang, R. Plastock – "Schaum's outlines Computer Graphics" – TMH
3. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
4. Sankar, Multimedia – A Practical Approach, Jaico Publication
5. Butord J. K. – "Multimedia Systems" – Pearson Education
6. Andleigh & Thakar, Multimedia, PHI
7. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles" – Pearson Education.
8. Banerjee – "Multimedia Technologies" – DearnTech Press



Unit I

Overview of computer graphics, introduction to Computer Aided Design, Visualization, image processing, Graphical user interface Random-scan and raster scan monitors, Color CRT, Plasma panel displays, LCD Panels, Plotters, Film recorders, Graphics workstations, Display processors, Graphics software, Input Output Graphical Devices, software standards.

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Unit IV

Objects in Homogeneous Coordinates, Three-Dimensional transformations: Scaling, Translation, Rotation, Shear Transformations, Reflection, World Coordinates and Viewing Coordinates, Projection, Parallel Projection, Perspective Projection.

Unit V

Introduction to multimedia, major characteristics of multimedia, Concepts of hypertext & hypermedia, Multimedia applications: Education, video conferencing, training, Entertainment, and electronic encyclopedias etc, Image Formats, Graphics Format, File Format, Image Quality and Graphic Systems, Compression, Image Compression, Compression Requirements, Standards (JPEG, MPEG and H.261), latest Multimedia Hardware, Currently available multimedia software.

Text Books:

1. Hearn, Baker – “ Computer Graphics ” – Pearson Education
2. Z. Xiang, R. Plastock – “ Schaum's outlines Computer Graphics ” – TMH
3. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
4. Sanhker, Multimedia –A Practical Approach, Jaico Publication
5. Buford J. K. – “Multimedia Systems” – Pearson Education
6. Andleigh & Thakrar, Multimedia, PHI
7. Foley, Vandam, Feiner, Hughes – “Computer Graphics principles “- Pearson Education.
8. Banerjee-“Multimedia Technologies”-DeamTech Press



UNIT-I

Introduction to .NET, .NET Framework features & architecture. Introduction to Visual Studio, Event driven Programming, Project Basics. VB.NET Development Environment, Solution Explorer, Toolbox, Properties Window, Form Designer, Output Window, Object Browser. The VB.NET Language - data types, variables, forcing variables declarations, Scope & lifetime of a variable, type conversion, constants, operators and expressions.

UNIT-II

Conditional statements, loop statements. Arrays, types of array, control array, Error Handling, Collections, Subroutines, Functions, Passing arguments, Optional Argument, Returning value from function. MsgBox & Inputbox.

UNIT - III

Object Oriented Programming: Concepts of classes & objects, Properties, methods and events, Creating a class, Constructors and Destructors, Inheritance, Access modifiers, Overloading & Overriding, Interfaces, Polymorphism.

UNIT-IV

Working with Forms: Loading, showing and hiding forms, controlling one form within another. GUI Programming with Windows Form: Method, properties, events and working of basic controls-Textbox, Label, Button, Listbox, Combobox, Checkbox, PictureBox, RadioButton, Panel, scroll bar, Timer, ListView, TreeView, toolbar, StatusBar. OpenFileDialog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog. Link Label. Designing menus : ContextMenu, access & shortcut keys.

UNIT-V

Introduction to database connectivity, Overview of ado.net, Connection Object, Command Object, Data Adapter, Dataset, Data Reader, Connection to database with Server Explorer, Data binding, Data Grid View, Data form wizard, Data Validation.


Text Books:

1. Peter Aitken's Visual Basic.NET Programming by Peter Aitken- Dreamtech Publications.
2. VB.NET Programming Black Book by Steven Holzner -Dreamtech Publications.
3. Mastering VB.NET by Evangelos Petroustos- BPB Publications
4. Visual Basic.NET Programming by Evjen, Beres, ET AL Wiley, Dreamtech Publications.
5. Beginning Web Programming using VB.NET and Visual Studio .NET by Daniel Cazzulino, et al
6. Designing VB.NET Application - A Developer's Indispensable Guide to VB.NET by David Vitter- Dreamtech Press
7. Michael Halvorson-"VB.Net", PHI
8. Holzner-"Visual Basic Programming", DreamTech Press



NOTE FOR PAPER SETTING:

The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit.

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**Syllabus of B.Sc. Part – II, Computer Applications (Vocational Course)
for the examination to be held in the years 2013, 2014 and 2015**

Max Marks – 150

Break up

1. There shall be two theory papers (A and B) each of 28 marks and of 3 hours duration.

Total Marks = 56

2. One practical examination of 40 marks (to be conducted by one external and internal examiner) to be held in one session of 4 hours duration.

Total Marks = 40

3. Theory paper shall carry internal assessment of 14 marks. Out of 14 marks, 4 marks are reserved for attendance. The remaining 10 marks shall be awarded on the basis of two class tests (one from each paper) of 5 marks each.

Total Marks = 14

4. Practical shall carry internal assessment of 40 marks. Out of 40 marks, 8 shall be reserved for the attendance and 8 marks for day – to – day evaluation. The remaining 24 marks are awarded on the basis of three practical tests of 8 marks each.

Total Marks = 40



Paper A : Database Management System & SQL

Unit - I

Introduction to data, Field, Record, File, Database, Data base management system, advantages and disadvantages of DBMS, Database Users, DBA, and its responsibilities, schema, instance, data independence.

Unit - II

Table, Keys: Primary, Secondary, Foreign, etc, Entities and attributes, ER Diagrams, Mapping Constraints, level architecture of database, Overview of Hierarchical, Network and Relational database Model, comparison of these models.

Unit - III

Dependencies, Normalization, 1NF, 2NF, 3NF and BCNF, Data base anomalies, Codd Rules.

Unit - IV

DDL, DML, and DCL commands, Overview of SQL, Data Type in SQL, Simple and Nested Query in SQL, Basic SQL functions, SQL joins, data integrity constraints, views

REFERENCES:

- | | |
|---|--------------|
| 1. SQL / PI-SQL | Ivan Byross |
| 2. Database Management System | Bipin Desai |
| 3. Database System Concept | Korth, PHI |
| 4. Schaum's Outline Series:
Fundamentals of Relational Databases | Toledo, TMcH |
| 5. PL/SQL Programming | Urman, TMcH |



Paper B : Computer Networking and Web Technologies

Unit - I

Computer Network and its types, Advantages of Networking, Fundamentals of Communication, Analog and Digital Transmission, transmission media (guided and unguided), transmission modes (simplex half duplex and full duplex), Topologies, Hardwar Components (Hub, Connector, Switch, router, Gateway, Bridge).

Unit - II

OSI Reference model, TCP/IP Model, Protocols and services Client-Server and Peer-to-Peer Model, IP addresses, Classes of IP addresses, Named Address, Address Resolution, Domain Name system, Browser, Web server, web page.

Unit - III

Introduction to html, format of HTML Program ,formatting tags, image tags, linking of documents, List Tag, Tables Tag, Frames, Forms, Introduction to Cascading Style sheet, defining style, inline styles, Internal and External Style sheet.

Unit - IV

Introduction to JavaScript, variables, conditional and loops control statement, functions, strings and mathematical functions, window and document object and Basic events.

REFERENCES:

- | | |
|--|--|
| 1. Computer Networks | S. Jain, BPB |
| 2. Computer Networks | Tenenbaum, PHI |
| 3. Computer Networks & Internet Protocol | Stallings, Pearson Education |
| 4. Jon Duckett | Beginning web programming with HTML, XHTML, CSS and JavaScript, Wiley India Pvt. Ltd. 2006 |
| 5. Lee Anne Phillips | HTML 4.0, Prentice- Hall of India |



NOTE FOR PAPER SETTING (for both A and B papers):

The question paper will contain nine questions in total. The question no. 1 is a compulsory which contains eight very small answer type questions (two from each unit) comprising of 1 mark only. The remaining eight questions (two from each unit) comprise of 5 marks each. The candidate is required to answer one question from each unit i.e. there is internal choice within each unit.

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Annexure - 2

Percentage Change in syllabi of

Syllabi of MCA (Semesters 1 and 2)

BCA Part –III

B.Sc. Part –II

**DEPARTMENT OF COMPUTER SCIENCE & IT,
UNIVERSITY OF JAMMU, JAMMU**

PROPOSED SCHEME OF MCA COURSE STRUCTURE YEAR-2012

Semester-wise Course Distribution and Paperwise Outline of Masters Degree In Computer Application [MCA] Programme

Semester - I

Course No.	Title	Credits	Percentage of Change
MCA-101	Mathematical Foundation of Computer Science	4	50%
MCA-102	Problem Solving & Programming in C	4	20%
MCA-103	Computer Organization & Assembly Language	4	20%
MCA-107	Operating System Principles	4	New Course
MCA-190	Practicals (<i>based on all the above courses using C on Windows/Linux platform</i>)	8	
Semester-I Total: -		24	

Semester-II

Course No.	Title	Credits	Percentage of Change
MCA-203	Data Structures using C-Language	4	10%
MCA-208	Database Management System & Oracle	4	10%
MCA-209	Computer Architecture & Microprocessor	4	10%
MCA-210	Object Oriented Concepts using C++	4	New Course
MCA-211	Discrete Mathematical Structures	4	15%
MCA-290	Practicals (<i>based on all the above courses preferably using C++</i>)	8	
Semester-II Total: -		28	



**DEPARTMENT OF COMPUTER SCIENCE & IT,
UNIVERSITY OF JAMMU, JAMMU**

PROPOSED SCHEME OF MCA COURSE STRUCTURE YEAR-2012

Semester-wise Course Distribution and Paperwise Outline of Masters Degree In Computer Application [MCA] Programme

Semester - I

Course No.	Title	Credits	Max. Marks		Total
			Sem. Exam.	Int. Assessment	
MCA-101	Mathematical Foundation of Computer Science	4	80	20	100
MCA-102	Problem Solving & Programming in C	4	80	20	100
MCA-103	Computer Organization & Assembly Language	4	80	20	100
MCA-107	Operating System Principles	4	80	20	100
MCA-190	Practicals <i>(based on all the above courses using C on Windows/Linux platform)</i>	8	75	75	150
Semester-I Total: -		24	395	155	550

Semester-II

Course No.	Title	Credits	Max. Marks		Total
			Sem. Exam.	Int. Assessment	
MCA-203	Data Structures using C-Language	4	80	20	100
MCA-208	Database Management System & Oracle	4	80	20	100
MCA-209	Computer Architecture & Microprocessor	4	80	20	100
MCA-210	Object Oriented Concepts using C++	4	80	20	100
MCA-211	Discrete Mathematical Structures	4	80	20	100
MCA-290	Practicals <i>(based on all the above courses preferably using C++)</i>	8	75	75	150
Semester-II Total: -		28	475	175	650



PASSING CRITERIA

The minimum number of marks required to pass each theory paper and practical paper from Semester-I to V shall be 40% (separately in the internal assessment and the university examination). The minimum number of marks required to pass Project work in VI semester examination shall be 50%.


The candidate must pass the MCA examination within six years of the initial admission to the first semester of the course as a regular candidate.

ATTENDANCE REQUIREMENT

The minimum attendance requirement for a regular student to appear in a Semester Examination is 75% of the total number of lectures and seminars (as per syllabus) conducted in the semester. The Head of the Department may condone shortage in attendance of a student in a semester upto five attendances in each course.

A candidate who falls short of attendance in more than half the total number of courses in any semester shall have to apply for new admission/enrolment in that semester in order to earn fresh eligibility to appear in the examination.

A candidate who falls short of attendance in half or less than half the total number of courses in any semester and promoted to next semester after fulfilling the conditions as per MCA statues , shall have to repeat those courses alongwith the candidates of next academic session, the department will make arrangements of extra classes for such students.



SCHEME OF EVALUATION

Theory Courses

Each theory paper shall be of total 100 marks in case of 4 credit course and 50 marks in case of a 2 credit course. The distribution of marks is as follows:

Examination	Weightage
Written Examination <i>(at the end of each semester to be conducted by the university)</i>	80%
Internal Assessment	20%

Internal Assessment

For each course, there shall be two tests/assignments. The scheme of internal assessment is as follows:

Course	Test/Assignment-I	Test/Assignment-II	Attendance	Total
Four Credit Course	8 marks	7 marks	5 marks	20 marks
Two Credit Course	4 marks	3 marks	3 marks	10 marks



SCHEME FOR PAPER SETTING

For a course of 4 credits

The question paper will be divided into the following two sections. No question will be repeated in the question paper.

Section A

Total of 10 short answer questions (2 from each Unit) shall be set and the candidates are required to answer one question from each unit. Answer to a question should not exceed 50 words. Each question shall be of 7 marks.

(35 marks)

Section B

It will contain five long answer questions (one from each Unit). The candidates will be required to answer any three questions. Answer to each question should not exceed 800 words. Each question shall be of 15 marks.

(45 marks)

For a course of 2 credits

Section A

Total of 6 short answer questions (2 from each Unit) shall be set and the candidates are required to answer one question from each unit. Answer to a question should not exceed 50 words. Each question shall be of 6 marks.

(18 marks)

Section B

It will contain three long answer questions (one from each Unit). The candidates will be required to answer any two questions. Answer to each question should not exceed 800 words. Each question shall be of 11 marks.

(22 marks)



Practical Courses

Each practical course carries 150 marks distributed as follows:

Practicals				Marks
Internal Evaluation	I	Program Implementation & Viva-Voce	55 marks	75
	II	Practical File	10 marks	
	III	Attendance	10 marks	
External Evaluation				75
Total				150

Internal Evaluation

Guidelines for internal Assessment of practical courses

- Performance of the students will be evaluated based on a comprehensive system of continuous evaluation.
- For each practical course, students will be given regular assignments by the concerned practical teachers.
- The Implementation of assignments will be assessed & evaluated and viva-voce will be conducted atleast once in every fifteen days and then a set of further assignments may be given.
- Record of the Internal evaluation components I(Program Implementation & Viva-voce) shall be maintained regularly by the concerned teachers.
- At the end of the semester the Internal evaluation components II(Practical File) & III(Attendance) will be evaluated and consolidated with the record of components I to prepare the final award for Internal Practicals.

External Evaluation

The practical examination shall be conducted by external and internal examiners. The external examiner shall be the incharge of the practical examination and will decide the distribution of marks for various components of the examination in consultation with the internal examiner.



CRITERIA FOR PROMOTION OF A STUDENT TO NEXT HIGHER SEMESTER

Semester-I to Semester-II

The candidates shall be enrolled in second semester provided they secure pass marks in internal assessment in all the courses of first semester and who are otherwise found eligible under the MCA statutes.

Semester-II to Semester-III

The admission to third semester shall be open to only those candidates who secured pass marks in at least 12 credit's courses of first semester in the University examination and in the internal assessment in all courses of second semester.

Semester-III to Semester-IV

The candidates shall be enrolled in fourth semester provided they secure pass marks in internal assessment in all the courses of third semester and who are otherwise found eligible under the MCA statutes.

Semester-IV to Semester-V

The admission to fifth semester shall be open to only those candidates who secured pass marks in at least 12 credit's courses of third semester in the University examination and in the internal assessment in all courses of fourth semester.

Semester-V to Semester-VI

The candidates shall be enrolled in sixth semester provided they secure pass marks in internal assessment in all the courses of fifth semester and who are otherwise found eligible under the MCA statutes.

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MCA - FIRST SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-101

COURSE TITLE: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

UNIT - I

Sets, Relations and Functions:

Definition of Sets and Subsets; Intersection, Union and Complements, Demorgan's Law; Cardinality; Relations - Equivalence relation etc. Mapping One-one Onto etc. Groups, Rings, Fields. Homomorphism and isomorphism.

10 HOURS

UNIT - II

Logic & Methods of Proof:

Propositions, Connectives, Well formed formulas, Truth Tables, Equivalence of WFF, logical identities, semantics, Normal forms of WFF, reasoning, disjunctive normal form, principle disjunctive normal form, conjunctive normal form, predicate calculus, rules of inference. Direct proof, Indirect Proofs, Counter examples, Proof by Induction, Strong and weak induction.

10 HOURS

UNIT - III

Number Theory:

Modulo arithmetic, Congruence and their applications, Multiplicative inverse, Euler's extended algorithm, Fermat's little theorem, Totient function, Euler's theorem, primitive roots, discrete logarithms, split search algorithm, Chinese remainder theorem. Prime numbers, Number bases, Primarily testing, discrete logarithm, primitive roots, Number sieves, Quadratic Residues.

10 HOURS

UNIT - IV

Coordinate Geometry:

Cartesian Coordinates, Two dimensional coordinate system, Point, locus of a point, Line, Slope of a line, Regular geometric shapes, special points in triangles, angle between two straight lines, Distance between two parallel lines; Circle, parametric equation, relative position of line and circle, tangents and chords, Conic Section, Parabola, Ellipse, Hyperbola. Three dimensional coordinate system, Lines and planes, simple curves and surfaces, parametric equations, Homogeneous coordinates, Euclidean transformations, affine and projective transformations, Introduction to Polar, cylindrical, and spherical coordinates.

10 HOURS



UNIT - V

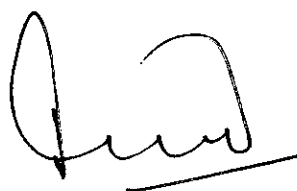
Vector Algebra:

Definition of Vector, Types of Vectors, Vector Arithmetic, Laws of vector, Collinear vectors, Coplanar vectors, Vector products, Orthogonal and Orthonormal vectors, Scalar and Vector Projection.

10 HOURS

SUGGESTED READINGS:

1. Modern Algebra by Prof. M.R. Puri and Dr. Raj Krishan Publisher: Malhotra Brothers
2. Trembley, J.P. and Manohar, R.P.: Discrete Mathematical Structures with Applications to Computer Science. McGraw-Hill.
3. Lew: Computer Science: A Mathematical Introduction, Prentice - Hall International (Paperback Edition).
4. Kenneth. H. Rosen: Discrete mathematics and its applications 3rd Edition, McGraw Hill international edition.
5. Algebraic Number Theory by Serge. Lang, Springer; 2nd edition.
6. Elements of Vector Algebra by B.L. Raina Publisher: Malhotra Brothers
7. Vector Algebra by R. Gupta Publisher: Laxmi Publishers (P) Ltd.



UNIT-V

File Accessibility & Graphics Programming:

File Accessibility and Directories (access, stat, chmod, chown ..., chdir, chroot...), Process Control: (Running Linux Commands from C, fork(), the exec family, wait(), exit())

Graphics Programming: OpenGL Basics, OpenGL Utility Toolkit (GLUT), Defining window, Display mode, OpenGL Functions, Primitives (Points, Lines, Polygons) and Attributes, Simple graphics programs.

10 HOURS

SUGGESTED READINGS:

1. B. Kernighan and D. Ritchie, "The ANSI C Programming Language", PHI., 2000.
2. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3rd Ed., 2007.
3. Jeri R. Hanly and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 5th Ed. 2007.
4. Yashwant Kanetkar, "Let us C", BPB Publications, 2002.
5. Edward Angel, "OpenGL- A primer", 3rd Ed. , Addison-Wesley 2007.
6. Kurt Wall, Mark Watson, and Mark Whitis, "Linux Programming Unleashed", SAMS.
7. Mark Mitchell, Jeffrey Oldham, and Alex Samuel, "Advanced Linux Programming", New Riders Publishing, 2001.
8. Edward Angel, "Interactive Computer Graphics", 5th Ed. , Addison-Wesley 2009



MCA - FIRST SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-102

COURSE TITLE: PROBLEM SOLVING & PROGRAMMING IN C

UNIT-I

Problem Solving & C Basics:

Steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Pseudocode and Flowchart Designing.

History of C, Characteristics of C, Introduction to GCC, compiling, linking and running a C – program, Using MAKE Utility.

C Program Structure, Data Types, Variables and Constants, Printing Out and Inputting Variables, Constants, Type-Casting, Operators and Expressions, Order of Precedence.

10 HOUR

UNIT-II

Control Statements & Arrays:

Conditional Statements, Program Loops and Iteration, Library functions. Syntax, semantic, linker, logical and runtime errors.

Single and Multi-dimensional Arrays, Strings, Basic String Handling Functions.

10 HOURS

UNIT-III

Functions & Further Data Types:

Functions, Passing Parameters, Recursion, Storage classes. Standard C Preprocessor Directives.

Standard Formatted & unformatted I/O Functions.

Defining New Data Types, Structures, Unions, Enumerated Types, Bitwise Operators, Bit Fields.

10 HOURS

UNIT-IV

Pointers & Files:

Pointers: Pointers arithmetic, const and void pointers. Dynamic Memory Allocation, Pointers to Pointers, Pointer to array, Array of pointers, Command line input, Pointers to a Function.

Files Character and Line Based I/O, Formatted I/O, Block I/O, File Positioning.

10 HOURS



MCA - FIRST SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-103

COURSE TITLE: COMPUTER ORGANIZATION & ASSEMBLY LANGUAGE

UNIT - I

Binary Systems:

Overview of digital computers, Binary Numbers, Number systems, Number based Conversions, Integer & floating point representation using IEEE FORMAT, Rules of Floating point Arithmetic, parity, Error detection and correction methods using Hamming technique, ASCII code representation, Rules of addition/subtraction for r's, (r - 1)'s complements, BCD, excess - 3 codes.

10 HOURS

UNIT - II

Boolean Algebra & Logic Gates:

Basic Theorems and functions, Boolean Expressions, Laws of Boolean Algebra, De - Morgan laws, simplification of Boolean Expressions using SOP, POS, K-map. Logic gates, AND, OR, NOT, NAND, XOR, NOR, XNOR Gates & their design.

10 HOURS

UNIT - III

Combinational Circuits:

Introduction, Half & Full adders & subtractors, parallel adders and subtractors. Encoder, decoder, Multiplexer, De - Multiplexer, code converters.

10 HOURS

UNIT - IV

Sequential circuits & Memory organization:

Sequential circuits, Basic memory cell, Flip-flops and their types, triggering of flip flops, Registers and their types, bi-directional register.

Memory Hierarchy, Memory and its types, characteristics of memory, memory address map to CPU, cache memory.

I/O devices FD/HD disks, VDU; I/O organization, Modes of I/O transfer like DMA, programmed control, interrupts technique.

10 HOURS



UNIT - V

Microprocessor & Assembly Language:

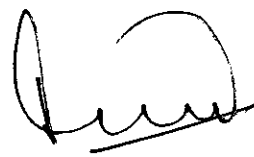
Microcomputer organization, microprocessor organization, Instruction set, addressing modes, stack, subroutines and interrupts, memory organization and I/O interface.

Need and use of Assembly Language, Types of Assemblers (TASM and MASM), assembly Language programming structure, Instruction Sets (operands and opcodes), description of Registers, writing and executing simple assembly programs.

10HOURS

SUGGESTED READINGS:

1. Gear, C.W.: Computer Organization and Programming McGraw – Hill.
2. Tannenbaum, A.S.: Structured Computer Organization Prentice - Hall of India.
3. Mano, M.M.: Computer System Architecture, Prentice – Hall, of India.
4. Langholz, G., Grancioni, J. and Kandel, A.: Elements of Computer Organization, PHI.
5. Assembler Manual for the chosen machine.
6. Hayes: Computer Architecture and Organization, McGraw – Hill International Edition.
7. Sloan, M.E.: Computer Hardware and Organization, 2nd Edn, Galgotia publ. Pvt. Ltd.
8. Floyd: Digital Fundamentals, 3rd edn, Universal bookstall, and pvt.ltd
9. R. K Gaur: Digital Electronics and microprocessor - dhantpat Rai pub.
10. Peter Abel: Assembly language and Programming
11. George W. Gorsline: Assembly and assemblers, Prentice hall International Edition.



MCA - FIRST SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-108

COURSE TITLE: OPERATING SYSTEM PRINCIPLES

UNIT-I

Introduction to Operating Systems:

Evolution of operating systems, operating systems concepts, types of operating systems, different views of the operating system, operating system services, System calls, Types of system calls. Operating system Structure, Layered Approach, Microkernels, Virtual machines.

10 HOURS

UNIT – II

Process Management:

Process concept, operation on processes, Inter-process communication, mutual exclusion, Process scheduling, Basic Concepts, Scheduling criteria, Scheduling algorithms, Process Synchronization, Inter process Synchronization, Critical section Problem, Semaphores, Monitors, Message passing.

Deadlocks, System Model, Deadlock characterization, Deadlock prevention, Deadlock avoidance.

10 HOURS

UNIT – III

Memory Management:

Memory management, swapping, contiguous memory allocation, relocation & protection, Memory management, Paging, Segmentation, Intel Pentium Segmentation, Intel Pentium Paging, Virtual memory, demand paging, performance of demand paging, Page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

10 HOURS

UNIT – IV

File & I/O Management:

Files system structure, file system implementation, Directory Implementation.

Allocation Methods, contiguous allocation, Linked allocation, Indexed allocation, Disk organization, disk space management, disk scheduling, Disk Management, RAID Structure.

10 HOURS



UNIT -V

Introduction to LINUX/UNIX:

Various parts of operating system, kernel, important parts of kernel;

Files and Directories: pathname; Directory Tree; current working directory; relative pathname; referring to home directories; device files; File permissions; Pipes; tee; mount, init, Files, Directories, Processes Commands: pwd, mkdir, rmdir, ls, cat, more, mv, cp, rm, diff, wc, pwd, wc, who, write, who am i, passwd, ps, kill, date, cal, man, gzip, df, chmod, mkdir, cd. Filters: pr, head, tail, cut, paste, sort, uniq, nl, tr. Regular Expression: grep; egrep; fgrep

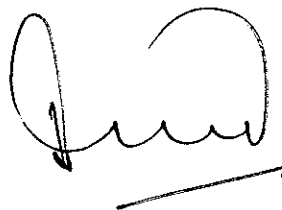
Vi-Editor, adding and replacing text, commands in Command mode, deletion, navigation, pattern search, repeating commands, undoing last command.

Shell Programming, Shell Script, Logical Operators, If else Statement, Case structure, Looping.

10 HOURS

SUGGESTED READINGS:


1. Silberschartz, Galvin, Gagne: Operating System Concepts 8th edition, WSE wiley.
2. Andrew. S. Tanenbaum: Modern operating systems, Pearson Prentice Hall.
3. Milenkovic M: Operating system-concepts and design, McGraw hillinternational editions.
4. A S Godbole: Operating systems, tata McGraw hill.
5. Deitel H. M. : An Introduction to operating system, addison- Wesley publications.
6. Madnick & Donovan: Operating systems, mcgraw-hill book co.
7. Sumitabha Das- UNIX Concepts and Application, Tata McGraw Hill
8. Richard L. Petersen, The Complete Reference Linux, Tata McGraw Hill



COURSE NO: MCA-190
PRACTICALS

Practicals will be based on following Papers:

1. Mathematical Foundation Of Computer Science (MCA-101)
2. Problem Solving & Programming In C (MCA-102)
3. Computer Organization & Assembly Language (MCA-103)
4. Operating System Principles (MCA-108)

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MCA - SECOND SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-203

COURSE TITLE: DATA STRUCTURES USING C-LANGUAGE

UNIT - I

Fundamental Notations:

Primitive and composite data types, self-referential structures, Algorithms, Types of data structures, Operations, Time and space complexity of algorithms, Asymptotic notation.

10 HOURS

UNIT - II

Linear Data Structures:

Arrays, Linked lists, Stacks, Queues, operations and their complexities, Implementations, Applications.

10 HOURS

UNIT - III

Non-Linear Data Structures:

Trees, Binary Trees, Traversing binary trees, Threaded binary trees, Binary search trees, heaps, Graphs, Traversing graphs.

10 HOURS

UNIT - IV

Indexing Structures:

ISAM, m-way trees, B - trees, B+ - trees, Hashing techniques for direct access, collision in hashing, collision resolution.

10 HOURS

UNIT - V

Sorting:

Internal and External sorts, Bubble sort, Insertion sort, Selection sort, Shell sort, Quick sort, Radix sort, Merge sort, Types of merging.

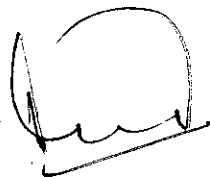
10 HOURS

SUGGESTED READINGS:

1. G. A. V. Pai, Data Structures and Algorithms: Concepts, Techniques and Applications, Tata Mcgraw Hill, 2008.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2008
3. J. P. Tremblay & P. G. Sorenson, Introduction to Data Structures with Applications, TMH, 2007.



4. Seymour Lipschutz, Theory and Problems of Data Structures, Schaum's Outline Series in Computers Tata McGraw-Hill, 2006
5. A. M. Tannenbaum & M..J. Augenstein and Y. Langsam, Data Structures with C, PHI, 2006.

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MCA - SECOND SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-208

COURSE TITLE: DATABASE MANAGEMENT SYSTEM & ORACLE

UNIT - I

Database Management System Concepts:

File based system, Need of Database Management System, Components of DBMS, Data independence, Three level architectural of Database, Centralized and client server architecture for DBMS, Introduction to hierarchical and network data models, Conventional file organizations, Inverted files.

10 HOURS

UNIT - II

Relational Data Model:

Relational data models, Entity relationship model, Conversion of ER diagrams to Relational Database Design, Joins, Relational algebra and relational calculus concepts, Queries using relational algebra and calculus, QBE.

10 HOURS

UNIT - III

Normalisation and Concurrency Control :

Concept of keys, Functional dependencies, Inference rules, Covers, Closure, Equivalence of functional dependencies, Multivalued dependencies, Theory of normalization, Normal forms (1st to 5th).

Transaction processing, Deadlocks, Concurrency control, Locking techniques, Timestamp ordering, Recovery management, Recovery techniques.

10 HOURS

UNIT - IV

SQL using Oracle:

SQL query processing, Table creation and management, Inbuilt functions, Data integrity constraints, Views, Joins, Operators, Privileges, roles and security policies.

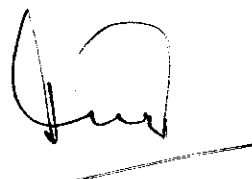
10 HOURS

UNIT - V

Oracle PL/SQL:

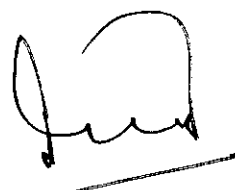
Architecture, Fundamentals, PL/SQL control structure, Exception handling, Cursor management, Procedures and functions, Packages Database triggers.

10 HOURS



SUGGESTED READINGS:

1. Bipin C.Desai: An Introduction to Database Systems, West-publishing company.
2. Elmasri, Navathe, Somayajulu, Gupta: Fundamentals of Database Systems, Pearson Education.
3. Date, C.J.: An Introduction to Database Systems Addison Wesley Pearson Education.
4. Narayan S Umanath, Richard W Scamell : Data Modelling and Database Design, Thomson Course Technology India Edition.
5. R.A. Parida, Vinod Sharma: The power of Oracle 9i, Firewall Media Publications.
6. Desh Pande: SQL/PL for Oracle 8 & 8i.

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MCA - SECOND SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-209

COURSE TITLE: COMPUTER ARCHITECTURE & MICROPROCESSOR

UNIT - I

Digital Electronics:

Semi-conductor, p-type, n-type formation, pn junction & its characteristics, Bipolar and MOSFET transistors as current controlled and voltage controlled Switch, Basic design for AND, OR, NOT, NAND, NOR using RTL, DTL, TTL, MOS Technology, Tristate logic

10 HOURS

UNIT - II

Sequential Circuits & Computer Arithmetic:

Sequential circuits: Sequence generator, counters, A/D & D/A converters.

Computer Arithmetic: Flowchart, Hardware design & algorithm for signed magnitude & 2's complement form for addition, subtraction, multiplication & division methods, floating point arithmetic.

10 HOURS

UNIT - III

Memory & Register Organization:

Memory: 2D/3D Static RAM, Static and Dynamic Memory, Types of ROM, associative memory and interleaved memory, Random access, Sequential access, direct access, virtual memory, cache memory.

Register transfer logic and micro-operation.

10 HOURS

UNIT - IV

Microprocessor & Control Design:

Internal structure of MPU, ALU & Micro-programmed control unit. Instruction format, Bit Slices, I/O interface adapter (Serial and Parallel), Memory read, Memory write, Memory map and I/O map, Interrupts and its types.

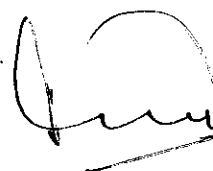
10 HOURS

UNIT - V

Parallel Processing and VHDL:

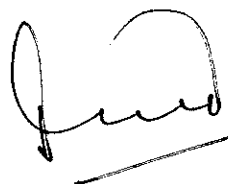
Classification of parallel machines, pipeline processing, Vector processing, multiprocessor system architecture-multiport memory, crossbar switch, timeshared common-bus, dual-bus, Bus arbitration. VHDL: Introduction, Need and importance of VHDL, characteristics, basic components of VHDL.

10 HOURS



SUGGESTED READINGS:

1. Malvino, A.P., Leach, D.P.: Digital Principles and Applications, Tata McGraw-Hill.
2. Millman and Halkias: Integrated Electronics, McGraw-Hill.
3. Strangio, C.E.: Digital Electronics – Fundamental Concepts and sons.
4. Khambata, J.: Microprocessor and Microcomputer, John Wiley and Applications, PHI.
5. Liu, Y.Gibson, G.A.: Microcomputer Systems: The 8086/808, Family, PHI 2nd Edn..
6. Alexandridis Nikitas, A.: Microprocessor System Design Concepts, Galgotia Publications.
7. Stone, S.: Introduction to Computer Architecture, Galgotia Publications, 2nd Edn.
8. Mano, M.M.: Computer System Architecture, Prentice-Hall.
9. Volnei A. Pedroni: Circuit design with VHDL.

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MCA - SECOND SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100,

Internal Assessment = 20

COURSE NO: MCA-210

COURSE TITLE: OBJECT ORIENTED CONCEPTS USING C++

Unit – I

The Object Oriented Methodology and C++ basics:

Paradigms of Programming Languages, Evolution of OO Methodology, Basic Concepts of OO Approach, Comparison of Object Oriented and Procedure Oriented Approaches, Benefits of OOPs, Introduction to Common OO Language, Applications of OOPs, Object-based programming languages.

Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C and C++. Basic program construction, working with variables and const qualifiers.

10 HOURS

Unit – II

Programming Constructs:

Input output statements: cin, cout, comments, escape sequence, manipulators, type conversion, operators, and library functions.

Control statements, Structures, Enumeration, Functions, passing arguments to functions, reference arguments, overloaded functions, inline functions, default arguments, variables and storage class and returning by reference, Arrays and Strings.

10 HOURS

Unit – III

Classes & Operator Overloading:

Objects and Classes, defining class, c++ objects as physical objects, c++ objects and data types, object as function argument, constructors, as function argument, overloaded constructors, copy constructors, returning objects from functions, this pointer, structures and classes, static class data, static functions, friend functions, const and classes, array of objects.

Overloading unary and binary operator, Data conversions (built-in & user defined data types).

10 HOURS


Unit – IV

Inheritance & Virtual Functions:

Inheritance concept, derived class and base class, derived class constructors, overloading member functions, class hierarchies, public, private & protected inheritance, levels of inheritance, multiple inheritance, Virtual Inheritance, new and delete operator.

Early & late binding, Virtual functions.

10 HOURS



MCA - SECOND SEMESTER

Duration of the Examination: 3 Hrs

Theory Examination = 80

Total Marks = 100

Internal Assessment = 20

COURSE NO: MCA-211

COURSE TITLE: DISCRETE MATHEMATICAL STRUCTURES

UNIT - I

Counting Techniques:

Basics of counting pigeon hole principles, permutation and combination, Recurrence Relations & their solution (Homogeneous & non-homogenous), Decision trees, Divide & Conquer Relations function, Decision trees.

10 HOURS

UNIT - II

Posets, Hasse Diagram and Lattices:

Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, and complemented lattices.

Introduction to fuzzy systems, fuzzy sets, equality of fuzzy sets, normal fuzzy sets, containment, support of a fuzzy set. Alpha-level sets. Basic operation of Fuzzy sets.

10 HOURS

UNIT - III

Graphs:

Introduction to Graphs; Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; connectedness; Walks, Paths and Circuits; Components; Connectedness Algorithm, shortest path Algorithms, Eulerian graph; Fleury's algorithms, Hamiltonian graph - Necessary conditions and sufficient conditions; Travelling salesman problem; Bipartite graphs; Directed Graphs, Binary relations, connectedness in directed Graph.

Matrix representations of graph: Incidence; Adjacency matrices and their properties.

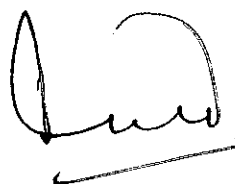
10 HOURS

UNIT - IV

Trees:

Properties of trees; Pendant vertices in a tree: Center of a tree; Rooted an binary trees; Spanning Trees – spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph, cutsets and cut-Vertices; Fundamental cutsets; connectivity and separativity.

10 HOURS



Unit – V

Files I/O & Generic Programming:

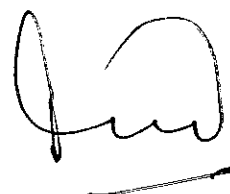
File Input/Output & Exception Handling: Using istream/ostream member functions, Understanding implementation of Files, Writing and Reading Objects. Understanding of working and implementation of Exception Handling.

Understanding Generic Functions with implementation of searching sorting algorithm. Understanding Class Templates using Implementation of Generic stack, linked lists, Understanding Components of Standard Template Library, Working of STL Elements.

10 HOURS

SUGGESTED READINGS:

1. Bjarne Stroustrup, The C++ Programming Language, (3rd edition), Addison Wesley.
2. Herbert Schildt, C++ The Complete Reference, McGraw Hill.
3. Robert Lafore, Object Oriented Programming In C++, Galgotia publ.
4. E. Balagursamy, Object Oriented Programming using C ++, Tata Mcgraw Hill.
5. D. Ravichandran, "Programming with C++", Tata Mcgraw Hill.
6. Scott Meyers, Effective C++: 50 Specific Ways to Improve Your Programs and Designs, Addison Wesley.
7. S. B. Lippman and J. Lajoie, "C++ Primer", 3rd Edition, Addison Wesley.
8. Bruce Eckel, "Thinking in C++", President, Mindview Inc., Prentice Hall, 2nd Ed.



UNIT - V

Planar graphs & Colouring:

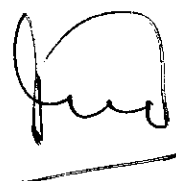
Combinatorial and geometric dual; Kuratowski's graphs; Detection of planarity; Thickness and crossings.

Colorings: Vertex coloring, Chromatic number; Chromatic polynomial, The four colour problem, edge coloring, Coloring algorithms.

10 HOURS

SUGGESTED READINGS:

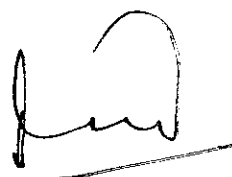
1. Harry, F.: Graph Theory: Addison - Wesley Publ. Camp.
2. Trembly, J.P. and Manohar, R.P.: Discrete Mathematical Structures with Applications to Computer Science, McGraw - Hill.
3. Deo, N.: Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall Inc..
4. Krishnamurthy, V.: Combinatorics: Theory and Applications, Affiliated East-West Press Pvt. Ltd.
5. Doerr, A. and Levasseur, K.: Applied Discrete Structures of Computer Science, Galgotia Publications Pvt. Ltd.



COURSE NO: MCA-290
PRACTICALS

Practicals will be based on following Papers:

1. Data Structures Using C-Language (MCA-203)
2. Database Management System & Oracle (MCA-208)
3. Computer Architecture & Microprocessor (MCA-209)
4. Object Oriented Concepts Using C++ (MCA-210)
5. Discrete Mathematical Structures (MCA-211)

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