

**Syllabus for  
Master of Science in Computer Science  
Under Choice Based Credit System**

**Academic Session:  
w.e.f. 2020-2022(onwards)**



*for*

**Binod Bihari Mahto Koyalanchal University,  
Dhanbad**

**Members of Board of Studies of CBCS Post-Graduate Syllabus as per Guidelines of the Binod Bihari Mahto Koyalanchal University, Dhanbad**

1. Chairman : Dr. K. Bandyopadhyay, Head, University Department of Computer Science, BBMK University, Dhanbad

2. External expert members:

i) Dr. S. N. Ojha, ISERC, Visva-Bharati University, Santiniketan, W.B.

ii) Prof. S. Karforma, Dept. of Comp. Science, The University of Burdwan, W.B.

iii) Dr. S. C. Dutta, Dept. of CS&E, BIT, Sindri, Dhanbad

iv) Sri A. G. P. Kujur, Dept. of CS&E, BIT, Sindri, Dhanbad (on lien)

v) Prof. Chiranjeev Kumar, Dept. of CS&E, IIT (ISM), Dhanbad

3. Members:

i) Dr. P. Mahto, (Retd.), Dept. of Mathematics, R.S.More College, Dhanbad

ii) Dr. D. K. Singh, Dept. of Physics, PKRM College, Dhanbad

## CONTENTS

3

<b>S. No.</b>	<b>Topic/Title</b>	<b>Page No.</b>
<b>1.</b>	<b>Members of BOS</b>	<b>02</b>
<b>2.</b>	<b>Contents</b>	<b>03</b>
<b>3.</b>	<b>Course Structure</b>	<b>04 - 06</b>
<b>4.</b>	<b>About Dissertation / Project</b>	<b>07 - 08</b>
<b>5.</b>	<b>Instruction to Faculty Members and Question Setters</b>	<b>09 - 10</b>
<b>6.</b>	<b>Semester - 1</b>	<b>11 - 14</b>
<b>7.</b>	<b>Semester - 2</b>	<b>14 - 17</b>
<b>8.</b>	<b>Semester - 3</b>	<b>17 - 23</b>
<b>9.</b>	<b>Semester - 4</b>	<b>23 - 32</b>
<b>10.</b>	<b>i) Annexure – 1(Research Methodology*) ii) Annexure – 2 (Format of Question Papers)</b>	<b>i)32 - 33 ii) 33 – 35</b>

**COURSE STRUCTURE**  
**Semester Wise Examination/Course Structure for Science Faculty**

Semester	Paper Code (Credit, Lectures)	Paper Name	Full Marks	End Semester Marks	Mid Semester (Internal) Marks <small>(Written 20 marks) + Day to Day assessment includes extracurricular activities (5 marks) + Attendance (5 marks)</small>
I	MCS -F-101 (5 Credits, 60 Lectures + 15 Tutorials)	Foundation	100	70	30
	MCS -C-102 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C-103 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C/P-104 (5 Credits, 75x2 Lectures)	Practical	100	70	30
II	MCS -S-205 (5 Credits, 60 Lectures + 15 Tutorials)	Skill Development Course (SEC)	100	70	30
	MCS -C-206 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C-207 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C/P-208 (5 Credits, 75x2 Lectures)	Practical	100	70	30
III	MCS -A-309 (5 Credits, 60 Lectures + 15 Tutorials)	Open Elective	100	70	30
	MCS -C-310 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C-311 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS -C/P-312 (5 Credits, 75x2 Lectures)	Core/ Practical	100	70	30
IV	MCS -E-413A/ MCS -E-413B/ MCS -E-413C	Discipline Centric Elective Theory A: B:	100	70	30

	(5 Credits, 60 Lectures + 15 Tutorials)	C:			
	MCS-E-414A/ MCS-E-414B/ MCS-E-414C (5 Credits, 60 Lectures + 15 Tutorials)	Discipline Centric Elective Theory A: B: C:	100	70	30
	MCS-C-415 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MCS-D-416* (5 Credits, 150 Lectures)	Dissertation/ Project	100	70	30
<b>Total Marks</b>			<b>1600</b>	<b>1120</b>	<b>480</b>

**Note: Symbol of Paper: XYZ-F-101:** The first three symbols in Roman capital letters indicate the subject; the next symbol(s) denotes Foundation (F), Core (C), Discipline Centric Elective (E), etc. Out of the next three digits, the first digit indicates the semester e.g. 1,2,3,4,5,6 for semester I, II, III, IV, V, VI respectively, and the next two digits indicate paper number. The last letter P indicates Practical.

**\*Dissertation/Project:** Evaluation of project dissertation work may be as per the following guidelines:

- **Mid-Semester/Internal Assessment Examination** = 30 marks (**Annexure-1**)
- **End Semester Examination:** Project model (if any) and the Project record notebook, Project presentation and viva-voce = 70 marks  
(Jointly conducted by One External & One Internal Examiners)

**Overall project dissertation may be evaluated under the following heads:**

- Motivation for the choice of topic
- Project dissertation design
- Methodology and Content depth
- Results and Discussion
- Future Scope & References
- Participation in Internship programme with reputed organization
- Application of Research technique in Data collection
- Report Presentation
- Presentation style
- Viva-voce

**Note:**

- (a) Each student must submit two copies of the dissertation work duly forwarded by the Head of the Department and duly signed by the supervisor concerned. The forwarded copies will be submitted to the concerned Department of University, for evaluation.  
The paper will consist of
  - Field work/Lab work related to the project.
  - Preparation of dissertation based on the work undertaken.
  - Presentation of project work in the seminar on the assigned topic & open viva there on.
- (b) Each student shall have to complete a project work on any topic of his choice, but relevant to the frontier area of Science and Technology, or on a topic allotted by his/her Project Guide/Supervisor/Department in Semester -IV. This is compulsory and the candidates shall ensure that his project is on a relevant topic completed by him independently with the help and inputs from his/her guide/supervisor. Other guidelines pertaining to this paper shall be provided by the Department.
- (c) Student alone or in a group of not more than five, shall undertake one Project approved by the Subject Teacher/H.O.D. of the Department/College concerned. The progress of the Project shall be monitored by the faculty members at regular intervals.
- (d) Students will select topics for the project work in consultation with a teacher of the Department. The Seminar will be held in the concerned Department of University.

The **Dissertation/Project** shall be presented with the following specifications:

- (a) **Size of Paper:** A4. Dissertation/Project must be printed on one side of the paper.
- (b) **Font Type:** Times New Roman/Arial for English and Kruti Dev 010 for Hindi.
- (c) **Font Size:** Font size for English text is 12pt. in standard form and for Hindi is 14pt.
- (d) **Font of Chapter Headings and Sub-Headings:**
  - Chapter headings may be written in all Capitals, bold text in point size 15
  - Sub-headings are written with left margin alignment
  - First level sub-headings are written in normal sentence case using bold text in point size 14
  - Second level sub-headings are point size 13
- (e) **Spacing and Paragraphing:**
  - Printing shall be in standardised form with 1.5 line spacing
  - Leave as triple spacing (2 empty lines) in base point size 12 before and after sub-headings and one empty line after all sub-headings
  - Use one empty line between left-justified paragraphs
- (f) **Margin:** Left margin should be 4cms and right and top margin should be 2cms. Bottom margins should be 2.5cms. No ornamental bordering of sides is permitted.
- (g) **Page Numbering:** Preliminary pages of the **Dissertation/Project**, i.e. those preceding in text are to be numbered in Roman numbered. Text should be numbered in Arabic beginning with Pg No 1 on the first page of chapter 1.
- (h) Preliminary sections of the **Dissertation/Project** should include, Declaration of Attendance, Certificate from Supervisor, Declaration by Candidate and Supervisor regarding Plagiarism, Acknowledgement, Table of Contents, List of Tables, List of Figures/Diagrams, List of Abbreviations (if any) and an Abstract of the Dissertation/Project.
- (i) **Referencing and Citation Style:** Citation i.e. a way of giving credit to individuals for their creative and intellectual works that you utilised to support your research, differs by faculty in the style of ordering, punctuating and formatting of name, date, page, work etc.

The referencing of work and Citation style in the Dissertation/Project submitted in **Faculty of Science and Social Science** will be in **American Psychological Association (APA) style (6<sup>th</sup> edition)**, for **Faculty of Humanities** except for the Indian Languages, format shall be **Modern Language Association (MLA) (8<sup>th</sup> edition)** and for **Medical Science**, it shall be **Vancouver style**.



***Instruction to faculty members and Question Setter for:***

***Mid Semester Examination (MSE):***

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).*

***End Semester Examination (ESE): There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.***

**Instruction to faculty members and Question Setter for:****Mid Semester Practical Examination (MSE):**

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each of 3 hours duration (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “**Best of Two**” shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks).

**End Semester Practical Examination (ESE):**

The questions in practical examination will be of equal to 70 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.

Specimen

## SEMESTER-IV

MCS-D-416	Dissertation/Project	Credits: 5
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**Guidelines to Examiners for:**

- **Mid-Semester/Internal Assessment Examination** = 30 marks
- **End Semester Examination:** Project model (if any) and the Project record notebook, Project presentation and viva-voce = 70 marks  
(Jointly conducted by One External & One Internal Examiners)

## SEMESTER - 1

### **MCS-F -101 (Programming Techniques) (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

#### **Mid Semester Examination (MSE):**

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “**Best of Two**” shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks ).*

**End Semester Examination (ESE):** *There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms - Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation - Compilation and Virtual Machines, programming environments. (15 lectures)

Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features. Data types: Introduction, primitive, character, user defined, array, union, pointer and reference types, structure, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. (20 lectures)

Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures - Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands. (08 lectures)

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines. (10 lectures)

Introduction and overview of logic programming, basic elements of prolog, application of logic programming, Introduction, fundamentals of FPL, LISP. (07 lectures)

**Text Books:**

12

1. Programming Languages -Louden, Second Edition, Thomson
2. LISP Patrick Henry Winston and Paul Horn Pearson Education.
3. Programming in PROLOG Clocksin, Springer
4. Programming With C, Gottfried, TMH
5. C Programming Essentials - Kashi Nath Dey and Samir K Bandyopadhyay, Pearson Education

**MCS-C-102 (Computer Organisation & Architecture) (60 lectures+ 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).*

**End Semester Examination (ESE):***There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Basic structure of Computer, Overview of von Neumann architecture, Number systems, Boolean postulates and laws, De-Morgan's Theorem, Boolean function, Minimization of Boolean expressions, SOP, POS, Karnaugh map, Logic Gates, Combinational and Sequential circuits. Overview on Arithmetic Unit, Processing Unit. (15 lectures)

Memory Devices - RAM, ROM, Cache memory, Virtual memory, Secondary Storage IO Organization - Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces - PCI, SCSI, USB

Basic Parallel Processing Architecture, Taxonomy- SISD, MISD, SIMD, MIMD structures, Serial, Parallel & Concurrent Computation, CISC Vs RISC

Concepts of pipelining, Hierarchical Memory Technology: Inclusion, Coherence and locality properties

Concepts of instruction-level parallelism (ILP), Superscalar, superpipelined and VLIW processor architectures; Vector and symbolic processors (25 lectures)

Multiprocessor Architecture, Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks, Distributed shared-memory architecture, Cluster computers. Non von Neumann Architectures, Data flow Computers, Reduction computer architectures, Systolic Architectures. (13 lectures)

Basic Features of Current Architectural Trends. DSP Processor, Dual core Technology (07 lectures)

**Text Books:**

1. Digital Design, 3.edition by M. Morris Mano, PHI publication
2. Computer Organization and Architecture - Designing for Performance, 6th Edition by William Stallings
3. Advanced Computer Architecture: Parallelism, Scalability and Programmability by Kai Hwang

13

**MCS-C- 103 (Design and Analysis of Algorithms) (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

*Mid Semester Examination (MSE):*

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

*The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).*

*End Semester Examination (ESE): There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Introduction to Data structure and algorithms. The running times of a program, Use of the Big-Oh, small o, Big-omega and small omega notation, Efficiency of algorithms, Analysis of recursive programs, Solving recurrence equation, Divide and conquer algorithms, Dynamic programming, Greedy algorithm. (20 lectures)

Implementation of Abstract data Types (ADT), list, stack, queue hashing, Tree structures: binary trees, AVL trees, Red-Black trees, priority queues, Tree traversal algorithms, Graphs and algorithms: Prim's algorithm, Kruskal's algorithm, Dijkstra's method, Backtracking minimum spanning trees, Sorting & Searching algorithms. (20 lectures)

Introduction to NP Problem, Polynomial-time, Abstract Problems, Encoding, NP-Completeness and Reducibility, NP-Completeness, Circuit Satisfiability, NP-Complete Problems, The Vertex-cover Problem, The Subset-sum Problem, The Hamiltonian-cycle Problem, The Traveling-salesman Problem. (20 lectures)

**Text Books:**

1. Data Structure using C and C++ - 2nd edition by Tanenbaum
2. Fundamentals Of Data Structures In C++ by Ellis Horowitz, Sahni, Dinesh Mehta
3. Introduction to Algorithm by Thomas H. Cormen, Charles E. Leiserson and Ronald. L. Rivest,
4. The Design and Analysis of Computer Algorithms by Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman.

**MCS –C/P -104 : Computing Laboratory -1 (75 x 2 lectures)**

*Instruction to faculty members and Question Setter for:*

*Mid Semester Practical Examination (MSE):*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each of 3 hours duration (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “Best of Two” shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).

**End Semester Practical Examination (ESE):**

The questions in practical examination will be of equal to 70 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.

## SEMESTER -2

### MCS-S-205 ( Computer Networks) (60 lectures +15 tutorials)

[ Instruction to faculty members and Question Setter for:

**Mid Semester Examination (MSE):**

There will be two groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “Best of Two” shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).

**End Semester Examination (ESE):** There will be two groups of questions. **Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].**

Fundamentals of data transmission, wired and wireless media, digital and analog transmission, data coding techniques, multiplexing, overview on OSI layers and TCP/IP model (10 lectures)

Local Area Networks and data link protocols, point-to-point links and sliding window flow control, CSMA/CD, Ethernet, wireless LAN, cellular networks, and advanced multi-user communication (CDMA, SDMA/MIMO), mobility (18 lectures)

Internetworking using TCP/IP: network programming using socket API, network client/server design (06 lectures)

Packet/circuit switching and wide-area networks: store-and-forward networks, source routing, virtual/permanent, circuits and call set-up, LAN/WAN addressing, hop-by-hop vs. end-to-end control (10 lectures)

Routing techniques - intra-domain routing (OSPF, RIP), inter-domain policy routing (BGP) and network connectivity (05 lectures)

Transport protocols - TCP and UDP, Congestion control, TCP window control, multimedia streaming (05 lectures)

High-level network services - DNS, HTTP, SMTP, network management (SNMP), network Security (06 lectures)

1. Computer Networks by AS Tanenbaum, Fourth Edition, 2002, Pearson Education
2. Data Communication and Networking by B. Forouzan
3. Data and Communication by W. Stallings,

**MCS-C-206 (Database Management Systems) (60 lectures + 15 tutorials)**

**[ Instruction to faculty members and Question Setter for:**

**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. **“Best of Two”** shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).

**End Semester Examination (ESE):** There will be two groups of questions. **Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].**

What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management. (04 lectures)

The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction. (06 lectures)

Database design and ER Model: overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML (08 lectures)

Relational database model: Logical view of data, keys, integrity rules. (03 lectures)

Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF). (05 lectures)

Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. (06 lectures)

Calculus: Tuple relational calculus, Domain relational Calculus, calculus Vs algebra, computational capabilities. (06 lectures)

What is constraints, types of constraints, Integrity constraints, (03 lectures)

Views: Introduction to views, data independence, security, updates on views, comparison between tables and views (04 lectures)

SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers. (05 lectures)

Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management. (10 lectures)

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill ,
2. Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning.
3. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
4. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
5. Ramakrishnan: Database Management System , McGraw-Hill

### MCS-C- 207 (Operating System) (60 lectures + 15 tutorials)

*[ Instruction to faculty members and Question Setter for:*

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).*

**End Semester Examination (ESE):***There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

OS services and components, multitasking, multiprogramming, time sharing, buffering, spooling (05 lectures)

Process & thread management, context switching, multithreading  
Concurrency control, mutual exclusion requirements, semaphores, monitors, Dead locks - detection, recovery, avoidance and prevention (10 lectures)

Memory management, partitioning, swapping, paging, segmentation, virtual memory, Demand paging, page replacement and allocation algorithm (08 lectures)

I/O Systems, interrupt handlers, device drivers, and device independent I/O software  
Secondary-storage structure, file system management (08 lectures)

Protection & security, Implementation of access matrix, Encryption  
Case studies on Linux & Windows 2000 (08 lectures)

Introduction to Distributed Systems, Architectures of Distributed Systems, communication networks, Mutual Exclusion in Distributed Systems, RMI, concept of Replication, Distributed File Systems (NFS, AFS, coda) overview, security in Distributed Systems (13 lectures)

Multiprocessor operating systems, basic multiprocessor system architectures, overview on Database



**Text Books:**

1. Advanced Concepts In Operating Systems by Mukesh Singhal and Niranjana Shivaratri
2. Distributed Operating systems by Andrew s.Tanenbanm
3. Operating System Concepts, 5<sup>th</sup> ed. By Silberschatz and Galvin

**MCS-C/P-208 : Computing Laboratory -2 (75 x2 = 150 lectures)**

**Instruction to faculty members and Question Setter for:**

**Mid Semester Practical Examination (MSE):**

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each of 3 hours duration (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “**Best of Two**” shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).

**End Semester Practical Examination (ESE):**

The questions in practical examination will be of equal to 70 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.

**SEMESTER - 3**

**MCS-A-309 ( Image Processing & Pattern Recognition) (60 lectures + 15 tutorials)**

**[ Instruction to faculty members and Question Setter for:**

**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “**Best of Two**” shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).

**End Semester Examination (ESE):**There will be two groups of questions. **Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].**

**Introduction:**

Definition, Origins of Digital Image Processing, Applications, Fundamental Steps, Components, Mathematical Preliminaries (03 lectures)

**Digital Image Fundamentals:**

Image sensing and Acquisition, Image sampling and Quantization, Some basic relationships between pixels, Linear and Nonlinear Operations (04 lectures)

**Image Enhancement in Spatial Domain:**

Basic Gray Level Transformation, Histogram Processing, Enhancement using Basic

**Image Enhancement in Frequency Domain:**

Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation (05 lectures)

**Image Restoration:**

Restoration Process, Noise Models, Restoration in the Process of Noise Only- Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradations, Estimating Degradations, Inverse Filtering, Wiener Filtering, Constrained Least Square Filtering, Geometric Mean Filtering, Geometric Transformations (09 lectures)

**Colour Image Processing:**

Introduction, Colour Models, Pseudo Colour Image, Processing, Basics of Full-Colour Image Processing, Colour Transformations, Smoothing and Sharpening, Colour Segmentation, Noise, Compression (06 lectures)

**Image Compression:**

Introduction, Compression Models, Elements of Information Theory, Error Free Compression, Lossy Compression, Image Compression Standards (04 lectures)

**Image Segmentation:**

Detection of Discontinuity, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Use of Motion in segmentation (03 lectures)

**Implementation of Image Processing Operations Using MATLAB/ImageJ/SciLab:**

Introduction to Image Processing Functions, Implementation of different Image Processing Operations, Implementation of general HP and LP filters, Implementation of Special Filters like Inverse, CLS, Weiner etc. Colour Image Processing (06 lectures)

The nature of statistical pattern recognition; Three learning paradigms; The sub-problems of pattern recognition; The basic structure of a pattern recognition system; Comparing classifiers. Basic statistical issues; Sources of classification error; Bias and variance; Three approaches to classification: density estimation, regression and discriminant analysis; Bayes' decision theory - General framework; Optimal decisions; Classification; Simple performance bounds, Empirical error criteria; Optimization methods; Failure of MLE; Linear and quadratic discriminants; Shrinkage; Logistic classification; Generalized linear classifiers; Perceptrons; Maximum Margin; Error Correcting Codes; Sample error and true error; Error rate estimation; Confidence intervals; Resampling methods; Regularization; Model selection; Minimum description length; Comparing classifiers, Histograms rules; Nearest neighbor methods; Kernel approaches; Local polynomial fitting; Flexible metrics; Automatic kernels methods, Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR, Speech and speaker recognition, Character recognition, Scene analysis. (16 lectures)

**Text Books:**

1. Gonzalez and Woods, Digital Image Processing, Pearson
2. Soloman, Fundamentals of Digital Image Processing, Wiley
3. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
4. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
5. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

**MCS-A-309 (Algorithmic Graph Theory) (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

*Mid Semester Examination (MSE):*

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

*The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks).*

*End Semester Examination (ESE): There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Cut-sets and Cut-vertices, Connectivity and Separability, 1-Isomorphism and 2-Isomorphism. Planarity, Planarity - Testing Algorithms, Coloring, Partitioning, Independent set, Vertex Cover, Matching, Algorithms for Bipartite Matching and General Matching, Graph Enumeration. (25 lectures)

Different Types of Graphs: Intersection Graphs, Circular-arc Graphs, Interval Graphs, Line Graphs of Bipartite Graphs, Perfect Graphs, Permutation graphs, Chordal Graphs, p-Critical Graphs, Comparability Graphs, F-Graphs, Recognizing Triangulated Graphs, MCS Algorithm, PEG Testing Algorithm, Minimum Fill-In Computation, Optimization Algorithms on Triangulated Graphs - Chromatic Number Calculation, Algorithm to Construct G-decomposition, TRO Algorithm. (35 lectures)

**Text Books :**

1. Perfect Graph Algorithms, Columbia,
2. Introduction to Graph Theory, Douglas B. West, Pearson Education.
3. Graph Theory with Applications\_ to Engineering and Computer Science, Narsingh Deo, Prentice-Hall, India.

OR

**MCS-A-309 ( Parallel Algorithms) (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

*Mid Semester Examination (MSE):*

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “Best of Two” shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).

**End Semester Examination (ESE):** There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].

Introduction; Sequential Algorithms, Sequential Algorithm Vs. Parallel Algorithms, Nature of Parallel Algorithms. Parallel Algorithms with Parallel Computers, Need for Parallel Algorithms, Analyzing an Algorithm; Running time: Counting Steps, Bounds (Lower and Upper), Speedup Ratio, Numbers of Processors, Amdahl’s Law, Cost, Other measures, Area, Length, Period, Flynn’s Classification of Computer, SISD, SIMD, MISD, MIMD models. (10 lectures)

Parallel Selection; Introduction, Lower bound, rank, Linear Order, Selection, Complexity. Sequential Algorithm, Desirable Properties of Parallel Algorithms, Broadcasting a Datum and Example of Parallel selection algorithm. (07 lectures)

Parallel Merging: Introduction to Parallel Merging, A Network for parallel Merging, Merging on CREW Model: parallel merging and Sequential Merging, Merging on EREW model. (07 lectures)

Parallel Sorting; Introduction, A Network for Sorting, Sorting on a Linear Array, Sorting on the CRCW Model, Sorting CREW Model, Sorting on EREW Model. Case study. (06 lectures)

Parallel Searching: Introduction, Searching a Sorted Sequence, EREW Searching. CREW Searching, CRCW Searching, Searching a random Sequence, searching on SM SIMD Computers, EREW, ERCW, CREW, CRCW. Searching on a Tree, Searching on a Mesh. (12 lectures)

Parallel Matrix Operations: Introduction, Transposition, Matrix-by-Matrix Multiplication, Mesh Network, Cube Network, CRCW, Matrix by Vector Multiplication. (08 lectures)

Parallel Algorithms for Graph Theory: Introduction, Definitions, Computing the Connectivity Matrix, Finding Connected Components, All-pairs of shortest paths, Computing the minimum Spanning Tree. (10 lectures)

### **Text Books :**

- 1, Parallel Algorithms, Salim G Aid, PHI.
- 2, Introduction to Parallel Algorithms, S, Quinn, Addison Wesley.
- 3, Parallel Algorithms, Joseph Jaja.

**MCS-C-310 (Software Engineering) (60 lectures + 15 tutorials)**

**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks ).

**End Semester Examination (ESE):** There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Question No. 1(A) will be multiple type questions** consisting of six questions of 1 mark each. **Question No. 1(B) will be two short answer type of 4 marks.** **Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].**

**The Product :** Software, Software Myths, (02 lectures)

**The process :** Software engineering : A Layered Technology, Software Process Models, The linear sequential Model, The prototyping Model, The RAD Model, Evolutionary Software Process Models. (08 lectures)

**Software project planning :** Project planning objectives, Software scope, Decomposition Techniques, Estimation models, The Make/Buy Decision. (06 lectures)

**Risk analysis and Management :** Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation, monitoring, and management, Safety risks and hazards, (08 lectures)

**Project scheduling and technique :** Basic concept, Defining a task set for the software project, Defining a task Network, Scheduling, Earned value analysis. (08 lectures)

**Software Quality Assurance :** Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, Mistake Proofing for Software, Introduction to ISO standard. (11 lectures)

**Software Testing Technique :** Software testing fundamentals, Test case design, White-box Testing, Basis path testing, Control structure testing, Black-box testing, Testing for specialized environments, architectures and application. (11 lectures)

**Object-Oriented Analysis :**

Introduction to UML Diagrams, Use Case Diagrams, Class Diagrams, Collaboration Diagrams, Implementation Diagrams. (06 lectures)

**Text Books :**

1. R. G. Pressman - Practitioners Approach to Software Engineering, TMH
2. Rajib Mall - Software Engineering Fundamentals
3. Ghezzi, Software Engineering, PHI
4. Pankaj Jalote - An Integrated Approach to Software Engineering, NAROSA.
5. Object Oriented & Classical Software Engineering (Fifth Edition), SCHACH, TMH
6. Vans Vlet, Software Engineering, SPD
7. Uma, Essentials of Software Engineering, Jaico
8. Sommerville, Ian - Software Engineering, Pearson Education
9. Benmenachen, Software Quality, Vikas
10. G. Booch, "Object oriented Analysis and Design with Applications", Second Edition, Benjamin Cummings, 1994.

**MCS-C-311 ( Wireless Networks ) (60 lectures + 15 tutorials)**

**[ Instruction to faculty members and Question Setter for:**

**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. **“Best of Two”** shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).

**End Semester Examination (ESE):**There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Question No. 1(A) will be multiple type questions** consisting of six questions of 1 mark each. **Question No. 1(B) will be two short answer type** of 4 marks. **Group B will contain descriptive type eight questions** of fourteen marks each, out of which any four are to be answered].

Cellular Mobile Wireless Networks: Description of Cellular System, Evolution of cellular networks, Overview of Layer-1 functionalities. (08 lectures)

GSM Architecture and Protocols: Network Architecture, air interface, multiple access scheme, channel organization, NAS procedures. (09 lectures)

GPRS: Network Architecture, Classes of Operation, TBF procedure for channel assignment, NAS protocols for Session Management, PS-domain Mobility procedures. (09 lectures)

UMTS: Concept of WCDMA, network architecture, channel structure, enhancement of NAS procedures over GSM/GPRS, RJS and Mobility related RRM procedures. (09 lectures)

HSPA over UMTS: HSDPA and HSUPA architecture, HARQ operations, realization of variable data rates over shared channels. (08 lectures)

CS and PS services over cellular networks: Voice call, SMS, Packet call, supplementary services, introduction to AT commands set. (08 lectures)

WLAN: IEEE 802.11x standards, architecture, air interface, authentication, Wi-Fi.

Ad-Hoc Network Concepts: Mobility and routing issues, MANET, VANET. (09 lectures)

**Text Books :**

1. Wireless Network Evolution (2G to 3G), Garg, Pearson Education.
2. Mobile Communications, Jochen Schiller, Pearson.

**MCS-C/P -312 : Computing Laboratory – 3 ( 75 x 2= 150 lectures)**

**Instruction to faculty members and Question Setter for:**

**Mid Semester Practical Examination (MSE):**

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each of 3 hours duration (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. **“Best of Two”** shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).

**End Semester Practical Examination (ESE):**

The questions in practical examination will be of equal to 70 marks and will be of 3 hours duration.

*Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

## SEMESTER - 4

### MCS-E-413A (Artificial Intelligence) (60 lectures + 15 tutorials)

**[ Instruction to faculty members and Question Setter for:**

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

*The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).*

**End Semester Examination (ESE):** *There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Overview: foundations, scope, problems, and approaches of AI (04 lectures)

Problem-solving through Search; forward and backward, state-space models, blind, heuristic, problem-reduction, A, A\*, AO\*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications. (14 lectures)

Knowledge Representation and Reasoning: ontology, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications. (16 lectures)

Variable-based models: Constraints; constraint satisfaction problems, factor graphs, independence, variable elimination, Markov networks, Gibbs sampling, particle filtering, Generative; Markov models, Bayesian networks, HMMs. (14 lectures)

Machine learning; supervised learning, linear models, loss minimization, maximum likelihood, unsupervised learning, reinforcement learning. (06 lectures)

Logic: propositional logic, first-order logic (03 lectures)

Applications: Language, vision, Robotics. (03 lectures)

#### **Text Books :**

1. Artificial Intelligence; A Modern Approach, Stuart Russell & Peter Norvig, Prentice-Hall.
2. Artificial Intelligence, Third Edition, Patrick Henry Winston, Addison-Wesley

3. Introduction to Artificial Intelligence & Expert Systems, D. W. Patterson, PHI

4. Nils J. Nilsson, "Artificial Intelligence: A New Sythesis", Morgan-Kaufmann.

### **MCS-E- 413B: Web Technologies (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

*The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).*

**End Semester Examination (ESE):***There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

The Internet Client server software models, world wide web & web browsers, HTML building blocks, search engines. Advanced web page construction: Image file, JAVA scripts, applets, query and query refinements, software on internet, internet relay chat etc. Java language introduction, object references, instance variables, dot operator constructors, Methods overloading, Inheritance, Exception handling Threads and Synchronization, utilities, I/O, Networking in Java, server socket, URLK, URL connection, Abstract Window, JDK. (26 lectures)

Web servers - IIS (XAMPP, LAMPP) and Tomcat Servers. Java Web Technologies- Servlets, JavaServer Pages, Java Server Faces, Web Technologies in Netbeans, Building a Web Application in Netbeans, JSF Components, Session Tracking, Cookies (18 lectures)

PHP- Basics, String Processing and Regular Expressions, Form Processing and Business Logic, Using Cookies, Dynamic Content, Operator Precedence Chart (08 lectures)

Database Connectivity with MySQL - Servlets, JSP, PHP. Case Studies- Student information system, Health Management System (08 lectures)

#### **Text Books:**

1. Elizabeth Castro, "HTML for the World Wide Web", Peachpit Press Pearson Education.
2. Lehnert Wendy, "Web 101, Making the network for you", Pearson Education, Asia.
3. Naughton Patrick, "The JAVA Hanbook", TataMcgraw Hill 1996.
4. Winston PH & Narsimhan, "On to JAVA 1.2", Addison Wesley.
5. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, "Internet & World Wide Web How to Program", Deitel series, 5th edition, 2012
6. Jason Gilmore, "Beginning PHP and MySQL From Novice to Professional", 4th Edition, Apress Publications, 2010
7. Robert W. Sebesta, "Programming with World Wide Web", Pearson, 4th edition, 2008



**MCS-E-413C : Advanced Database Management System (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

**Mid Semester Examination (MSE):**

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **multiple type questions** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks ).*

**End Semester Examination (ESE):***There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Introduction : Concept & Overview of DBMS, Concepts of Different Database Models, Database Languages, Functions of Database Administrator, Database Users, Three Schema architecture of DBMS. (08 lectures)

Relational Databases: Integrity Constraints revisited: Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes. (08 lectures)

Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information. (08 lectures)

Parallel and Distributed Databases: Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation. (12 lectures)

Advanced Transaction Processing: Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery. (12 lectures)

Deductive Databases: Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Object Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2. (12 lectures)

**Text Books :**

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, McGraw-Hill.
2. Raghu Ramakrishnan, Database Management Systems, WCB/McGraw-Hill.
3. Bipin Desai, An Introduction to Database Systems, Galgotia.
4. J. D. Ullman, Principles of Database Systems, Galgotia.
5. R. Elmasri and S. Navathe, Fundamentals of Database Systems, Addison-Wesley.
6. Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases. Addison-Wesley.

### **MCS-E- 414A: Cloud Computing (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks ).*

**End Semester Examination (ESE):** *There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Introduction to Cloud Computing : Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing (12 lectures)

Introduction to Cloud Technologies : Study of Hypervisors, Compare SOAP and REST, Webservices, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services (06 lectures)

Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization (03 lectures)

Multitenant software: Multi-entity support, Multi-schema approach, Multi tenance using cloud data stores, Data access control for enterprise applications (04 lectures)

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. (03 lectures)

Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce,

Cloud security : security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations-General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control Identity management, Access control, Autonomic Security  
 Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud. (10 lectures)

Issues in cloud computing: Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud (08 lectures)

Cloud computing platforms: Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, Open Nebula, Nimbus, T Platform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform. (06 lectures)

#### **Text Books :**

1. Mastering Cloud Computing, Rajkumar Buyya,Christian Vecchiola, Selvi
- 2.Cloud Computing Bible by Barrie Sosinsky, Wiley India
3. Enterprise Cloud Computing by Gautam Shroff,Cambridge
4. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
5. Cloud Security & Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill

#### **MCS-E414B : Software Testing and Reliability (60 lectures + 15 tutorials)**

*[ Instruction to faculty members and Question Setter for:*

##### ***Mid Semester Examination (MSE):***

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).*

***End Semester Examination (ESE):****There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].*

Evolving Role of Software, Software Characteristics, Software Applications. (02 lectures)

Software Engineering, Definitions of Software Engineering, The Serial or Linear Sequential Development Model, Iterative Development Model, The incremental Development Model, The Parallel or Concurrent Development Model, Hacking. (06 lectures)

Software Reliability: Introduction to Software Reliability, Software reliability metrics, Programming for Reliability- Fault avoidance, Fault tolerance; Software Reuse (04 lectures)

Introduction to Software Design, System Models-data -flow model, Semantic data models, Object models; Data Dictionaries, Software Design- The design process, Design Methods, Design description, Design strategies, Design quality; Architectural Design- System structuring, Control models, Modular decomposition, Domain-specific architectures. (08 lectures)

Software Testing: Basic Testing Vocabulary, Quality Assurance versus Quality Control, The Cost of Quality, Software Quality Factors, How Quality is Defined, Why Do We Test Software? What is a Defect? The Multiple Roles of the Software Tester(People Relationships), Scope of Testing, When Should Testing Occur? Testing Constraints, Life Cycle Testing, Independent Testing, What is a QA Process? Levels of Testing, The “V” Concept of Testing (10 lectures)

Software Testing Techniques: Software Testing Fundamental, Testing Principles, White Box Testing, Control Structure Testing, Black Box Testing, Boundary Value Analysis, Testing GUIs, Testing Documentation and Help Facilities. (04 lectures)

Software Testing Assurance: Verification and Validation- Validation Testing, Validation Test Criteria; Test Plan- Test Documentation; Test Strategies- Top-Down Testing, Bottom-Up Testing, Thread testing, Stress testing , Back-to-back testing; Principles of Testing, Testing methods and tools- Testing through reviews, Black-box testing (Functional testing), White box testing (glass-box testing), Testing software changes; Additional requirements in testing OO Systems, System Testing, Acceptance Testing, Regression testing , Metrics Collection, Computation, and Evaluation, Test and QA plan, Managing Testing Functions. (10 lectures)

Software Testing Strategies: Introduction to Software Testing Strategies, Organizing for software testing, Software Testing Strategy, Unit Testing- Unit Test Considerations; Topdown Integration, Bottom-up Integration (04 lectures)

Managing Change: Software Configuration Management, Change Management (02 lectures)

Risks - Risk Analysis and Management with examples (02 lectures)

Case Study: How to test web, stand alone and database applications - with examples.

Basics of automation testing - why, when and how to perform automation testing, Factors for choosing a particular tool, An overview for the major functional testing tools, Overview of Test management and bug tracking tools (06 lectures)

### **Text Books :**

1. R.S. Pressman, “Software Engineering”, Tata McGraw Hill Pub. Co., Delhi, 2000.
2. Ian Sommerville, “Software Engineering”, Pearson Education, Delhi, 2000.
3. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Narosa Publishing House,

4. J.D. McGregor and D.A. Sykes, A Practical Guide to Testing, Addison-Wesley, 2001.
5. Glenford J. Myers, The Art of Software Testing (2nd ed.), John Wiley, 2004.
6. D. Graham, E.V. Veenendaal, I. Evans and R. Black, Foundations of Software Testing, Thomson Learning, 2007.
7. N.S. Godbole, Software Quality Assurance: Principles and Practice, Narosa Publishing House, 2006
8. Daniel Galin, Quality Assurance: From theory to implementation, Pearson Education Ltd., 2004.
9. S.H. Kan, Metrics and Models in Software Quality Engineering (2nd ed.), Pearson Education Inc., 2003.
10. Behforooz, Software Engineering Fundamentals, OUP
11. Peters and Pedrycz, "Software Engineering: an Engineering Approach", Wiley
12. Benmenachen, Software Quality, Vikas
13. Ghezzi, Software Engineering, PHI

#### **MCS-E-414C : Cryptography & Network Security (60 lectures + 15 tutorials)**

##### ***[ Instruction to faculty members and Question Setter for:***

##### ***Mid Semester Examination (MSE):***

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

*(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks ).*

***End Semester Examination (ESE): There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].***

Concepts and Terminology: (06 lectures)

Threats, Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Spoofing, Sniffing, Firewall.

Cryptography: (04 lectures)

Techniques, Mathematical foundation, Stream Ciphers, Block Ciphers, Cryptanalysis, Hash Algorithms.

Secret Key Cryptography: (06 lectures)

Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

Hash Functions and Message Digests: (07 lectures)

Length of hash, uses, algorithms (MD2, MD4, MD5, SHA) MD2: Algorithm (Padding,

checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages.

Public key Cryptography: (06 lectures)

Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

Authentication: (10 lectures)

Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter-domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

Security Policies and Security Handshake Pitfalls: (07 lectures)

What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

Network Security: (06 lectures)

Electronic mail security, IP security, Network management security.

Security for electronic commerce: E-commerce security analysis, protocol, SSL, SET System Security: (08 lectures)

Intruders and Viruses, Firewalls, Intrusion Detection. Case Studies ,Web threats, E-mail threats, Domain controller threats, Extranet and VPN threats. Assignment and Project work.

#### **Text Books:**

1. Atul Kahate, Cryptography and Network Security, McGraw Hill
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002
3. Stallings, W., Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR., 2003
4. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000
5. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan
6. Information Security Intelligence Cryptographic Principles and App. Calabrese Thomson
7. D. P. Nagpal, Information Security, S. Chand Complany Limited
8. Securing A Wireless Network, Chris Hurley SPD.

#### **MCS-C-415 : Big Data and Analytics (60 lectures + 15 tutorials)**

**[ Instruction to faculty members and Question Setter for:**

**Mid Semester Examination (MSE):**

*There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of multiple type questions consisting of 1 mark each. Group B will contain descriptive type five questions of five marks each, out of which any three are to be answered.*

*The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "Best of Two" shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks ).

**End Semester Examination (ESE):** There will be two groups of questions. Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each. Question No. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered].

Introduction to big data: Introduction, distributed file system, Big Data and its importance, Drivers, Big data analytics, Big data applications. Algorithms, Matrix-Vector, Multiplication by Map Reduce. (08 lectures)

Introduction to HADOOP: Big Data, Apache Hadoop & Hadoop Ecosystem, Moving Data in and out of Hadoop, Understanding inputs and outputs of MapReduce, Data Serialization. (06 lectures)

HADOOP Architecture: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce Paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup - SSH & Hadoop Configuration - HDFS Administering - Monitoring & Maintenance. (10 lectures)

HADOOP ecosystem and yarn: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN. (08 lectures)

Introduction to Python : History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements & Looping If, If- else, Nested if-else For, While, Nested loops Break, Continue, Pass, String Manipulation Accessing Strings Basic Operations String slices Function and Methods (08 lectures)

Lists, Tuple and Dictionaries Lists - Introduction, Accessing list, Operations, Working with lists, Function and Methods Tuple - Introduction, Accessing tuples, Operations, Working, Functions and Methods Dictionaries - Introduction, Accessing values in dictionaries, working with dictionaries, Properties, Functions, Defining a function calling a function Types of functions Function Arguments Anonymous functions Global and local variables, Modules Importing module Math module Random module Packages Composition (10 lectures)

Input-Output Printing on screen Reading data from keyboard Opening and closing file Reading and writing files Functions (03 lectures)

Regular expressions Match function Search function Matching VS Searching Modifiers Patterns (03 lectures)

CGI Introduction Architecture CGI environment variable GET and POST methods, Cookies File upload Database Introduction Connections Executing queries Transactions Handling error (04 lectures)

#### **Text Books:**

1. Boris Lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

2. Chris Eaton, Dirk deRoos et al. "Understanding Big data ", McGraw Hill, 2012.
3. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.
4. Map Reduce Design Patterns (Building Effective Algorithms & Analytics for Hadoop) by Donald Miner & Adam Shook
5. Dive into Python by Mark Pilgrim
6. Programming Python by Mark Lutz, O'Reilly Media
7. Python Programming: An Introduction to Computer Science" by John Zelle

### **MCS- D – 416 : DISSERTATION (150 lectures)**

**\*Dissertation/Project:** Evaluation of project dissertation work may be as per the following guidelines:

- **Mid-Semester/Internal Assessment Examination** = 30 marks (**Annexure-1**)
- **End Semester Examination:** Project model (if any) and the Project record notebook, Project presentation and viva-voce = 70 marks  
(Jointly conducted by One External & One Internal Examiners)

**Overall project dissertation may be evaluated under the following heads:**

- Motivation for the choice of topic
- Project dissertation design
- Methodology and Content depth
- Results and Discussion
- Future Scope & References
- Participation in Internship programme with reputed organization
- Application of Research technique in Data collection
- Report Presentation
- Presentation style
- Viva-voce

#### **Annexure-1**

### **Paper Code: MCS –D - 416**

#### **Research Methodology (Common for All Faculties)**

**M.A./M.Sc./M.Com. Courses  
Semester-IV**

**Mid Semester Examination (MSE):** There will be **two** groups of questions in written examinations of **30 marks**. **Group A is compulsory** and will contain ten questions of **multiple type questions** consisting of **1 mark** each. **Group B** will contain **descriptive type eight questions** of **five** marks each, out of which any **four** are to be answered.



**Introduction of Research Methodology:** Meaning of Research, Objectives of Research, Research Methods

**Types of Research:** Descriptive vs. Analytical Research, Applied vs. Fundamental Research, Quantitative vs. Qualitative Research, Conceptual vs. Empirical Research

**Research Process:** Basic Overview; Literature Review; Formulating the Research Problem, Hypothesis, Research Questions, Research Methodology

**Data Collection:** Primary and Secondary Data, Sampling Method, Observation Method, Interview Method, Questionnaires, Case Study Method, Historical Method, Processing and Analysis of Data, Interpretation of Data/Results, Conclusions/Findings.

**Research Writing:** Synopsis, Article/Research Paper, Research Project, Thesis, Dissertation, Book, Book-Review, Case Review, Criteria of Good Research, Plagiarism

**Citation Style & Methods:** MLA, APA, Foot Note, Text Note, End Note, Footnotes, Bibliography, References

**Reference Books:**

- a) Best and Kahn, Research Methodology, PHI Limited.
- b) Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher

**Annexure-2**

**Format of question Paper of Mid-Semester Theory Examination**



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**Binod Bihari Mahto Koyalanchal University, Dhanbad**  
**Mid-Semester Examination xxxx (Session: xxxx-xx)**

**Subject/Code:**

Full Marks: 20

Pass Marks: 08

Time: 1.5 Hours

**General Instructions:**

Candidates are required to give their answers in their own words as far as practicable.  
The Questions are of equal value.

**Answer any five questions of the following in which Q.1 is compulsory.**

**Group A**

**1. Multiple Choice Questions**

**(1x5=05)**

- (i) ..
- (ii) ..
- (iii) ..
- (iv) ..
- (v) ..

**Group B**

(Descriptive answer type questions)  
Answer any three of the following.

34

(5x3=15)

2.           ..
3.           ..
4.           ..
5.           ..
6.           ..

x  
.....  
-----  
.....

**Note:** The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. “**Best of Two**” shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks ).

### Format of question Paper of End-Semester Theory Examination



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**Binod Bihari Mahto Koyalanchal University, Dhanbad**

**End-Semester Examination xxxx (Session: xxxx-xx)**

**Subject/Code:**

Full Marks: 70

Pass Marks: 28

Time: 3Hours

**General Instructions:**

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

**Answer any five questions of the following in which Q.1 is compulsory.**

**Group A**

1. (A) Multiple Choice Questions

(1x6=06)

(i)

..

(ii)

..

- (iii)                   ...
- (iv)                    ..
- (v)                     ..
- (vi)                    ..

(B) Short answer type questions

(4x2=08)

- (a)                   ..
- (b)                   ..

**Group B**

(Long answer type questions)

Answer any four of the following.

(14x4=56)

2. ..
3. ..
4. ..
5. ..
6. ..
7. ..
8. ..

9. Short notes type questions

(7x2=14)

- (a)                   ..
- (b)                   ..
- (c)                   ..
- (d)                   ..

X  
.....  
.....