Regulations and Syllabi

Of

Master of Computer Applications

(Self- Supporting)

MCA DEPARTMENT

Outcome Based Education

ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

Re-Accredited with 'A' Grade Status by NAAC

College with Potential for Excellence by the UGC

(Effective from the academic year 2019-2020)

OBJECTIVES OF THE MASTER'S PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

MCA Programme will produce post graduates who will be able to:

PEO 1: Professional Upgradation
Graduates will have successful academic career growth to excel in the IT profession by offering concrete technical foundations in the field of computer applications.

PEO 2: Research & Innovation
Graduates will have the cognitive ability to choose the research domain to pursue lifelong learning.

PEO 3: Managerial Skills
Graduate will have employment in public and private sectors and resolve economic, social and environmental needs.

PEO 4: Communication Efficacy:
To prepare the students to communicate and function effectively as an individual or as a team member.

1. ELIGIBILITY FOR ADMISSION

Candidate who have passed the under-mentioned degree examinations of University of Madras or an examination of other institution recognized by this University as equivalent there to provided they have undergone the course under 10+2+3 or 11+1+3 or 11+2+2 pattern shall be eligible for admission to the M.C.A. Degree Course under CBCS.

(a) B.C.A/B.E.S/B.Sc. in Computer Science/Mathematics/Physics/ Statistics / Applied Sciences (OR)
(b) B.Com / Bachelor of Bank Management/B.B.A/B.L.M/B.A Corporate Secretaryship / B.A. Economics/ any other Bachelor's Degree in any discipline with Business Mathematics and Statistics or Mathematics/Statistics in Main/Allied level (OR)
(c) B.Sc., Chemistry with Mathematics and Physics as allied subjects (OR)
(d) B.E/B.Tech/M.B.A (OR)
(e) A Bachelor's Degree in any discipline with Mathematics as one of the subjects at the Higher Secondary level (i.e. in +2 level of the 10+2 pattern).

Candidates should have appeared for TANCET.

2. DURATION OF THE COURSE

The course duration shall be three years consisting of six semesters. In order to be eligible for the award of the degree the candidate shall successfully complete the course in a maximum period of five years reckoned from the date of enrolment for the first semester of the course.

3. ELIGIBILITY FOR THE AWARD OF DEGREE (REGULAR)

A candidate shall be eligible for the award of the Degree of Master of Computer Applications only if she has undergone the prescribed courses of study in the Ethiraj College for Women (Autonomous) affiliated to the University of Madras for a period

of three academic years and passed the examinations of all the six semesters and fulfilled such conditions as have prescribed therefore.

4. PROVISION FOR LATERAL ENTRY

Students who have completed Bachelor's degree, of minimum of 3 years in B.C.A/B.Sc. (Computer Science) with mathematics as a course at 10+2 level or at graduate level shall alone be eligible for admission to second year M.C.A course (Lateral Entry) up to a maximum of **20%** of sanctioned intake which will be treated supernumerary intake of the approved intake.

Candidates should have appeared for TANCET.

5. PASSING MINIMUM

A minimum of **50%** marks taken as an aggregate of CIA and EE of the course is prescribed for a **PASS**. A candidate who has not secured a minimum of **50%** of the maximum marks **(aggregate of CIA: 40 and EE: 60)** in a course shall be deemed to have failed in that course. A candidate who successfully completes the course and passes the examinations of all the six semesters prescribed as per the syllabus earning a minimum of **144** credits shall be declared to have qualified for the degree, provided the whole course has been completed within a maximum period as prescribed and permissible by the College.

PROGRAMME OUTCOMES (PO)

The post graduates are able to:

PO1: **Computational Knowledge:** Acquire in-depth insight into the recent technologies and integrate with existing knowledge thereby stimulating thrust to think 'out of the box' in wider and global perspective.

PO2: **Problem Analysis:** Analyze and design Information and Communication Technology applications to build solutions for real-time problems and necessities.

PO3: **Conduct Investigation of Complex problems:** Find the probability of optimal utilization of the developed product and the feasible study over the size and scope of the future demand.

PO4: **Design and Development:** Design and develop a solution for recent research trends and real-time problems.

PO5: **Modern Tools Usage:** Create/Select the appropriate recent research trend tools to demonstrate or to simulate the technical test beds for the better clarity to reach out the further move towards academic excellence.

PO6: Communication: Communicate effectively on ICT activities with the academic community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive instructions with at most clarity.

PO7: Individual and Teamwork: Cultivate and impart the skills to work as an individual and as a team in proposing solutions to cater the business and research requirements.

PO8:Life-long learning: Incline for independent life-long learning.

PO9: Creativity and Entrepreneurship: Search for opportunities in the field of Entrepreneurship to create and add value for the progress of an individual and society.

PO10: Social Responsibility: Knowing the risks and threats involved in the cyber access and deriving the possible precautionary and preventing measures.

PROGRAMME SPECIFIC OUTCOMES (PSO)

After completing the course, the post graduate students will be able to,

PSO1: Accomplish both technical and non-technical skills in developing algorithms and implement them in high level languages to deploy and promote them for innovative software solutions

PSO2: Excel in managerial and leadership skills and recognize the need of lifelong learning to adapt themselves with ease to new technologies

PSO3: Analyze real life problems, design computing solutions appropriately that are technically sound, economically feasible and socially acceptable

PSO4: Develop professional ethics in utilizing modern computer technologies, environments, and platforms in creating innovative career paths towards the technological growth

PSO5: Impart strong technical foundation to the students in pursuing research thereby contributing technical upgradations to the society.

6. CLASSIFICATION AND RANKING OF SUCCESSFUL CANDIDATES

a. Successful candidates securing not less than **75%** in the aggregate of the marks prescribed for the course shall be declared to have qualified for the Degree in **First Class with Distinction** provided they pass all the examinations prescribed for the course as well as the project work in the First appearance.

b. Successful candidates securing not less than **60%** in the aggregate of the marks prescribed for the course shall be declared to have qualified for the Degree in **First Class.**

c. All other successful candidates shall declare to have passed the examination in the **Second Class**.

d. Only those candidates who have passed all the papers including practical and project work in the first appearance shall be considered for the purpose of **RANKING.**

e. The candidates admitted in the lateral entry system shall not be considered for Ranking. However, those candidates shall be considered for classification.

7. COMPONENTS OF THE MASTERS PROGRAMME

The Master's Programme has three components. They are Core Courses, Extra Disciplinary courses, Elective Courses and Soft Skill Courses. Each course carries a credit depending upon the content. Students have to earn **144** credits comprising of Core, Elective, Extra Disciplinary and Soft Skill Courses.

S.NO	Course	Credits
1	Core: Theory Practical	**4** **2**
2	Elective and Extra Disciplinary Course	**3**
3	Summer Project Internship	**2** **2**
4	Major Project and Viva-voce	**15**
5	Soft Skill Course	**2**
6	Self-Study Course	**2**

COURSE PROFILE

Course Code	Course Title	Hrs/ Wk	Credit	CA	End Sem	Total
SEMESTER I						
MCA18/1C/DCF	Digital Computer Fundamentals	4	4	40	60	100
MCA18/1C/DSS	Data Structures	4	4	40	60	100
MCA18/1C/PSP	Problem Solving and Programming	4	4	40	60	100
MCA18/1C/SEG	Software Engineering	4	4	40	60	100
MCA18/1ED1/MFC	Mathematical Foundations of Computer Science	3	3	40	60	100
MCA18/1P1/DSS	Computer Laboratory- I: Data Structures	5	2	40	60	100
MCA18/1S1/PET	Personality Enrichment	3	2	-	100	100
	Total Credits		**23**			
SEMESTER II						
MCA18/2C/CAM	Computer Architecture and Microprocessors	4	4	40	60	100
MCA18/2C/OSS	Operating Systems	4	4	40	60	100
MCA18/2C/DAA	Design and Analysis of Algorithms	4	4	40	60	100
MCA18/2C/PIC	Programming in C++	4	4	40	60	100
MCA18/2C/DMS	Database Management Systems	4	4	40	60	100
MCA18/2P2/DAA	Computer Laboratory – II: Design and Analysis of Algorithms	5	2	40	60	100
MCA18/2P3/DMS	Computer Laboratory -III: Database Management Systems	5	2	40	60	100
MCA18/2P4/SPT	Computer Laboratory -IV: Summer Project	-	2	40	60	100
MCA18/2S2/FFB	French for Beginners	3	2	-	-	100
	Total Credits		**28**			
SEMESTER III						
MCA18/3C/CNS	Computer Networks	4	4	40	60	100
MCA18/3C/PIJ	Programming in Java	4	4	40	60	100
MCA18/3C/STG	Software Testing	4	4	40	60	100
MCA18/3E1/SAD MCA18/3E1/SPM MCA18/3E1/CDN	**Elective I:** • System Analysis and Design • Software Project Management • Compiler Design	3	3	40	60	100
MCA18/3ED2/MCE	M-Commerce	3	3	40	60	100
MCA18/3P5/PIJ	Computer Laboratory – V: Programming in Java	5	2	40	60	100

MCA18/3P6/STG	Computer Laboratory – VI: Software Testing	5	2	40	60	100
MCA18/3S3/BCNA MCA18/3S3/BCNB MCA18/3S3/BCNC	Business Communication - Vantage Business Communication - Preliminary Business Communication – Basic	2	2	-	-	100
	Total Credits		**24**			
SEMESTER IV						
MCA18/4C/DWM	Data Warehousing and Mining	4	4	40	60	100
MCA18/4C/VNP	Visual .Net Programming	4	4	40	60	100
MCA18/4C/CNS	Cryptography and Network Security	4	4	40	60	100
MCA18/4C/PPG	Python Programming	4	4	40	60	100
MCA18/4E2/AFM MCA18/4E2/STS MCA18/4E2/RMT	**Elective II:** • Accounting and Financial Management • Statistical Methods • Resource Management Techniques	3	3	40	60	100
MCA18/4P7/VNP	Computer Laboratory – VII: Visual .Net Programming	5	2	40	60	100
MCA18/4P8/PPG	Computer Laboratory – VIII: Python Programming	5	2	40	60	100
MCA18/4P9/INP	Computer Laboratory – IX: Internship	-	2	-	-	100
MCA18/4S4/TSR	Technical Seminar and Report Writing	3	2	-	-	100
	Total Credits		**27**			
SEMESTER V						
MCA18/5C/AJP	Advanced Java Programming	4	4	40	60	100
MCA18/5C/MLG	Machine Learning	4	4	40	60	100
MCA18/5E3/CCG MCA18/5E3/MCG MCA18/5E3/AIE	**Elective III:** • Cloud Computing • Mobile Computing • Artificial Intelligence	3	3	40	60	100
MCA18/5E4/DIP MCA18/5E4/BDA MCA18/5E4/IOT	**Elective IV:** • Digital Image Processing • Big Data Analytics • Internet of Things	3	3	40	60	100
MCA18/5ED3/OBR	Organizational Behavior	4	3	40	60	100
MCA18/5P10/AJP	Computer Laboratory – X: Advanced Java Programming	5	2	40	60	100

MCA18/5P11/MLG	Computer Laboratory – XI: Machine Learning	5	2	40	60	100
MCA18/5P12/MPT	Computer Laboratory – XII: Mini Project	5	2	40	60	100
MCA18/5S5/QAE	Quantitative Aptitude	3	2	-	-	100
***Self Study Course (extra credit)**	Any NPTEL/SWAYAM/ MOOC course	-	2	-	-	-
	Total Credits		**25**			
SEMESTER VI						
MCA18/6S6/ESD	Entrepreneurial Skill Development	3	2	-	-	100
MCA18/6P13/MPV	Computer Laboratory XIII: Major Project and Viva Voce	-	15	80	120	200
	Total Credits		**17**			
	Overall Credits		**144**			

(Summer Project and Internship were carried out during summer vacation for the period of 6 to 8 weeks and will be evaluated in the subsequent semesters).

*** In the Self Study course, students can take up any NPTEL/SWAYAM/MOOC courses according to their area of interest to earn an extra credit 2.**

ELECTIVE COURSES:

Elective I:

- System Analysis and Design
- Software Project Management
- Compiler Design

Elective II:

- Accounting and Financial Management
- Statistical Methods
- Resource Management Techniques

Elective III:

- Cloud Computing
- Mobile Computing
- Artificial Intelligence

Elective IV:

- Digital Image Processing
- Big Data Analytics
- Internet of Things

SOFT SKILL COURSES

1. Personality Enrichment
2. French for Beginners
3. Business English Communication
4. Technical Seminar and Report Writing
5. Quantitative Aptitude
6. Entrepreneurial Skill Development

SELF-STUDY COURSE (Extra Credit Course)

During Semester V, students are encouraged to pursue an additional self-study course which can be any **NPTEL/ SWAYAM/ MOOC** Course to earn an extra **2** credits subject to the approval from the Departmental Committee comprising 3 senior faculty members.

10. EXAMINATION AND EVALUATION

10.1. Evaluation pattern of both Theory and Laboratory courses

Evaluation shall be done on a continuous basis. There shall be **two Tests for two hours** duration (Continuous Internal Assessment Test) and **one External Examination for three hours** duration in each course during each semester. Continuous Assessment will be evaluated by one or more participatory tools such as Test, Assignment/Seminar, Participation Learning and Laboratory activities etc., whichever would be suitable to the course.

Distribution of marks in CIA for Theory Courses:

Test	Duration	Max. Marks	CA Final Marks
I	2 Hours	40	10
II	2 Hours	40	10
		Assignment	10
		Seminar / Participatory Learning	10
		Total	40

Distribution of marks in CIA for Practical Courses:

Test	Duration	Max. Marks	CA Final Marks
I	2 Hours	40	10
II	2 Hours	40	10
		Model Exam	10
		Record	5
		Lab Activities	5
		Total	40

Distribution of marks to CIA and EE:

I. THEORY COURSES:

Maximum Marks (CIA + EE)	: 100 Marks
Continuous Internal Assessment(CIA)	: 40 Marks
External Evaluation (EE)	: 60 Marks

II. COMPUTER LABORATORY EXAMINATION

Duration	: 3 Hrs
Maximum for Lab Course	: 100 Marks
Continuous Internal Assessment(CIA)	: 40 Marks
Passing Minimum in CIA	: 20 Marks
External Examination*	: 100 Marks
***Double valuation by Internal and External Examiner**	
Passing Minimum in EE	: 50 Marks
(Max. Marks: 100 to be converted to 60)	

III. MINI PROJECT, SUMMER PROJECT AND INTERNSHIP

Maximum Marks (CIA+EE)	: 100 Marks
Continuous Internal Assessment(CIA)	: 40 Marks
External Examination	: 100 Marks
Max. Marks: 100 to be converted to 60	
Final Marks: Internal + External Marks	: 100 Marks

IV. MAJOR PROJECT

Maximum Marks (CIA+EE)	: 200 Marks
Continuous Internal Assessment(CIA)	: 80 Marks
External Examination	: 120 Marks
Final Marks: Internal + External Marks	: 200 Marks

10.2 Examiners for the conduct of Laboratory Examinations

For the conduct of Computer Laboratory Examinations, the Controller of Examinations of the College will appoint one external examiner, one internal examiner who shall normally be the Faculty-in-Charge of the Computer Laboratory Course. The examiners will conduct the examinations and award the marks on the same day and forward the Mark List to the Controller of Examinations of the College.

There will be one question with or without subsections to be asked for the practical examination. Every question should be chosen from the question bank prepared by the examiner(s). i.e., each question may be repeated thrice in the same batch.

10.3. Distribution of Marks in the evaluation of Lab courses/Mini Project/Summer Project/ Internship/Major Project during External Examination.

10.3.1 Distribution of Marks in the evaluation of Lab courses

Logical Thinking Skill (Flow chart / Algorithm)	: 20 Marks
Coding Skill (writing syntax error free codes)	: 20 Marks
Debugging Skill (Entering, Debugging errors and Compilation)	: 20 Marks
Neatness in Presentation of the Output	: 20 Marks
Record Note Book	: 20 Marks

TOTAL: 100 Marks

10.3.2 DISTRIBUTION OF MARKS IN THE EVALUATION OF MINI PROJECT/SUMMER PROJECT/INTERNSHIP

Dissertation	**Internal**	**External**
Problem for study	4 Marks	8 Marks
Knowledge in the System Requirement Specification	4 Marks	8 Marks
Development of Extra skill in the chosen software	4 Marks	8 Marks
Scientific writing capability	4 Marks	8 Marks
Implementation of the developed System	4 Marks	8 Marks
TOTAL	**20 Marks**	**40 Marks**

Viva-voce	**Internal**	**External**
Preparation of the Presentation (OHP/LCD etc.,)	10 Marks	30 Marks
Defense capability in oral examination	10 Marks	30 Marks
TOTAL	**20 Marks**	**60 Marks**

Total Internal Marks: 40; Total External Marks: 100 **(to be converted to 60);**
Final Marks: Internal + External Marks

10.3.3 DISTRIBUTION OF MARKS IN THE EVALUATION OF MAJOR PROJECT AND VIVA VOCE

Dissertation	**Internal**	**External**
Problem for study	8 Marks	16 Marks
Knowledge in the System Requirement Specification	8 Marks	16 Marks
Development of Extra skill in the chosen software	8 Marks	16 Marks
Scientific writing capability	8 Marks	16 Marks
Implementation of the developed System	8 Marks	16 Marks
TOTAL	**40 Marks**	**80 Marks**

Viva-voce	**Internal**	**External**
Preparation of the Presentation (OHP/LCD etc.,)	20 Marks	20 Marks
Defense capability in oral examination	20 Marks	20 Marks
TOTAL	**40 Marks**	**40 Marks**

Total Internal Marks: 80; Total External Marks: 120;
Final Marks: Internal +External Marks.

10.3.4 DISTRIBUTION OF MARKS IN THE EVALUATION OF TECHNICAL SEMINAR AND REPORT WRITING

Every student should submit a final paper as per project specifications along with all short review reports (**at least 5 internal reviews**) and corresponding evaluation comments to the concerned staff members.

Choice of subject and Review of Literature	: 20 marks
Organization and Interpretation	: 20 marks
Report Writing	: 20 marks
Project Presentation	: 20 marks
Viva-Voce	: 20 marks
Total	**: 100 marks**

10.3.5 SOFT SKILL COURSES

Maximum Marks : 100 Marks

Written Examination for 3 Hours duration at the end of the semester

(Internal valuation only)

11. QUESTION PAPER PATTERN

A. WRITTEN EXAMINATION: CORE, ELECTIVE AND EXTRA DISCIPLINARY COURSES

KNOWLEDGE LEVEL (as per revised Bloom's Taxonomy)	Maximum **: 100 Marks;** Passing Minimum **: 50 Marks;** Duration**: 3 Hrs.**
K1, K2 **(REMEMBERING & UNDERSTANDING)**	**PART –A (10 X 2 = 20 Marks)** Answer **ALL Questions** (Each question carries **2Marks**) 1,2 Question from Unit I 3,4 Question from Unit II 5,6 Question from Unit III 7,8 Question from Unit IV 9,10 Question from Unit V
K2, K3 **(UNDERSTANDING & APPLYING)**	**PART-B (5X 6 = 30 Marks)** Answer any **FIVE** questions out of SEVEN questions (Each question carries **6 Marks**) 11. Question from Unit I 12. Question from Unit II 13. Question from Unit III 14. Question from Unit IV 15. Question from Unit V 16. Question from Unit I/II/III/IV/V(based on the complexity) 17. Question from Unit I/II/III/IV/V(based on the complexity)
K4,K5 **(ANALYZING & EVALUATING)**	**PART-C (5 X 10 = 50 Marks)** Answer **ALL** Questions (Each question carries **10 marks**) 18. a Question from Unit I (Or) b. Question from Unit I 19. a. Question from Unit II (Or) b. Question from Unit II 20.a. Question from Unit III (Or) b. Question from Unit III 21.a. Question from Unit IV (Or) b. Question from Unit IV 22.a. Question from Unit V (Or) b. Question from Unit V

Question papers should be set for maximum of 100 marks and the answer scripts should be evaluated for the same. **The awarded marks should be converted to 60 Marks.**

12. FORMAT FOR THE PREPARATION OF RECORD/PROJECT WORK

12.1 Record of Laboratory work in the case of Programming exercises

(a) Aim
(b) Flowchart and/or Algorithm
(c) Source Code
(d) Printout(s)
(e) Result.

12.2 Format for the Project Work

(a) Title page
(b) Bonafide Certificate
(c) Acknowledgement
(d) Table of contents
(e) Summary of content
(f) Chapter-wise report
(g) References
(h) Appendices, if any

12.3 Format of the Title Page

TITLE OF THE PROJECT

A project report
Submitted in partial fulfillment for
the award of the Degree of
Master of Computer Applications

by

Candidate's name (Register Number)

Under the guidance of
Guide's name

Name of the Department
College Name
Month and Year

12.4 Format of the Certificate

For Dissertation	For Laboratory Records

CERTIFICATE This is to certify that the technical report entitled **"TITLE OF THE PROJECT"** being submitted to the Ethiraj College for Women,(Autonomous). affiliated to the University of Madras, Chennai by Candidate's name (Reg. No:) In partial fulfillment for the award of the Degree of **Master of Computer Applications** is a bona fide record of work carried out by her under my guidance and supervision Date: Signature Signature of the Place: of the Guide HOD Submitted for the viva-voce examination at..... ..... on ..... Examiner-1: ..... (Signature and Name of the Examiner) Examiner-2: ..... (Signature and Name of the Examiner)	**CERTIFICATE** This is to certify that this is the bonafide record of work carried out under my supervision in the Computer Laboratory Course: **"TITLE OF THE LABORATORY COURSE"** submitted to the Ethiraj College for Women,(Autonomous). affiliated to the University of Madras, Chennai by Candidate's name (Reg. No:) as a part of Course work leading to the award of the Degree of **Master of Computer Applications** Date: Signature Signature of the Place: of the Faculty HOD Submitted for Laboratory Examination at..... ..... on ..... Examiner-1: ..... (Signature and Name of the Examiner) Examiner-2: ..... (Signature and Name of the Examiner)

12. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

Candidates shall register their names for the First Semester Examination after the admission in the Master's Programme. Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester examinations subject to the condition that the candidates should register for all the arrear courses of earlier semesters along with current (subsequent) semester courses. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed therefore by the College from time to time.

"Provided in the case of candidate earning not less than 50% of attendance in any one of the semesters due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the College from time to time".

COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2018, for students who are admitted to the first year of the course during the academic year 2018 and thereafter.

TRANSITORY PROVISION

Candidates who were admitted to the course of study in 2018 under this Master's Programme shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of March/April 2018. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

SEMESTER I

DIGITAL COMPUTER FUNDAMENTALS

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/1C/DCF**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Identify various number systems and work with Boolean algebra.
2. Realize various logic gates and their implementations.
3. Simplify the Boolean expression using K -Map and Tabulation techniques
4. Analyze various types of flip flops used for designing registers and Counters.
5. Understand the Register transfer logic and Micro operations.

COURSE OUTLINE:

UNIT I: Number system: converting numbers from one base to another-complements-Binary Codes -Binary storage and registers- Binary Logic- Integrated Circuits Boolean Algebra- Boolean Functions-Canonical and standard forms- Other Logic operations-Digital Logic gates. **12hrs**

UNIT II: Simplification of Boolean Functions: K-map method Simplification- Product of Sums- NAND NOR implementation- Don't Care Conditions - The Tabulation method.

12hrs

UNIT III: Combinational Logic: Introduction - Design Procedures - Adders-Sub tractors-Code Conversion- Multilevel NAND NOR circuits- XOR and Equivalence function- Binary Parallel Adder- Decimal Adder- Decoders- Multiplexers.

12hrs

UNIT IV: Sequential Logic: Flip flops- Triggering of Flip Flops- Clocked Sequential Circuits- Design of Counters- Registers- Shift Registers- Ripple Counters and Synchronous Counters. **12hrs**

UNIT V: Register Transfer Logic: Introduction- Inter register Transfer- Shift Micro Operations- Conditional Control Statement- Fixed point binary Data- Overflow- Arithmetic Shifts- Decimal Data- Floating point Data- Non numeric Data- Instruction Codes- Design of Arithmetic and Logic Unit. **12hrs**

RECOMMENDED TEXTBOOKS:

1. Morris Mano, Digital Logic and Computer Design, PHI, Sixth Edition 2013.
2. M.M. Mano and C. R. Kime, Logic and Design Fundamentals, Pearson Education, Fifth Edition, 2015.

REFERENCE BOOKS:

1. Thomas Bartee, Digital Logic Fundamentals, 6th Edition, Tata McGraw Hill, 2015.
2. K. Shashidhar, Digital & Computer Fundamentals, Sapna Book House, 2014.
3. A. Anand Kumar, Fundamentals of Digital Circuits, PHI, Fourth Edition 2014.

JOURNALS:

1. https://digital-library.theiet.org/content/journals/iet-cdt
2. https://www.elsevier.com/books/an-introduction-to-digital-computing/george/978-0-08-011280-0

E-LEARNING RESOURCES:

1. https://www.oreilly.com/library/view/fundamentals-of-digital/9781118969504/9781118969504c01.xhtml
2. http://scanlibs.com/logic-computer-design-fundamental.
3. https://www.britannica.com/technology/digital-computer
4. https://www.scribd.com/doc/45720966/Digital-Electronics-Computer-Fundamentals-theory
5. https://learn.sparkfun.com/tutorials/digital-logic#boolean-logic-in-programming

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Gain a clear understanding of the concepts that underlie digital computer fundamentals along with logic circuits and implementations.
CO 2	Define key mechanisms and analyse different logic gates and their realizations.
CO 3	Correlate different Boolean expression simplification techniques and coordinate with its implementation.
CO 4	Understand the steps involved in designing flip-flops and counters
CO 5	Realize the possible micro operations that can be performed by means of Register Transfer Logic.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	3	3	2	2	2
CO 3	3	2	3	2	3
CO 4	3	3	3	2	2
CO 5	3	2	2	3	3
Average	**2.8**	**2.4**	**2.4**	**2.2**	**2.4**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of Logic Gates, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER I

DATA STRUCTURES

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/1C/DSS**

CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the role of Data structures in real time applications
2. Design and execute the various operations of Data structures
3. Create and usage of the doubly link list
4. Analyze and apply the Tree and Graph operations
5. Know about the sorting and searching techniques

COURSE OUTLINE:

UNIT I : Introduction, Basic Terminology, Data Structures, Data Structure Operations, Preliminaries – Algorithmic Notation, Complexity of Algorithms **10 Hrs**

UNIT II : Arrays, Records and Pointers – Introduction, Linear Arrays, Representation of Linear Arrays, Operations on Linear Arrays, Searching- Linear and Binary, Multidimensional Arrays, Pointer Arrays, Records, Representation of Records, Matrices and sparse Matrices. **10 Hrs**

UNIT III : Linked List – Representation, Traversing, Searching, Memory Allocation, Insertion into and Deletion Stacks, Application of Stacks, Queues and Recursion, Towers of Hanoi. **14 Hrs**

UNIT IV : Trees -Binary Trees, Representation of Binary Trees, Traversing, Binary Search Trees, Searching and Inserting and Deleting, Heap Sort, Huffman Algorithm. **13 Hrs**

UNIT V : Graphs, Representation, Shortest paths, Operations and traversing of Graphs, Sorting and Searching – Insertion Sort, Selection Sort, Merge Sort, Radix sort **13 Hrs**

RECOMMENDED TEXTBOOKS:

1. SeyMour Lipschutz ,Theory and Problems of Data Structures, Schaum's Outline Series,2016
2. A.V.Aho, J.D.Ullman, J.E.Hopcraft ,Data Structures and Algorithms, ,Wiley India,2014

REFERENCE BOOKS:

1. E.Horowitz, S.Sahni and Mehta,Fundamentals of Data structures,TMH,2015
2. Jean Paul Tremblay, Paul G.Sorenson, An Introduction to DataStructures with Applications ,TMH,1995.
3. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia,2013.
4. Reema Thareja, "Data Structures Using C", Oxford University Press, 2011.

JOURNALS:

1. http://journalspub.com/journalspub/JournalsDetails.aspx?jid=104

2. https://www.journals.elsevier.com/journal-of-computer-and-system-sciences

E-LEARNING RESOURCES:

1. http://cs-fundamentals.com/data-structures/introduction-to-data-structures.php
2. https://www.w3schools.in/data-structures-tutorial/data-structures-arrays/
3. https://www.cs.cmu.edu/~adamchik/15-121/lectures/LinkedLists/linkedlists.html
4. https://www.w3schools.in/data-structures-tutorial/sorting-techniques/
5 .https://www.cs.auckland.ac.nz/software/AlgAnim/searching.html

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Choose the Data structure to suit the given problem
CO 2	Understand ,implement the operations of linear data structures
CO 3	Design their own data structure according to the application need
CO 4	Apply the tree, graph operations in real time
CO 5	Develop any application using the data structures

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	2	2	2	2	2
CO 2	3	3	2	2	2
CO 3	3	2	3	2	2
CO 4	3	3	3	3	3
CO 5	3	2	2	2	3
Average	2.8	2.4	2.4	2.2	2.4

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY

Lecture by chalk and talk, learning through Demonstrations, LCD Projectors, e-content, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER I

PROBLEM SOLVING AND PROGRAMMING

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/1C/PSP**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Gain knowledge of implementing problem solving techniques using programming languages.
2. Understand the concepts and syntax of Programming language
3. Learn the basics of decision making and looping statements
4. Familiarize on the manipulation of strings, arrays, functions and categories of functions
5. Analyzing pointers, file management in C and customizing I/O files and dynamic memory locations

COURSE OUTLINE:

UNIT I: Introduction – The Problem Solving aspect – Top down Design – Implementation of Algorithms – Program Verification – Efficiency of Algorithms – Analysis of Algorithms. **12Hrs**

UNIT II: Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input/output Operations – Formatted I/O. **12 Hrs**

UNIT III: Decision Making - Branching –- IF, Nested IF – Switch – goto - Looping- While, do, for statements. **12 Hrs**

UNIT IV: Arrays – dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Categories of Functions – Recursion - Structures and Unions – Array of Structures – Structures and Functions. **12 Hrs**

UNIT V: Pointers – Declaration, Accessing a variable, character strings, pointers to functions and structures - File Management in C – Dynamic Memory location — Preprocessors. Command Line Arguments **12 Hrs**

RECOMMENDED TEXTBOOKS:

1. R.G.Dromley "How to Solve it by Computer ", Pearson Education, 2006
2. Yashwant kanetkar " Let Us C " 15th Edition, BPB Publications. 2014
3. E.Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 2015
4. VenuGopal and Prasad, "Mastering C", Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. Deitel and Deitel "C How to Program ", Addisson Wesley, 2001
2. Brian W.Kernighan& Dennis Ritchie "C Programming Language", PHI, 1990
3. Byron.S.Gottfried "Schaum's Outline of Programming with C", 2nd Edition, 1996

JOURNALS:

1.https://www.journals.elsevier.com/science-of-computer-programming
2.https://dl.acm.org/citation.cfm?id=576122

E-LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/c-programming-language/
2. https://www.tutorialspoint.com/cprogramming/c_useful_resources.htm
3. https://en.cppreference.com/
4. https://www.geeksforgeeks.org/c-programming-language/
5. https://hackr.io/tutorials/learn-c-plus-plus

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Gain a clear understanding of the fundamentals of C programming and analyzing the efficiency of algorithm.
CO 2	Gaining knowledge of syntax of C and managing various Input/Output operations
CO 3	Understanding the decision making and branching statements
CO 4	Analyzing the concept and implementation of different operations on arrays, functions ,structures and unions
CO 5	Demonstration of file management in c with dynamic memory allocation. Understanding the concept of pointer and command line arguments

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	2	2
CO2	3	2	2	3	3
CO3	3	3	3	2	3
CO4	2	2	3	2	2
CO5	3	3	3	2	3
AVERAGE	2.8	2.4	2.8	2.2	2.6

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER I
SOFTWARE ENGINEERING

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/1C/SEG**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVE:

To enable the post graduate students to

1. Provide information about software engineering issues involves in the development of complex, evolving (software-intensive) systems.
2. Understand the software development lifecycle models
3. Familiarize the basic concepts of software design and implementation.
4. Perform software testing on various applications.
5. Apply various software metrics on software products improve the quality

COURSE OUTLINE:

UNIT I : A Generic View of Process – Process Models-The Waterfall Model- Incremental Model-Evolutionary Model-Specialized Model-The Unified Process–Agile Process – Agile Models – Software Cost Estimation – Planning – Risk Analysis – Software Project Scheduling. **12 Hrs**

UNIT II : System Engineering Hierarchy – System Modeling – Requirements Engineering: Tasks- Initiating the Process-Eliciting Requirements-Developing Use Case - Negotiating Requirements-Validating Requirements **12 Hrs**

UNIT III : Building the Analysis Models: Concepts. Design Concepts – Design Models – Pattern Based Design – Architectural Design – Class Based and Conventional Components Design – User Interface Design **12 Hrs**

UNIT IV : Software Testing – Strategies: Conventional - Object Oriented – Validation Testing – Criteria – Alpha – Beta Testing- System Testing – Recovery – Security – Stress – Performance - Testing Tactics – Testing Fundamentals-Black Box – While Box – Basis Path-Control Structure. **12 Hrs**

UNIT V : Software Configuration And Management-Features-SCM Process - Software Quality Concepts – Quality Assurance – Software Review–Technical Reviews – Formal Approach To Software Quality Assurance – Reliability – Quality Standards – Software Quality Assurance Plan. **12 Hrs**

RECOMMENDED TEXTBOOKS:

1. Ian Sommerville, "Software Engineering", Tenth Edition, Pearson, 2015.
2. Roger S Pressman, Software Engineering: A practitioner's approach, McGraw-Hill Education, 8thEdition

REFERENCE BOOKS:

1. Ali Behforroz, Frederick J.Hudson,Software Engineering Fundamentals, Oxford Indian Reprint,2012.
2. Jibitesh Mishra, Ashok Mohanty, Software Engineering, Pearson Education, First Edition, 2011.
3. Pankaj Jalote,An Integrated approach to Software Engineering,,Third Edition, Narosa Publications, 2011

JOURNALS:

1. https://www.journals.elsevier.com/advances-in-engineering-software
2. https://jserd.springeropen.com/

E-LEARNING RESOURCES:

1 .https://www.udemy.com/course/sdlc-models/
2 .https://www.edx.org/learn/project-management
3. https://www.edx.org/micromasters/software-development
4. https://www.edx.org/course/software-testing-fundamentals-usmx-umuc-stv1
5. https://www.coursera.org/courses?query=quality%20management

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Understand the SDLC process models
CO 2	Able to understand the functions of requirements engineering and SRS
CO 3	Able to design models and various designs of software development
CO 4	Understand the concept of testing in software and importance
CO 5	Able to understand software quality concepts

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	3	2	2	2	3
CO 2	3	3	2	2	2
CO 3	2	2	3	2	2
CO 4	2	3	3	3	2
CO 5	3	2	2	3	3
Average	2.6	2.4	2.4	2.4	2.4

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, learning through Demonstrations, LCD Projectors, e-content, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER I

COMPUTER LABORATORY-I: DATA STRUCTURES

TOTAL HOURS: 45hrs **COURSE CODE: MCA18/1P1/DSS**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Develop skills in design and implementation of data structures and their applications
2. Learn and implement linear, non-linear and tree data structures
3. Study, implement and analyze the sorting, searching technique.

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Writing applications using Array concepts
CO 2	Choose the data structures to convert Infix to Postfix
CO 3	Develop real time applications using Linked List
CO 4	Apply the sorting, search technique for an application

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	3	3	2	2	2
CO 2	3	3	2	2	3
CO 3	3	3	3	3	2
CO 4	2	3	3	2	3
Average	2.8	3	2.5	2.23	2.5

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

LIST OF EXPERIMENTS:

Implement the following concept using c

1. Array: Insertion and Deletion
2. Application using array of structures
3. Array Implementation of Stack
4. Array Implementation of Queue
5. Infix to postfix conversion
6. Singly Linked List operations
7. Polynomial manipulation- addition, subtraction
8. Binary Tree Traversal
9. Quick Sort
10. Binary Search

E-LEARNING RESOURCES:

1. https://www.sanfoundry.com/c-programming-examples-data-structures
2. https://www.programiz.com/dsa

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER II

COMPUTER ARCHITECTURE AND MICROPROCESSORS

TOTAL HOURS: 60 hrs **COURSE CODE: MCA18/2C/CAM**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Study and compare various micro controllers
2. Classify Instruction set architecture, types and addressing
3. Learn operating system machine level and assembly language
4. Extend the study over microprocessor types and addressing modes
5. Understand the logic behind the execution of Instructions and problems

COURSE OUTLINE:

UNIT I: Computer Systems Organization: The Micro Architecture Level: An example micro architecture – Design of Micro architecture level – Improving performance – Comparison of i7, OMAP4450, ATMega168 Micro controller.

12hrs

UNIT II: The Instruction Set Architecture Level: Overview of the ISA level – Data types – Instruction formats and addressing – Instruction types – Flow of Control.

12hrs

UNIT III: Operating System Machine Level: Virtual Memory – OSM level Instructions for parallel processing – Introduction to Assembly Language – Assembly Process.

12hrs

UNIT IV: Microprocessor: Detailed study over 8085 and 8086 processor – Addressing Modes – Assembler – Instruction Set of 8085 – Data Transfer schemes – Handshaking – Polling – DMA – I/O processor.

12hrs

UNIT V: Instruction Execution Mechanism – Machine Language Processor – Completeness of Instruction Set – Assembly Language programs for common application problems such as Sorting, Searching and Delay routines.

12hrs

RECOMMENDED TEXTBOOKS:

1. Andrew S Tanenbaum, 6th Edition "Structured Computer Organization", Pearson-Prentice Hall, 2013. (Unit I, II, III)
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2016.

REFERENCE BOOKS:

1. Gaonkar, "Microprocessor Architecture Programming Applications with 8085/8080A", Penram International Publishers, 2012. (Unit IV, V).
2. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 2nd Edition, Morgan Kaufmann, 2012.
3. Hayes, John P, "Digital System Design and Microprocessors", TataMcGraw-Hill Publishers, 2012.

JOURNALS:

1. http://www.science.smith.edu/~jcardell/Courses/EGR328/Readings/uProc%20Ovw.
2. http://angom.myweb.cs.uwindsor.ca/teaching/cs266/Lec26601.pdf.

E-LEARNING RESOURCES:

1 https://www3.risc.jku.at/education/courses/ss2002/compsys/slides/systems/slides-main.pdf.
2 https://en.wikibooks.org/wiki/IB/Group_4/Computer_Science/Computer_Organisation
3 http://pdplab.it.uom.gr/teaching/tanenbaum/2.pdf
4 https://www.elprocus.com/8085-microprocessor-architecture/
5 https://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Lecture_Notes/LNm1.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Extend adequate study over the basics of Network Hardware, Software and entities present in Physical layer.
CO 2	Compare the functionality among various protocols associated with the Data link layer.
CO 3	Design and Develop the algorithms to address the Routing and Congestion control.
CO 4	Evaluate the protocols responsible for the Transport layer services.
CO 5	Learn the technical implementations wrapped-up in the services offered by Application layer.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	3	3	2	2	3
CO 3	3	2	2	2	3
CO 4	3	3	2	3	2
CO 5	3	2	3	3	3
Average	**2.8**	**2.4**	**2.2**	**2.4**	**2.6**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of Microprocessor Instructions in Digital Trainer Kit, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER II
OPERATING SYSTEMS

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/2C/OSS**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Be aware the fundamental principles of processes and operating system and their communication
2. Comprehend the various functions of process management
3. Comprehend the deadlock and memory management
4. Know about the file management and file system
5. Learn the I/O management

COURSE OUTLINE:

UNIT I : Introduction: Definition of OS-Mainframe System-Desktop Systems-Multi processor System-Distributed-Clustered-Real time Systems-Handheld Systems-Operating System Structure-System Components-Services-System Calls-System Programs – System Design and Implementation **12 Hrs**

UNIT II : Process Management: Concepts-Process Scheduling-Operations on Processes-Co-operating Processes-Inter Process Communication-CPU Scheduling-Scheduling Concepts-Criteria-Scheduling Algorithms-Multiprocessor Scheduling-Real time Scheduling. **12 Hrs**

UNIT III : Process Synchronization: Critical Section-Synchronization Hardware- Semaphores-Problems of Synchronization-Critical Regions-Monitors-Deadlocks-Characterization -Handling Deadlocks - Deadlock Prevention- Avoidance- Detection-Recovery. **12 Hrs**

UNIT IV : Memory Management: Storage Hierarchy-Storage Management Strategies-Contiguous-Non Contiguous Storage Allocation-Single User-Fixed Partition-Variable Partition-Swapping-Virtual Memory-Basic Concepts-Multilevel Organization-Block Mapping-Paging-Segmentation-Page Replacement Methods-Locality-Working Sets. **14 Hrs**

UNIT V : I/O And File Systems: Disk Scheduling-File Concepts-File System Structure-Access Methods-Directory Structure-Protection-Directory Implementation-Allocation Methods -Free Space Management Case Study: Linux Operating System – Commands, Shell Programming. **10 Hrs**

RECOMMENDED TEXTBOOKS:

1.Abraham Silberschatz and Peter Galvin ,Operating System Concepts, Wiley; 8th Revised edition

2.William Stallings ,Operating Systems: Internals and Design Principles,Pearson Education; 2019 edition .

REFERENCE BOOKS:

1. D M Dhamdhere , Operating Systems: A Concept-Based Approach" McGraw Hill Education, 3rdEdition,2017
2. Andrew S.Tanenbaum, Modern operating Systems, PHI Learning Pvt.Ltd,2016
3. Gary J Nutt, Operating Systems: A Modern Perspective, Addison-Wesley Pub

JOURNALS:

1. http://stmjournals.com/Journal-of-Operating-Systems-development-and-Trends
2. https://www.elsevier.com/catalog/computer-science/software/operating-systems

E-LEARNING RESOURCES:

1. https://www.coursera.org/courses?query=operating%20system
2. https://www.udacity.com/course/introduction-to-operating-systems--ud923#
3. https://www.coursera.org/lecture/technical-support-fundamentals/memory-management-CKcxg
4. https://www.coursera.org/lecture/technical-support-fundamentals/files-and-file-systems-5n8dt
5. https://www.coursera.org/lecture/technical-support-fundamentals/files-and-file-systems-5n8dt

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Understand the operating system components and its services
CO 2	Able to demonstrate the functions of process management and issues
CO 3	Able to synchronize and deadlock among processes
CO 4	Apply memory management concepts in OS
CO 5	Able to understand the file system recent OS

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	3	2	2	2	3
CO 2	3	3	2	2	2
CO 3	2	2	3	2	2
CO 4	2	3	3	3	2
CO 5	3	2	2	3	3
Average	2.6	2.4	2.4	2.4	2.4

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY

Lecture by chalk and talk, learning through Demonstrations, LCD Projectors, e-content, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER II

DESIGN AND ANALYSIS OF ALGORITHMS

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/2C/DAA**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the basic algorithms analysis extensively.
2. Understand the problem and design algorithms
3. Solve graph based problems.
4. Design and develop efficient algorithms with minimum complexity using design techniques using graph structures.
5. Learn complex algorithms and limitations.

COURSE OUTLINE:

UNIT I : Introduction: Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving –Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms. **10 Hrs**

UNIT II : Brute Force And Divide-And-Conquer: Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex-Hull Problems. **13 Hrs**

UNIT III : Dynamic Programming And Greedy Technique: Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm-Huffman Trees. **13 Hrs**

UNIT IV : Iterative Improvement: The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem. **10 Hrs**

UNIT V : Coping With The Limitations Of Algorithm Power: Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems–Coping with the Limitations – Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem. **14 Hrs**

RECOMMENDED TEXTBOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition,Pearson Education, 2012.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, 2006.
3. Donald E. Knuth, The Art of Computer Programming, Pearson Education, 2009.

JOURNALS:

1. https://www.journals.elsevier.com/journal-of-algorithms
2. https://link.springer.com/search?query=algorithm+analysis&package=openacces articles

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106101060/
2 https://nptel.ac.in/courses/106/101/106101060/
3 https://cosmolearning.org/courses/design-analysis-algorithms/video-lectures/
4 https://nptel.ac.in/downloads/106105164/
5 http://www.vssut.ac.in/lecture_notes/lecture1428551222.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Gain a clear understanding of the algorithm and basic frame work of algorithm development. Learn to implement the algorithm notations.
CO 2	Gain knowledge to understand the basic problems and problem solving techniques.
CO 3	Learn to solve graph related problems and write algorithms.
CO 4	Understanding the steps to involve and design algorithm for Flow Problem and Bipartite Graph problems
CO 5	Learn limitations of Algorithm and Approximation Algorithms and solve practical problems.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	1	2	2
CO 2	2	2	2	2	2
CO 3	2	2	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	2
Average	**2.4**	**2.4**	**2.2**	**2**	**2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER II

PROGRAMMING IN C++

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/2C/PIC**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the object oriented concepts
2. Learn the basic concepts like Object, Class and bottom-up approach.
3. Understand and implement the principles like Abstraction, Data Hiding, Dynamic binding, Polymorphism and Inheritance.
4. Apply the generic programming features
5. Design and development of object oriented snippets to achieve reusability

COURSE OUTLINE:

UNIT I: Introduction: Overview of C++ – Classes and Objects – Structures, Unions and Classes – Friend Functions – Friend Classes – Inline Functions – Parameterized Constructors – Static Class Members – Scope Resolution Operator - Nested Classes. **12Hrs**

UNIT II: Arrays – Arrays of Objects – this pointer – Pointers to Class Members - References – Passing Reference to Objects – Returning References – Dynamic Allocation Parameters – Function Overloading – Constructor Overloading, Copy Constructor. **12 Hrs**

UNIT III: Operator Overloading – Operator Overloading using Friend function – Overloading new and delete – Overloading special characters [ ], ( ), → and Comma. Inheritance – Protected Members-Inheritance Multiple Base Classes. **12 Hrs**

UNIT IV: Arrays – dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Categories of Functions – Recursion - Structures and Unions – Array of Structures – Structures and Functions. **10 Hrs**

UNIT V: C++ Streams – Formatted I/O – Unformatted and Binary I/O - C++ File I/O - <fstream> and the File Classes – Opening and Closing a file – Reading and Writing Text files – Namespace Fundamentals – using – Standard Template Library – Overview – Containers – Algorithms–Iterators. **14 Hrs**

RECOMMENDED TEXTBOOKS:

1. Herbert Schildt ,C++ - The complete Reference, 5th Edition, TMH, 2014.
2. E.Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 2015.

REFERENCE BOOKS:

1. K. R. Venugopal and Raj Kumar Buyya, "Mastering C++" Tata McGraw Hill, 2013.
2. VenuGopal and Prasad, "Mastering C", Tata McGraw Hill, 2013.

JOURNALS:

1. https://www.scirp.org › journal
2. www.bcbjournal.org

E-LEARNING RESOURCES:

1. https://www.udemy.com/course/c-programming-a-z
2. https://hackr.io/tutorials/learn-c-plus-plus
3. http://www.cplusplus.com
4. https://www.learncpp.com
5. https://www.edx.org/learn/c-programming?

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Gain a clear understanding of the basic concepts of C++along with their implementations.
CO 2	Gaining knowledge in developing secured object oriented application using protected members
CO 3	Acquirement of technical skills to elucidate the overloading mechanism.
CO 4	Understanding the concept of virtual function types , generic programming features ,templates and exceptional handling functions.
CO 5	Demonstration of I/O streams implementation

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	3	3
CO2	3	3	3	0	3
CO3	3	1	3	3	3
CO4	2	1	3	3	3
CO5	3	1	3	3	3
AVERAGE	2.8	1.8	2.8	2.4	3

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER II

DATABASE MANAGEMENT SYSTEMS

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/2C/DMS**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the basics of database, data models and various structures of SQL statements.
2. The introduction of ER models, various constraints and the normalization techniques
3. Expose the different types of data storage medium, RAID Architecture and indexing techniques.
4. Impart knowledge in Transaction processing, Concurrency Control and Recovery System
5. Understand the concepts of concurrency control, the protocols used and various recovery algorithms during transaction failures. Also students gains knowledge about the servers oracle and Microsoft SQL server

COURSE OUTLINE:

UNIT I: Introduction: Relational Model – Introduction to SQL – Intermediate SQL – Advanced SQL **12 Hrs**

UNIT II: Database Design and ER model: Overview – E-R Model , Constraints – Removing Redundant Attributes – E-R Diagrams – Extended ER Features – Relational Database Design **12 Hrs**

UNIT III: Storage and File Structure : Physical Storage media – Magnetic Disk and Flash Storage – RAID-Tertiary Storage – File Organization of Records in Files – Data Dictionary Storage – Database Buffer - Indexing and Hashing **12 Hrs**

UNIT IV Query Processing: overview – Measures of Query Cost – Selection Operation – Sorting – Join operations – Query Optimization – Transformation of Relational Expressions – Estimating Statistics – Choice of evaluation Plans - Transactions – Concepts – Transaction Model-Storage Structure – Atomicity and Durability – Transaction Isolation – Serializability. **12 Hrs**

UNIT V Concurrency Control: Lock Based Protocols – Timestamp Based protocols-Validation Based Protocols – Recovery System – Failure Classification – storage – Recovery and Atomicity – Recovery Algorithm – Buffer Management - Case Study – Oracle – Microsoft SQL Server **12 Hrs**

RECOMMENDED TEXTBOOKS:

1 Abraham Silberschatz , Henry F. Korth , S. Sudarshan " Database System concepts, 6th Edition, McGraw Hill Education, 2013.
2 C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3 Raghu Ramakrishnan , "Database Management Systems", 4th Edition, Tata Mcgraw Hill 2011.

REFERENCE BOOKS:

1 Ivan Bayross , "SQL, PL/SQL: The Programming Language of Oracle", BPB Publications , 2002
2 Elmasri, Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education (2008).
3 Jeffrey A. Hoffer, Ramesh Venkataraman, , Heikki Topi, "Modern Database Management", Pearson Education 2016
4 Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden, "Modern Database Management"
8th Edition, Prentice Hall, 2006
5 Mark L. Gillenson, Fundamentals of Database Management Systems, 2nd Edition, Kindle Edition

JOURNALS:

1 https://www.journals.elsevier.com/data-and-knowledge-engineering
2 https://www.scimagojr.com/journalsearch.php?q=13581&tip=sid

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106105175/
2 http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/
3 https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/
4 https://www.coursera.org/learn/database-management
5 https://www.coursera.org/learn/core-database

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Understand the fundamentals of the database and data models and SQL
CO 2	Design a database using ER diagrams and map ER into Relations and compare the normalized relations by I NF, II NF, III NF, IV NF and BCNF
CO 3	Know the different physical media for storage, different file organizations and understand how indexing and hashing used for effective storage of databases
CO 4	Acquire the knowledge of query evaluation and optimization to monitor the performance of the DBMS
CO 5	Illustrate various concurrency control protocols and recovery algorithms from failures. Construct a mini project using servers like Oracle or SQL Server as backend

MAPPING-CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	2	3	2	3	2
CO 2	2	3	3	3	3
CO 3	3	2	2	2	2
CO 4	3	2	2	3	3
CO 5	2	3	3	2	3
Average	**2.4**	**2.4**	**2.4**	**2.6**	**2.6**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

'Chalk and Talk' with blend of laboratory sessions, Team work through projects, class activities, Use of ICT tools like Massive Open Online Courses (MOOCs), videos, Talks by personnel from industry/academia, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER II

COMPUTER LABORATORY II: DESIGN AND ANALYSIS OF ALGORITHMS

TOTAL HOURS : 45 Hrs **COURSE CODE : MCA18/2P2/DAA**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Implement the graph related algorithms.
2. Solve the problem using different algorithm techniques.
3. Design and develop efficient algorithms with minimum complexity using design techniques

COURSE OUTCOMES:

CO No.	CO Statements
CO1	Learn to develop the problem based program and implement the analysis of algorithm.
CO2	Learn to implement different algorithm techniques.
CO3	Develop a program for the basic graph related problems.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	2
CO 2	3	3	2	2	2
CO 3	3	3	2	2	2
Average	**3**	**3**	**2**	**2**	**2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

LIST OF EXPERMENTS:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a) Obtain the Topological ordering of vertices in a given digraph.
   b) Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. a) Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b) Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl, s2,.....,sn} of n positive integers whose sum is equalto a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.

E-LEARNING RESOURCES:

1 https://www.slideshare.net/kandarp23395/daa-lab-file-c-programs

2 https://www.geeksforgeeks.org/fundamentals-of-algorithms/

3 http://camelliait.ac.in/Lab%20Manual/ADA%20Lab%20Programs.pdf

TEACHING METHODOLOGY:
Learning through Demonstrations, LCD Projectors, e-content, Hands on sessions, Group Discussion.

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER II

COMPUTER LABORATORY-III: DATABASE MANAGEMENT SYSTEMS

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/2P3/DMS**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the concepts of DBMS
2. Familiarize with SQL queries
3. Write stored procedures in DBMS
4. Learn front end tools to integrate with databases.

COURSE OUTCOME:

CO No	CO Statements
CO1	To learn various fundamental and complex SQL queries
CO2	Learn to develop a project in the area of their interest

Students have to develop a project based on their choice and submit a report at the end of the semester

MAPPING-CO With PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	2	2
Average	**3**	**3**	**2**	**2**	**2.5**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER II

COMPUTER LABORATORY-IV: SUMMER PROJECT

CREDITS : 2 **COURSE CODE: MCA18/2P4/SPT**

Students have to undertake a summer project during the summer vacation for the period of 4 to 6 weeks

CO No	Statements
CO 1	To learn about new technologies and developments in the field of Computer Science
CO2	To know how to development applications as per industry standards

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	2	3
CO 2	3	3	2	3	3
Average	**3**	**3**	**2.5**	**2.5**	**3**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER III
COMPUTER NETWORKS

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/3C/CNS**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Develop knowledge over the basics of Networks and Physical layer.
2. Recognize the functionality of various protocols in Data link layer.
3. Analyze the steps involved in algorithms belong to Network layer.
4. Know the significance of services offered by the Transport layer.
5. Understand the real time end-user applications.

COURSE OUTLINE:

UNIT I: Introduction: The uses of Computer Networks - Network Hardware - Reference Models - Example of Networks. The Physical Layer: Guided Transmission Media - Wireless Transmission – Public Switched Telephone Network - Mobile telephone System.

12hrs

UNIT II: The Data Link Layer: Data link layer design issues - Error detection and correction - Elementary Data Link Protocols - Sliding Window Protocols - Example of data Link Protocols- ETHERNET – 802.11 – Bluetooth.

12hrs

UNIT III: The Network Layer: Network Layer Design Issues - Routing Algorithms - Congestion Control Algorithms - Internetworking- Network layer in the Internet.

12hrs

UNIT IV: The Transport Layer: Transport Service - Transport Protocols –(what is this) Simple Transport Protocol - Internet Transport protocols: UDP, TCP.

12hrs

UNIT V: The Application Layer: Domain Name System - Electronic mail - World wide web – Multimedia - Communication Security.

12hrs

RECOMMENDED TEXTBOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", Fifth Edition, Pearson Education 2012.
2. Behrouz A. Forouzan and FirouzMosharraf, "Data Communications and Networking", McGraw Hill, Special Indian Edition 2012.

REFERENCE BOOKS:

1. William Stallings, Data and Computer Communications, Sixth Edition, PHI, 2013.

JOURNALS:

1. https://www.springer.com/gp/all-titles-in-computer-networks/9850852
2. http://www.sciepub.com/journal/JCN

E-LEARNING RESOURCES:

1. http://iips.icci.edu.iq/images/exam/Computer-Networks---A-Tanenbaum---5th-edition.pdf
2. https://www.oreilly.com/library/view/computer-networks-fifth/9780133485936/
3. http://elearning.ascollegelive.net/studyMaterial/bca/bca_3rd_year/Networking
4. http://www.vssut.ac.in/lecture_notes/lecture1428550521.pdf
5. http://164.100.133.129:81/econtent/Uploads/Computer_Networks_Data_Communication.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Extend adequate study over the basics of Network Hardware, Software and entities present in Physical layer.
CO 2	Compare the functionality among various protocols associated with the Data link layer.
CO 3	Design and Develop the algorithms to address the Routing and Congestion control.
CO 4	Evaluate the protocols responsible for the Transport layer services.
CO 5	Learn the technical implementations wrapped-up in the services offered by Application layer.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	2
CO 2	3	2	2	2	2
CO 3	3	2	2	3	2
CO 4	3	2	2	2	2
CO 5	2	2	2	3	3
Average	**2.8**	**2**	**2**	**2.8**	**2.2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, learning through Demonstrations, LCD Projectors, e-content, Realization of algorithms, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III
PROGRAMMING IN JAVA

TOTAL HOURS:60 Hrs **COURSE CODE: MCA18/3C/PIJ**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the OOPS concept and how to apply in programming.
2. Realize and apply the fundamentals core java, Packages, Event Handling for computing.
3. Enhance the knowledge to Server side programming.

COURSE OUTLINE:

UNIT I: Introduction to Java : The History and Evolution of Java- An Overview of Java- Object Oriented Programming - Lexical Issues - Data Types - Variables - Arrays - Operators - Control Statements.

10 Hrs

UNIT II: Classes: Class Fundamentals- Declaring Objects – Introducing Methods- Constructors – this Keyword- Garbage Collection-The finalize method-Overloading methods - Access Control - Static and final – Nested and Inner Classes - String Class - Inheritance – Using Super- Overriding methods - Abstract class- Using final with Inheritance.

10 Hrs

UNIT III: Packages: Access Protection – Importing Packages- Interfaces - Exception Handling - Thread - Synchronization - Inter thread Communication - Deadlock - Suspending, Resuming and stopping threads – Multithreading.

15 Hrs

UNIT IV: Event Handling: Basics of Event Handling-Mouse and Keyboard Events-AWT Classes – AWT Controls-Labels-buttons-Check Boxes-Lists-Scroll Bars-Text Field –Text Area-Layout Managers-Flow Layout-Border Layout-Grid Layout-Card Layout-Grid Bag Layout- Menus.

15 Hrs

UNIT V: Input/Output: The I/O Classes and Interfaces- File – The Applet Class - Networking basics- TCP/IP Sockets - INet Address – URL-Datagrams.

10Hrs

RECOMMENDED TEXTBOOKS:

1. Herbert Schildt, Java The Complete Reference, Ninth Edition, McGraw Hill Edition, 2014.
2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press 2014

REFERENCE BOOKS:

1. Xavier, "JAVA Programming – A Practical Approach", Tata McGraw Hill Edition, 2014.
2. K.Arnold and J.Gosling, The Java Programming Language, Second Edition, Addison Wesley, 2014.

JOURNALS:

1. https://ieeexplore.ieee.org/document/591652
2. https://www.oracle.com/technetwork/java/javamagazine/index.html
3. http://java.sys-con.com/

E-LEARNING RESOURCES:

1. https://www.edx.org/professional-certificate/uc3mx-introduction-java-programming
2. https://www.edx.org/course/ap-computer-science-a-java-programming-classes-and-objects
3. https://www.coursera.org/lecture/object-oriented-java/core-defining-classes-and-creating-objects-0kv8I
4. https://www.edx.org/course/introduction-to-java-programming-starting-to-code-in-java
5. https://www.coursera.org/lecture/object-oriented-java/core-introduction-to-event-driven-programming-j3FBx

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Knowledge over fundamentals of programming.
CO 2	Acquire the logic over OOPS concepts.
CO 3	Implement Java Programs.
CO 4	Make use of hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API.
CO 5	Design and implement Server side Programs.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	3
CO 2	2	3	2	2	3
CO 3	2	2	2	3	3
CO 4	3	2	3	3	2
CO 5	3	3	3	3	3
Average	**2.4**	**2.4**	**2.6**	**2.6**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of Logical problems, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III
SOFTWARE TESTING

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/3C/ STG**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Explore the basics of various testing strategies.
2. Distinguish the essential need and necessity for testing strategies.
3. Investigate the strategies involved in variants of testing platforms.
4. Discern the significance of testing tools and their usage.
5. Comprehend the entities needed for Quality Management.

COURSE OUTLINE:

UNIT I: White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing.

12hrs

UNIT II: The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.

12hrs

UNIT III: Testing Client / Server Systems – Testing in a Multiplatform Environment - Testing Object Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Quality Aspects – Web Engineering – Testing of Web based Systems. Case Study: Web Application Testing.

12hrs

UNIT IV: Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool. **12 hrs**

UNIT V: Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics. **12hrs**

RECOMMENDED TEXTBOOKS:

1. Adithya P. Mathur, "Foundations of Software Testing – Fundamentals algorithms and techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
2. Boris Beizer, "Software Testing Techniques", Dream Tech Press, 2009.
3. Dale H. Besterfiled, "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2011).

REFERENCE BOOKS:

1. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
2. Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", 3rd Edition, John Wiley & Sons Publication, 2012.
3. Naresh Chauhan , "Software Testing Principles and Practices " Oxford University Press , New Delhi ,2010.

JOURNALS:

1. https://onlinelibrary.wiley.com/journal/10991689
2. https://www.sciencedirect.com/science/article/pii/S1571066106000442

E-LEARNING RESOURCES:

1 https://www.softwaretestingmaterial.com/selenium-tutorial/

2 https://www.softwaretestingclass.com/wp-content/uploads/2016/06/Beginner-Guide-To-Software-Testing.pdf

3 http://moodle.nccu.edu.tw/pluginfile.php/77731/mod_resource/content/1/software_testing.pdf

4 http://testingmasters.com/wp-content/uploads/ManualTestingMaterial.pdf

5 https://www.softwaretestinggenius.com/download/mtnarsir.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Study over the basics of testing strategies and its applications.
CO 2	Move on with the flow in which the testing strategies to be applied to the product is being developed.
CO 3	Learn the testing strategies to be adapted for different platforms.
CO 4	Evaluate the testing tools best suited for automating the testing process.
CO 5	Assess the performance levels for ensuring the Quality Management.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	3	2
CO 2	3	3	2	3	3
CO 3	3	2	2	3	3
CO 4	3	3	2	2	3
CO 5	2	2	3	3	2
Average	**2.8**	**2.4**	**2.2**	**2.8**	**2.6**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Understanding of Testing strategies, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III

COMPUTER LABORATORY-V: PROGRAMMING IN JAVA

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/3P5/ PIJ**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the OOPS concept and how to apply in programming.
2. Realize and apply the fundamentals core java, Packages, Event Handling for computing.
3. Develop Java based web programming.

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Writing Java program using OOPS concepts
CO 2	Developing packages, event handlers and web programming

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	3	3
Average	**3**	**3**	**2**	**2.5**	**3**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

LIST OF EXPERIMENTS:

1. Implementation of Arrays.
2. Implementation of Control Structures
3. Implementation of Overloading and Overriding Methods.
4. Implementation of Inheritance
5. Implementation of Interfaces
6. Implementation of Multithreading
7. Implementation of Event Handling
8. Implementation of Menus.
9. Implementation of String Objects.
10. Implementation of Applets.

E-LEARNING RESOURCES:

1 https://www.w3schools.in/java-tutorial/
2 https://www.studytonight.com/java/
3 https://www.javatpoint.com/java-tutorial

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER III

COMPUTER LABORATORY-VI: SOFTWARE TESTING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/3P6/STG**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Validate the web page through test suite using selenium IDE.
2. Verify the programs intended for various real-time problems.

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Writing test suite containing test cases to check web page contents using selenium IDE.
CO 2	Developing test case to ensure the functionality of Program entities using selenium IDE.

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	2	2
Average	**3**	**3**	**2**	**2**	**2.5**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, Corelation-0

LIST OF EXPERIMENTS:

1. Using Selenium IDE, Write a test suite containing minimum 4 test cases.
2. Install Selenium server and demonstrate it using a script in Java/PHP.
3. Write and test a program to login a specific web page.
4. Write and test a program to update 10 student records into table into Excel file.
5. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects)
6. Write and test a program to provide total number of objects present / available on the page
7. Write and test a program to get the number of list items in a list / combo box.
8. Write and test a program to count number of check boxes on the page checked and unchecked count.

E-LEARNING RESOURCES:

1 https://www.seleniumhq.org/docs/01_introducing_selenium.jsp

2 https://www.softwaretestingmaterial.com/selenium-tutorial/

TEACHING METHODOLOGY:

Learning through Demonstrations, Hands-on sessions, Dry-run methodology and Trial and Error methods.

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER IV

DATA WAREHOUSING AND MINING

TOTAL HOURS: 60 hrs **COURSE CODE: MCA18/4C/DWM**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the definition of data mining, its architecture, technologies used , various types of data and about data visualization
2. Know about various preprocessing techniques, online analytical processing, data warehouse architecture and multidimensional data models
3. Explore the fundamentals of data cube technology, multidimensional data analysis, frequent item set mining and various evaluation methods
4. Analyze various classification methods like decision tree induction, bayes, rule based classification etc.,
5. Know about various cluster analysis methods, outlier detection and recent research trends in data mining

COURSE OUTLINE:

UNIT I: **Introduction** – Why Data Mining? What is Data Mining? What kinds of Data can be mined? What kinds of Patterns can be Mined? Technologies used- Kinds of applications targeted – major issues - Know your Data – Data Objects and Attribute Types - Basic Descriptions of Data – Data Visualization – Measuring Data Similarity and Dissimilarity **9Hrs**

UNIT II: **Data preprocessing** – Overview- Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization - Data Warehousing and Online Analytical Processing – Basic Concepts – Data Warehouse Modeling – Data Warehouse Design and Usage – Data Warehouse Implementation – Data Generalization **9 Hrs**

UNIT III: **Data Cube Technology** – Data Cube Computation and Methods – Exploring Cube Technology – Multidimensional Data Analysis - Mining Frequent Patterns – Basic concepts – Frequent Item set Mining Methods – Pattern Evaluation Methods **9 Hrs**

UNIT IV **Classification** - Basic concepts – Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Advanced Methods – Bayesian Belief Networks – Back Propagation – Support Vector Machines. **9 Hrs**

UNIT V **Cluster Analysis** - Partitioning methods –Advanced Cluster Analysis – Clustering High Dimensional Data – Network Data - Outlier Detection – Outlier Detection Methods – Data Mining Trends and Research Frontiers. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1 J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Morgan Kauffman, 2011.
2 Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics", PearsonEducation 2004
3 Sam Anahory, Dennis Murry, "Data Warehousing in the real world", Pearson Education 2003
4 David Hand, Heikki Manila, PadhraicSymth, "Principles of Data Mining", PHI 2004.
5 Alex Bezon, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", McGraw-Hill Edition, 2001.

REFERENCE BOOKS:

1 Charu C. Aggarwal, "Data Mining: The Textbook" , Springer 2015 Edition.
2 Da Ruan, "Intelligent Data Mining: Techniques and Applications" Springer 2007.
3 Mohammed J. Zaki, Wagner Meira, Jr, Wagner Meira, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press.
4 Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal,"Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann, Fourth Edition 2017.
5 Arun K. Pujari, "Data Mining Techniques", Universities Press, 2005.

JOURNALS:

1 https://link.springer.com/journal/10618
2 https://www.inderscience.com/jhome.php?jcode=ijdmmm
3 http://www.sciencepublishinggroup.com/journal/index?journalid=603
4 https://tist.acm.org/
5 https://www.scimagojr.com/journalsearch.php?q=19700190323&tip=sid

E-LEARNING RESOURCES:

1 https://www.classcentral.com/course/coursera-pattern-discovery-in-data-mining-2733
2 https://www.classcentral.com/subject/data-mining
3 https://web.ccsu.edu/datamining/resources.html?redirected
4 http://whitepapers.virtualprivatelibrary.net/Data%20Mining%20Resources.pdf
5 https://www.guru99.com/data-mining-tutorial.html

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Ability to apply acquired knowledge in understanding data, nature of data and select suitable methods for data analysis and various data mining principles
CO 2	The importance of data preprocessing, Design data warehouse with dimensional modeling and apply OLAP operations.
CO 3	Design and deploy appropriate classification techniques for high dimensional data for better organization of the data
CO 4	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
CO 5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Mapping- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	1	1
CO 2	2	3	3	1	1
CO 3	2	3	2	2	2
CO 4	2	3	3	3	2
CO 5	1	2	2	3	3
Average	2	2.6	2.4	2	1.8

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of Logic Gates, Group Discussion, Assignment, Quiz, Peer Learning and Seminar

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

VISUAL.NET PROGRAMMING

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/4C/VNP**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Gain knowledge of implementing problem solving techniques using programming languages
2. Understand the concepts and syntax of Programming language
3. Learn the basics of decision making and looping statements
4. Learn on the manipulation of strings, arrays, functions and categories of functions
5. Learn pointers, file management in C and customizing I/O files and dynamic memory locations.

UNIT I: **Introduction to C#** : Introducing C#- Understanding .NET- overview of C#- Literals- Variables- Data Types- Operators- checked and unchecked operators- Expressions- Branching- Looping- Methods- implicit and explicit casting- Constant- Arrays- Array Class- Array List- String- String Builder- Structure- Enumerations- boxing and unboxing. **12 Hrs**

UNIT II: **Object Oriented Aspects of C#:** Class- Objects- Constructors and its types- inheritance- properties- indexers- index overloading- polymorphism- sealed class and methods- interface- abstract class- abstract and interface- operator overloading- delegates- events- errors and exception- Threading. **12 Hrs**

UNIT III: **Application Development on .Net**: Building windows application- Creating our own window forms with events and controls- menu creation- inheriting window forms, SDI and MDI application- Dialog Box (Modal and Modeless)- accessing data with ADO.NET- Data Set- typed dataset- Data Adapter- updating database using stored procedures- SQL Server with ADO.NET- handling exceptions- validating controls- windows application configuration. **12 Hrs**

UNIT IV: Web Based Application Development On .Net**:** Programming web application with web forms- ASP.NET introduction- working with XML and .NET- Creating Virtual Directory and Web Application- session management techniques- web.config- web services- passing datasets- returning datasets from web services- handling transaction- handling exceptions- returning exceptions from SQL Server. **12 Hrs**

UNIT V: CLR And .Net Framework : Assemblies- Versioning- Attributes- Reflection- Viewing meta data- type discovery- reflection on type- marshalling- remoting- security in .NET. **12 Hrs**

BOOKS FOR REFERENCES:

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.
3. Andrew Troelsen, "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
4. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.

E-LEARNING RESOURCES:

https://msdn.microsoft.com/en-us/library/aa288436 (v=vs.71).aspx
www.csharp-station.com/Tutorial.aspx

JOURNALS:

1. https://journals.sagepub.com
2.https://www.planet-source-code.com

E-LEARNING RESOURCES:

1. https://www.tutorialspoint.com/vb.net/index.htm
2. https://www.guru99.com/vb-net-tutorial.html
3. https://www.udemy.com/learning-visual-basic-net/
4. https://www.homeandlearn.co.uk/csharp/csharp.html
5. https://www.geeksforgeeks.org/introduction-to-net-framework/

CO No.	CO Statements
CO 1	Compare and contrast the features of C# over Java and vice versa.
CO 2	Explain how C# provides support for OOPS concepts and event handling.
CO 3	Develop the web based applications using ADO.NET in C#
CO 4	Apply XML in the .NET environment to create Web Service-based applications
CO 5	Summarize the basics of Asynchronous programming

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	3
CO2	2	3	2	3	2
CO3	2	2	3	3	3
CO4	2	0	3	3	3
CO5	3	3	3	3	3
AVERAGE	2.4	2.2	2.6	2.8	2.8

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

CRYPTOGRAPHY AND NETWORK SECURITY

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/4C/CNS**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Know the methods of conventional encryption and to understand the concepts of public key encryption and Key exchange Algorithms.
2. Understand authentication and to know the network security tools and applications and to understand the system level security used.

COURSE OUTLINE:

UNIT I: Introduction: Symmetric Ciphers: Classical Encryption Techniques, Block Ciphers and the Data Encryption Standard. **12 Hrs**

UNIT II: AES: Transformation Functions – Key Expansions - Block Cipher Operation – Multiple Encryption and Triple DES – ECB – CBC – CFM – OFM – Counter Mode. **12 Hrs**

UNIT III: Public Key Encryption: Principles of Public Key Cryptosystems - RSA Algorithm – Daffy - Hellman Key Exchange Protocol. **12 Hrs**

UNIT IV: Key Management and Distribution: – Distribution of Public keys – X.509 Authentication Service – User Authentication – Kerberos Authentication – Federated Identity Management – Personal Identity Verification **12 Hrs**

UNIT V: Electronic Mail Security: PGP – S/MIME - IP Security – Overview – IP Security Policy – Encapsulating Security Payload. **12Hrs.**

RECOMMENDED TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson, Sixth Edition, 2015.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2011.
2. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Third Edition, Pearson Education, 2013.

JOURNALS:

1. https://wireilla.com/ijcis/index.html
2. https://ieeexplore.ieee.org/document/4646371/
3. https://www.journals.elsevier.com/network-security

E-LEARNING RESOURCES:

1. https://freevideolectures.com/course/5027/cryptography-and-network-security
2. https://www.coursera.org/lecture/cryptography/public-key-encryption-40Sb3
3. https://www.coursera.org/learn/asymmetric-crypto
4. https://www.udacity.com/course/applied-cryptography--cs387

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Impart knowledge on Encryption techniques, Design Principles and Modes of Operation
CO 2	Design a security solution for a given application
CO 3	Devise the Key Management techniques
CO 4	Create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
CO 5	Examine the issues and structure of Authentication Service and Electronic Mail Security

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	3
CO 2	2	3	2	3	3
CO 3	2	2	2	3	3
CO 4	3	2	3	3	2
CO 5	3	3	3	3	3
Average	**2.4**	**2.4**	**2.6**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of security problems, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

PYTHON PROGRAMMING

TOTAL HOURS : 60 Hrs **COURSE CODE: MCA18/4C/PPG**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand basic Python statements.
2. Teach Python operators, methods and built in methods.
3. Learn lists, tuples, and dictionaries in Python programs.
4. Learn Python object types and components of a Python program.
5. Use indexing and slicing to access data in Python programs.

COURSE OUTLINE:

UNIT I : Welcome to Python – What is Python? – Origins – Features – Downloading and Installing Python – Running Python – Python Documentation. Getting Started – Program Output statement – Program Input function – Python Basics – Statements and syntax – Variable Assignment – Identifiers – Numbers – Introduction – Integers – Double Precision Floating Point Numbers – Complex Numbers – Operators – Built-in functions for all numeric types. **12 Hrs**

UNIT II : Sequences: Strings, Lists and Tuples – Sequences – Strings – Strings and Operators – String-Only Operators – Built-in Functions – String Built-in Methods – Lists – Operators - Built-in Functions – List Type Built-in Methods – Tuples – Tuple Operators and Built-in Functions - Mapping and Set Types: Dictionaries – Mapping Type Operators – Mapping Type Built-in Functions and Built-in Methods – Dictionary Keys. **12 Hrs**

UNIT III : Conditionals and Loops – If statement – else statement – elif statement – Conditional expressions – while statement – for statement – break statement – continue statement – pass statement - Functions and Functional Programming – What are functions? – Calling Functions – Creating Functions – Passing Functions – Formal Arguments – Variable-Length Arguments. **12 Hrs**

UNIT IV : Errors and Exceptions – What are Exceptions? – Exceptions in Python – Detecting and Handling Exceptions – Context Management – with statement – Raising Exceptions – Modules – What are Modules? – Modules and Files – Namespaces – Importing Modules – Features of Module Import – Module Built-in Functions – Packages – Other Features of Modules. **12 Hrs**

UNIT V : Files and Input / Output: File Objects – File Built-in Functions – File Built-in Methods – File Built in Attributes – Command-Line Arguments - File System – Object-oriented Programming – Introduction – Classes – Class Attributes – Instances – Instance Attributes – Binding and Method Invocation – Sub classing – Inheritance. **12 Hrs**

RECOMMENDED TEXTBOOKS:

1. Wesley J. Chun, Core Python Programming, 3rd Edition, Pearson Education LPE, New Delhi, 2018.
2. Allen Downey Chris Meyers Je_reyElkner, How to Think Like a Computer Scientist Learning with Python, Green Tea Press Wellesley, Massachusetts, 2015.
3. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers , How to Think Like a Computer Scientist: Learning with Python 3Documentation Release 3rd Edition , http://openbookproject. net/ thinkcs / python/ english3e/ , 2019.
4. Nicholas H.Tollervey, Programming with MicroPython , Shroff/ O'Reilly, 2017.

REFERENCE BOOKS:

1. Charles Severance , Python for Everybody , Shroff Publishers , 2017
2. Brain Jones, David Beazely, Python Cookbook, 3rd Edition, Shroff Publishers, 2017
3. Mark Lutz, Learning Python, 5th Edition, O'Relly, 2018

JOURNALS:

1. https://dl.acm.org/citation.cfm?id=1047569
2. https://www.scripps.edu/sanner/html/papers/IPC02.pdf

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106/106/106106182/
2 https://www.coursera.org/learn/python?specialization=python
3 https://www.learnpython.org/
4 https://www.coursera.org/learn/python-data?specialization=python
5 https://www.coursera.org/learn/python-network-data?specialization=python

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Learn basics of python. Understanding the basic python program.
CO 2	Learn to solve the new operations of python. understanding and implement the basic problems.
CO 3	Learn conditional and unconditional statements in python. Learn to solve function related problems.
CO 4	Understanding the Errors and Exceptions of python program. Gain knowledge about modules and packages.
CO 5	Learn file handling in python. Absorb the OOPS concepts of python.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	3	3
CO 2	3	2	2	3	3
CO 3	3	2	2	3	3
CO 4	3	2	2	3	3
CO 5	3	2	2	3	3
Average	**3**	**2**	**2**	**3**	**3**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Working in tools, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

COMPUTER LABORATORY-VII: VISUAL .NET PROGRAMMING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/4P7/VNP**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the building blocks of .Net and learn to build C# applications
2. Be familiar with connection of ADO.NET programming

COURSE OUTCOMES:

CO No.	CO Statement
CO 1	Identification of building blocks of .NET and design C# applications using visual studio
CO 2	Development of C# advanced programming techniques and build various .NET assemblies

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	3
CO 2	3	2	3	2	3
Average	**3**	**2**	**2,5**	**2**	**3**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

LIST OF EXERCISES:

1. 1. Write a C# program to find the Income tax for the following slab. Check for senior citizens with 2% lesser with the given schedule.

Annual Income	Tax Rates	Health and Education Cess
Up to Rs.2.5 lakh*	Nil	Nil
Rs.2,50,001-Rs.5 lakh	5%	3% of Income Tax
Rs.5,00,001-Rs.10 lakh	20%	4% of Income Tax
Above Rs.10 lakh	50%	4% of Income Tax

2. Write a C# program to prepare the Electricity Bill with the following criterion.

Units consumed	Fixed Charges	Energy Charges
>= 25	-	110
26 to 50 or 51-100	-	150
101-200	5	260
201-600	5	350
>601	5	475

3. Create a Web service in .NET for temperature conversion
4. Write a C# program to implement Single Inheritance. Accept and display the data for one table.

Class Furniture (PC)
Data Members : material ,price
|
|
Class Table (DC)
Data Members : Height ,surface_area

5. Create a Web service in .NET for calculator processing.
6. Create a simple program to demonstrate a multi-thread concept.
7. Create a Web service in .NET for temperature conversion
8. Create a simple program to demonstrate a string builder class with sample string as "ASSOCIATION"
9. Write a C# program to display the Employee Information system using Indexer.
10. Design a resume and validate all the fields using different validation controls.
11. Write a C# program to display the Student Information using property.
12. Write a C# program to implement Banking application with Funds transfer operation and display the reflection in both creditor and debtor accounts.
13. Write a C# program to implement the method overloading for concatenating string values and integer type values.
14. Create an assembly program for invoking different modules from main modules.
15. Write a C# program to display the periodical weather report for two days.
16. Write a C# program to prepare the student information system using struct.
    The fields are: Student id, Student Name, Course Name and Date of Birth.
    The application should also display the information of all the students.
17. Write a C# program to define a class SALARY which will contain member variable Basic, TA, HRA, DA. Use constructor for default values for DA and HRA. Calculate the salary of the employee.
18. Design a railway database and validate all the fields using validation controls.
19. Design a Blood bank database and validate all the fields using validation controls

E-LEARNING RESOURCES:

1 https://dotnet.microsoft.com/learn

2 hhttps://www.codementor.io/collections/learn-c-sharp-online-bwbavow0y

Teaching Methodology

Learning through Demonstrations, Hands-on sessions, Dry-Run methodology and Trial & Error methods.

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER IV

COMPUTER LABORATORY-VIII: PYTHON PROGRAMMING

TOTAL HOURS : 45 Hrs
CREDITS : 2

COURSE CODE : MCA18/4P8/ PPG
L-T-P : 0-0-5

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand basic statements of python.
2. Learn real world problems extensively
3. Learn various libraries in python
4. Learn python installation and various tools to use.

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Working with python Libraries
CO 2	Installing new packages and working with oops
CO 3	Working with files and graphics.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	3	3
CO 2	3	3	2	3	3
CO 3	3	3	3	3	3
Average	**3**	**3**	**2.3**	**3**	**3**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

LIST OF EXPERMENTS

SIMPLE PROGRAMS

1. Write a Python program to reverse the digits of an integer.

2. Write a Python program to multiply matrices.

PYTHON NumPy:

3. Python NumPy: Sort an along the first, last axis of an array.

4. Python NumPy: Collapse a 3-D array into one dimension array.

PYTHON Matplotlib

5. Write a Python program to draw a line using given axis values with suitable label in the x axis, y axis and a title. test.txt

6. Write a Python program to draw line charts of the financial data of Alphabet Inc. between October 3, 2016 to October 7, 2016. Sample financial data (fdata.csv):

FILES PROGRAM

7. Python Program to Read the Contents of a File and Count the Number of Words in a Text File.
8. Python Program to Read a Text File and Print all the Numbers Present in the Text File

GRAPHICS PROGRAM

9. Simulate elliptical orbits in Pygame.
10. Simulate bouncing ball in Pygame.

CLASSES AND OBJECTS

11. Python Program to Create a Class in which One Method Accepts a String from the User and another Prints it.
12. Python Program to Create a Class and Get All Possible Subsets from a Set of Distinct Integers

E-LEARNING RESOURCES:

1 https://www.w3resource.com/python-exercises/

2 https://www.edureka.co/blog/python-numpy-tutorial/

3 https://www.geeksforgeeks.org/numpy-in-python-set-1-introduction/

TEACHING METHODOLOGY:

Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Quiz, Hands on session.

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER IV

COMPUTER LABORATORY-IX: INTERNSHIP

COURSE CODE: MCA18/4P9/INP
CREDITS : 2

Students have to undergo internship in reputed industries for the period of 4 to 6 weeks during summer vacation

SEMESTER V

ADVANCED JAVA PROGRAMMING

TOTAL HOURS: 60 Hrs **COURSE CODE: MCA18/5C/AJP**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the importance of Enterprise Applications, role of JDBC
2. Learn, develop the server side and client side components
3. Create and send Java mail and JMS
4. Analyze and apply the Enterprise components
5. Use the Frameworks

COURSE OUTLINE:

UNIT I : J2EE overview: The beginning of Java- Java Byte code- Advantages of Java- J2EE and J2SE- J2EE Multi-tier Architecture-J2EE Best Practices- J2EE Design Pattern-Concept. **10 Hrs**

UNIT II : J2EE Database concepts: Data- Database- Database schema –JDBC objects: JDBC Driver types- JDBC Packages – Overview of JDBC Process-database connection-JDBC-ODBC Bridge- statement objects- Result Set- Transaction Processing- Meta data- Java and XML **12 Hrs**

UNIT III :Java Servlets &JSP: Servlets and CGI- anatomy of servlet-Deployment Descriptor- Reading data from client- Reading HTTP Request Headers- Sending data to a client- working with cookies- Tracking sessions- JSP- Installation- JSP Tags- Tomcat-Request String- user Sessions- cookies- session Objects- RMI- Java RMI – Remote Interface- passing objects- RMI Process- server - client side. **14 Hrs**

UNIT IV : Enterprise Java Beans: Deployment Descriptors- Session Bean- Entity Java Bean- Message Driven Bean- Java Mail- Protocols-exceptions- sending ,Retrieving ,Deleting and Reply to, Forwarding an Email Message- Receiving attachments- searching an Email Folder. **12 Hrs**

UNIT V :Java Message Service: JMS fundamentals- Components of JMS Program-messages- message selector- sending messages to a queue- receiving messages – compiling and running queue programs- creating a publisher- creating a subscriber- compile and running the publisher and subscriber- JNDI- Naming and Directories- JND Interface- Naming Operations.

14 Hrs

RECOMMENDED TEXTBOOKS:

1. Java6 and J2EE1.5 Black Book,Kogent learning solutions, Wiley India, 2014
2. J2EE : The Complete Reference, Jim Keogh,Mc-Graw Hill,Reprint2014

REFERENCE BOOKS:

1. Teach Yourself J2EE in 21 Days,Martin Bond, Debbie Law, Sams Publishing,Reprint
2. Rapid J2ee Development: An Adaptive Foundation for Enterprise Applications, Alan Monnox, Prentice Hall,2005,
3. Pro J2EE 1.4: From Professional to Expert , Apress

JOURNALS:

1. https://www.journals.elsevier.com/science-of-computer-programming
2. http://java.sys-con.com/

E-LEARNING RESOURCES:

1. https://www.udemy.com/course/how-to-connect-java-jdbc-to-mysql/
2. https://www.udemy.com/course/jsp-servlet-free-course/
3. https://www.udemy.com/course/java-message-service-jms-fundamentals/
4. https://www.udemy.com/course/the-java-ee-course/
5. https://www.udemy.com/course/advanced-java-programming-java-se-7-vtc/

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Know the importance of Enterprise Applications, role of JDBC
CO 2	Understand ,implement the server side and client side components
CO 3	Understand the Java mail, JMS components
CO 4	Learn and apply EJB in Enterprise applications
CO 5	Understand Frameworks in the real time application development

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	2	2	2	3	2
CO 2	2	3	2	2	2
CO 3	3	2	3	2	2
CO 4	3	3	3	3	2
CO 5	3	2	2	2	2
Average	2.6	2.4	2.4	2.4	2

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, learning through Demonstrations, LCD Projectors, e-content, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V

MACHINE LEARNING

TOTAL HOURS : 60 Hrs **COURSE CODE : MCA18/5C/MLG**
CREDITS : 4 **L-T-P : 4-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Learn basic ML algorithms and techniques and their applications extensively.
2. Develop a basic understanding of the principles of machine learning and derive practical solutions using predictive analytics.
3. Know several software libraries and data sets publicly available will be used to illustrate the ML application.
4. Use data patterns to make decisions and predictions with real-world examples.
5. Learn real life case studies and identify the solutions.

COURSE OUTLINE:

UNIT I : **Introduction to Machine Learning:** Types of Human Learning – Types of Machine Learning – Applications of Machine Learning – Tools in Machine Learning –**Preparing to Model :**Machine Learning Activities – Basic types of Data in ML – Exploring of Data – Data quality remediation – Data Pre-processing. **12 Hrs**

UNIT II : **Modelling and Evaluation :** Selecting a Model – Training a Model – Model Representation and interpretability – Evaluating performance of a Model. **Basic of Feature Engineering:** Introduction – Feature Transformation – Feature Subset Selection. **Brief Overview of Probability:** Introduction – Importance of Statistical tools in ML – Concept of Probability. **12 Hrs**

UNIT III : Random Variables – Bernoulli Distribution – Binomial Distribution – Sampling Distribution. **Bayesian Concept Learning:** Bayes Theorem – Bayes Theorem and concepts – Bayesian Belief Network. **Supervised Learning:** Classification Model – Classification Learning Steps –Common Classification Algorithms. **12 Hrs**

UNIT IV : **Supervised Learning: Regression :** Introduction – Example of Regression – Common Regression Algorithms. **Unsupervised Learning: Regression:** Support Vector Machine – Linear and non Linear. **Learning with Neural Networks :** Towards Cognitive Machine – Network Architecture. **12 Hrs**

UNIT V : **Decision Tree Learning:** Example of Classification Decision Tree – Measures of Impurity for Evaluating Splits in Decision Trees – ID3 , CART Decision Trees – Pruning Tree – Strength and Weakness of Decision Tree Approach. **Machine Learning Workflow:** NYC Taxi Data –Advanced NLP example: Movie review sentiment – Scaling Machine Learning workflow. **12Hrs**

RECOMMENDED TEXTBOOKS:

1. Saikat Dutt , Subramanian Chandramouli , Amit Kumar Das, Machine Learning , First Edition , Pearson India Services Pvt. Ltd , 2019. (Unit 1, 2, 3)
2. M.Gopal, Applied Machine Learning, McGraw Hill Education Pvt. Ltd , 2018. (Unit 4)
3. Henrik Brink , Joseph W. Richards, Mark Fetherolf , REAL – WORLD MACHINE LEARNING , Dreamtech Press , 2017. (Unit 5)

REFERENCE BOOKS:

1. Peter Harrington , Machine Learning in Action , Dreamtech Press , 2018.
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
4. Ethem Alpaydin , Introduction to Machine Learning , Third Edition , Eastern Economy Edition , 2017.

JOURNALS:

1. Machine Learning and Knowledge Extraction — Open Access Journal - https://www.mdpi.com/journal/make
2. https://link.springer.com/journal/10994
3. http://www.jmlr.org/papers/v20/

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106/106/106106139/
2 https://www.guru99.com/machine-learning-tutorial.html
3 https://nptel.ac.in/courses/106/106/106106202/
4 https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners
5 https://cs.nyu.edu/~mohri/mlu11/

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Learn machine learning basics and Models of ML
CO 2	Gain knowledge about feature engineering and learn about statistical tool.
CO 3	Gain knowledge about supervised learning in ML
CO 4	Gain knowledge about unsupervised learning in ML
CO 5	Learn Decision tree algorithms and some real world problem implementation.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	2	3	2	3	3
CO 3	2	2	2	3	3
CO 4	2	2	2	3	3
CO 5	2	2	2	3	3
Average	**2**	**2.2**	**2**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of Tools, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V

COMPUTER LABORATORY-X: ADVANCED JAVA PROGRAMMING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5P10/AJP**
CREDITS :2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Design and develop a web application using IDE.
2. Apply the business logic for various real-time applications.

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Writing JDBC connectivity to post and retrieve through a web application.
CO 2	Developing the servlet, JSP using IDE.
CO 3	Develop real world enterprise modules
CO 4	Send a email from an application using Java Mail

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO 1	3	3	3	2	2
CO 2	3	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	2	3
Average	3	3	2.5	2	2.3

LIST OF EXERCISES:

1. Program to prompt the user for a hostname and then looks up the IP address for the hostname and displays the results.
2. Program to read the webpage from a website and display the contents of the webpage.
3. Programs for TCP server and Client interaction as per given below.
   i. Program to create TCP server to send a message to client.
   ii. Program to create TCP client to receive the message sent by the server.
4. Program to display a greeting message in the browser by using Http Servlet.
5. Program to design a loan calculator in a JSP Page and display using Http Servlet.
6. Program to display a list of five websites in a JSP page and visit to the selected website by using Response redirection.
7. Program to store the user information into Cookies. Write another program to display the above stored information by retrieving from Cookies.
8. Program by using JDBC to execute a SQL query for a database and display the results.

9. Program by using JDBC to execute an update query by using Prepared Statement and display the results.
10. Program to execute a stored procedure in the database by using Callable Statement and display the results.
11. Program to track session using servlet.
12. Program to develop an Enterprise Java Bean of "Session Bean" type.
13. Program to develop an Enterprise Java Bean of "Entity Session Bean" type.
14. Program to develop an Enterprise Java Bean of "Message Driven Bean" type.
15. Program to develop an application using RMI.
16. Program to send an e-mail.

E-LEARNING RESOURCES:

1. https://javaee.github.io/tutorial
2. https://docs.oracle.com/javaee/7/tutorial
3. https://netbeans.org/kb/trails/java-ee.html
4. https://www.oracle.com/technetwork/articles/javaee/tutorials-

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER V

COMPUTER LABORATORY-XI: MACHINE LEARNING

TOTAL HOURS : 45 Hrs **COURSE CODE : MCA18/5P11/MLG**
CREDITS : 2 **L-T-P : 0-0-5**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Learn real world problems extensively.
2. Understand ML algorithms and implement.
3. Identify new application requirements in the field of computer vision.
4. Make use of Data sets in implementing the machine learning algorithms.

COURSE OUTCOMES:

CO No.	CO Statements
CO1	Working with machine learning tools
CO2	Implement basic machine learning concepts

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	3	3
CO 2	2	2	2	3	3
Average	**2**	**2**	**2**	**3**	**3**

LIST OF EXPERMENTS:

1. Working with Data in OpenCV and Python

a) Loading External Dataset in Python.(Raw text, CSV, JSON, XML, Spreadsheets, and Images.

b) Visualizing the data using Matplotlib.

2. Working with Decision Trees and the Visualization

a) Bank Loan Analysis.

b) Diagnose of breast cancer.

3. Working with Data and Engineering Features

a) Implementing PCA in OpenCV

b) NLP working with bag of words

c) Extracting Features using SIFT and ORB.

4. Working with clustering

a) Classify the handwritten digits using K-means.
b) Weather Data Classification

5. Working with Classification

a) Classify your own dataset using SVM.
b) Classify your own dataset using KNN.
c) Bayesian Classification

E-LEARNING RESOURCES:

1 https://docs.opencv.org/2.4/doc/tutorials/tutorials.html

2 https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_tutorials.html

3 https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_ml/py_knn/py_knn_index.html

4 https://www.bogotobogo.com/python/OpenCV_Python/python_opencv3_Machine_Learning_Classification_K-nearest_neighbors_k-NN.php

5 https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_ml/py_svm/py_svm_basics/py_svm_basics.html

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Hands on session.

QUESTION PAPER PATTERN:

Knowledge Level	Section-A	Marks	Total
K2, K3 (UNDERSTANDING & APPLYING)	1 Question	30	60
K3, K4 (APPLYING & ANALYSING)	1 Question	30	

SEMESTER V

COMPUTER LABORATORY –XII: MINI PROJECT

TOTAL HOURS :45 Hrs **COURSE CODE: MCA18/5P12/MPT**
CREDITS : 2 **L-T-P : 0-0-5**

Students have to develop a Mini Project in their area of interest using latest technology and tools.

SEMESTER VI

COMPUTER LABORATORY-XIII: MAJOR PROJECT AND VIVA VOCE

CREDITS: 15 **COURSE CODE: MCA18/6P13/MPV**

Students have to undergo project development in reputed industries for the period of 4 Months

EXTRA DISCIPLINARY COURSES

SEMESTER I

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/1ED1/MFC**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the mathematical logic notations and truth table.
2. Realize statement and Predicate calculus and their implementations.
3. Simplify the set and graph theory and possible operations.
4. Analyze the classification and Tabulation of data using statistics.
5. Understand the theorems of probability.

COURSE OUTLINE:

UNIT I: Mathematical Logic**:** Introduction - Statements and Notation - Connectives :Negation, Conjunction, Disjunction, Conditional and Biconditional , Statement Formulas and Truth Tables. **8 Hrs**

UNIT II: Statement and Predicate Calculus: The theory of Inference for the Statement Calculus: Validity Using Truth tables –Rules of inference-Consistency of Premises and Indirect Method of Proof- The Predicate Calculus :Predicates – StatementFunction, Variables and Quantifiers – Theory of Inference for the Predicate Calculus. **16 Hrs**

UNIT III: Set And Graph Theory: Basic Concepts of Set Theory – Operations on Sets – Venn Diagrams – Basic Set Identities – Basic Concepts of Graph Theory : Basic Definitions– Paths, Reachability and connectedness. **12 Hrs**

UNIT IV: Fundamentals Of Statistics : Classification And Tabulation of Data: Types of Classification – Types of Tables – Diagrammatic and Graphic Presentation –Measures of Central Value – Arithmetic Mean, Median, Mode. **12 Hrs**

UNIT V: Probability: Calculation of Probability – Theorems of Probability: Addition theorem –Multiplication theorem-Conditional Probability – Bayes' Theorem. (Statements only) (Note: No Derivation Required) **12 Hrs**

RECOMMENDED TEXTBOOKS:

1. J.P.Tremblay, R.Manohar, Discrete Mathematical Structures with applications to Computer Science, TM Hall Edition, 2008.
2. S.P.Gupta , Statistical Methods ,Sultan Chand & Sons, 2011.

REFERENCE BOOKS:

1.D.C.Sancheti , V. K . Kapoor ,Statistics (Theory , Methods and Applications),Sultan Chand & Sons , 2011

JOURNALS:

1. https://www.aimsciences.org/journal/A0000-0001
2. https://link.springer.com/journal/10208

E-LEARNING RESOURCES:

1. https://lecturenotes.in/subject/381/mathematical-foundations-of-computer-science-mfcs
2. https://doc.lagout.org/science/0_Computer%20Science/3_Theory/Mathematics/Discrete%20Mathematics/Mathematical%20Foundation%20of%20Computer%20Science.pdf
3. https://www.springer.com/gp/book/9781461277927
4. https://www.smartzworld.com/notes/mfcs-notes-pdf-mathematical-foundation-of-computer-science/
5. https://online.stanford.edu/courses/cs103-mathematical-foundations-computing

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Thorough knowledge over mathematical logic through formulas and truth tables.
CO 2	Imply the theory of inference for statement and predicate calculus.
CO 3	Insight into the basic concept of Set and Graph Theory
CO 4	Acquaintance of statistical fundamentals like the types of tabulation and classification.
CO 5	Acquiring knowledge over probability and its associated theorems

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	3	3	2	2	2
CO 3	3	2	3	2	3
CO 4	3	3	3	2	2
CO 5	3	2	2	3	3
Average	**2.8**	**2.4**	**2.4**	**2.2**	**2.4**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content,Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III
M-COMMERCE

TOTAL HOURS : 45 Hrs **COURSE CODE : MCA18/3ED2/MCE**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the E – commerce strategies and value chains
2. Understand the M-commerce services
3. Understand M – commerce infrastructure and applications.
4. Know the availability of latest technology and applications of M- commerce in various domains.
5. Apply mobile commerce in business-to-business application.

COURSE OUTLINE:

UNIT I : Electronic Commerce: Introduction - The e-commerce environment - The E-commerce marketplace -Focus on portals, Location of trading in the Marketplace - Commercial arrangement for transactions - Focus on auctions - Business models for e-commerce - Revenue models **.9 Hrs**

UNIT II: Mobile Commerce: Introduction – Infrastructure of M– Commerce – Types of Mobile commerce services – Technologies of wireless business – benefits and limitations, support, mobile marketing & advertisement, Non– internet applications in M– Commerce –wireless/wired commerce comparisons.

9Hrs

UNIT III: Mobile Commerce: Technology: A Framework for the study of Mobile Commerce –Wireless Devices For Mobile Commerce – Towards a classification framework for mobile location based services –The Impact of technology advances on Strategy Formulation in Mobile Communications Networks. **9Hrs**

UNIT IV: Mobile Commerce: Theory and applications : The Wireless Application Protocol – Mobile Portal – Factors Influencing The Adoption of Mobile Gaming Services – Mobile Data Technologies – Location– Based Services: Criteria For Adoption and solution deployment – The Role of Mobile advertising in building a brand– M– Commerce Business Models.

9Hrs

UNIT V: Business– To– Business Mobile E-Commerce : Enterprise Enablement – Email and Messaging – Field force automation (insurance, real estate, maintenance, healthcare) – Field sales support (Content access, Inventory) – Asset tracking and maintenance/management – remote IT support –Customer Retention (B2C Services, Financial, Special Deals) **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Dave Chaffey, "E-Business and E-Commerce Management", Third Edition, 2009, Pearson Education.
2. Brian E. Mennecke, Troy J. Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
3. P. J. Louis, " M-Commerce Crash Course", McGraw- Hill Companies February 2001.

REFERENCE BOOKS:

1. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 2001.
2. Michael P. Papazoglou, Peter M.A. Ribbers, 'e-business organizational and Technical foundation ',Wiley India 2009.
3. Dr.Pandey , Saurabh Shukla E-commerce and Mobile commerce Technologies , Sultan chand ,2011.

JOURNALS:

1. https://pdfs.semanticscholar.org/439b/1e9f284aacb77980ba97eec4f325062e09c7.pdf
2. https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/file.php?val=March_2017_1491815087__192.pdf

E-LEARNING RESOURCES:

1 https://pdfs.semanticscholar.org/bb70/823424ad9e7eb1398535fcc113cc76bbfe3c.pdf

2 http://assets.vmou.ac.in/MCA503.pdf

3 https://cgi.csc.liv.ac.uk/~trp/Teaching_Resources/COMP327/327-Lecture10-MobileCommerce.pdf

4 https://nptel.ac.in/courses/106105084/

5 https://www.toppr.com/guides/business-environment/emerging-trends-in-business/m-commerce/

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Learn to know about online payments. Gain a clear understanding about online business.
CO 2	Gain to understand the Mobile commerce business models. Learn to know the techniques involved in M-commerce.
CO 3	Learn to know about the communication networks. Understand the Services.
CO 4	Understanding the steps to involve in small business and design business models.
CO 5	Learn real world online business. Gain knowledge about asset Maintenance/ Management.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	2	2	2	3	3
CO 3	2	2	2	3	3
CO 4	2	2	2	3	3
CO 5	2	2	2	3	3
Average	**2**	**2**	**2**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V

ORGANISATIONAL BEHAVIOUR

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5ED3/OBR**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. To inspect the basics of organizational behavior models.
2. To recognize the individual behavior and personality types.
3. To study the group behavior and the communication.
4. To understand the leadership and power.
5. To obtain the work-life balance and job satisfaction.

COURSE OUTLINE:

UNIT I: Focus and Purpose: Definition - need and importance of organizational behavior – Nature and Scope- Frame Work – Organizational Behaviour models. **9 Hrs**

UNIT II: Individual Behaviour : Personality – types – factores influencing personality – Theories – Learnning – Types of learners – The learning process- Learning theories – Organizational behaviour modification – Misbehaviour – Types – Managmement intervention – Emotions – Emotional Labour – Emotional Intelligence - Theories – Attitudes – Characteristics - Components – Formation – Measurement – Values – Perceptions – Importance – Factors influencing perception- Interpersonal Perception – Impression Management – Motivaiton – Importance – Types – Effects on Work Behaviour. **9 Hrs**

UNIT III: Group Behaviour: Organizational Structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal learders and working norms – Group Decision making techniques - Team Building – interpersonal relations – Communication – Control. **9 Hrs**

UNIT IV: Leadership and power: Meaning – Inportance – Leadership styles – Theories – Leaders Vs – Managers - Sources of power - Power Centers – Power and Politics. **9 Hrs**

UNIT V: Dynamics of Orgnizational Behaviour: Organizational Culture and climate – Factors affecting organizational climate – Importance – Job Satisfaction – Determinants – Measurements – Influence on Behaviour – Organizational change – Importance – Stability vs Change – Proactive vs Reactive Change – the change process – Resistance to change – Managing Change – Stress – Work Stressors – Prevention and Management of Stress – Balancing Work and Life – Organizational Development – Characteristics – objectives – Organizational Effectiveness – Developing Gender sensitive work place. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Stephen P. Robins , Organizational Behaviour , PHI Learning/ Pearson Education 11th edition 2015.
2. Fred Luthans , Organizational Behaviour , McGraw Hill 11th edition 2013.

REFERENCE BOOKS:

1. Nelsonm Quick, Khandelwal ORGB - An Innovative approach to learning and teaching, Cengage learning. , 2nd edition 2016.
2. Mc Shane & Von Glinov , Organisational Behaviour – 4th edition – Tata Mc Graw Hill 2014.

JOURNALS:

1. https://onlinelibrary.wiley.com/journal/10991379
2. https://www.journals.elsevier.com/research-in-organizational-behavior

E-LEARNING RESOURCES:

1 https://lecturenotes.in/subject/55/organizational-behaviour-ob

2 https://open.umn.edu/opentextbooks/textbooks/organizational-behavior

3 https://www.slideshare.net/sumanpoudel18/mba-1s-sem-organisational-behaviour-notes

4 https://www.studocu.com/en/document/syddansk-universitet/organisational-behaviour/lecture-notes/organizational-behavior-notes/1102139/view

5 https://www.scribd.com/doc/94519033/Organizational-Behaviour-Study-Material-1

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Study over the basics of organizational behavior.
CO 2	Build the personality grooming and learning process and its types.
CO 3	Coordinate with the group to establish the proper communication.
CO 4	Acquire the adequate amount of leadership skills.
CO 5	Grasp the knowledge over the dynamics organizational climate.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	2
CO 2	3	2	2	3	2
CO 3	2	2	2	3	2
CO 4	3	2	2	2	2
CO 5	2	3	2	2	3
Average	**2.6**	**2.2**	**2**	**2.4**	**2.2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Understanding of Mobile Communication Standards, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

ELECTIVE

SEMESTER III
SYSTEM ANALYSIS AND DESIGN

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/3E1/SAD**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:
To enable the post graduate students to

1. Analyze the Systems, Roles and Development Methodologies.
2. Incorporate the methods for gathering requirements and design engineering.
3. Depict the requirements and system flow as schematic representation.
4. Investigate object oriented analysis and design using UML.
5. Understand the interaction between the System and Human.

COURSE OUTLINE:

UNIT I: Systems, Roles and Development Methodologies – Types of Systems - Integrating Technologies for Systems – Need for System Analysis and Design – Roles of System Analyst – SDLC - Understanding and Modeling Organizational Systems – Project Management. **9 Hrs**

UNIT II: Information Gathering and Interactive Methods – Interviewing – Joint Application Design – Using Questionnaires - Unobtrusive Methods – Sampling - Investigation– Agile Modeling and Prototyping – Developing a prototype - Rapid Application Development. **9 Hrs**

UNIT III: Using Data Flow diagrams –Developing data flow diagrams – Logical and Physical Data flow diagrams – A data flow diagram example - Analyzing systems using Data dictionaries – The Data Dictionary – The Data Repository – Creating the data dictionary - Process Specifications and structured decisions – Overview of Process Specifications – Structured English – Decision Tables. **9 Hrs**

UNIT IV: Object Oriented Analysis and Design using UML – Objected Oriented Concepts – UML Modeling concepts and Diagrams – Use case Modeling – Activity Diagrams – Sequence and Communication Diagram - Class Diagram – State Chart Diagram - Designing Output & Input. **9 Hrs**

UNIT V: Human Computer Interaction – Usability – Types of UI – Guidelines for Dialog and Design – Feedback for users - Designing Accurate Data Entry Procedures - Effective Coding – Effective and Efficient Data Capture – Ensure Data Quality Through Input Validation - Quality Assurance and Implementation – Total Quality Management approach – Documentation Approaches – Testing, Maintenance and Auditing – Implementing Distributed Systems **9Hrs**

RECOMMENDED TEXTBOOKS:

1. Kendall& Kendall, Systems Analysis and Design, Pearson Education, Eighth Edition, 2016.
2. Dennis, Wixom and Roth, Systems Analysis and Design, John Wiley & Sons Publications, Fifth Edition, 2014.

REFERENCE BOOKS:

1.Sajja, Priti Srininvas , Essence of System Analysis and Design, Springer, 2017.
2.Allan Dennis, Systems Analysis and Design, John Wiley & Sons Publications, 7th Edition, 2018.

JOURNALS:

1. https://pdfs.semanticscholar.org/5a94/68fa888e293593817b5e44bcb11c269a464e.pdf.
2. http://www.sciencepublishinggroup.com/journal/paperinfo?journalid=526&doi=10.11648/

E-LEARNING RESOURCES:

1 http://www.saigontech.edu.vn/faculty/huynq/SAD/Systems_Analysis_Design_UML_5th%20ed.pdf
2 https://www.oreilly.com/library/view/system-analysis-and/9781118057629/
3 http://www.zu.edu.jo/UploadFile/Library/E_Books/Files/LibraryFile_12159_26.pdf
4 https://www.springer.com/gp/book/9789811051272

COURSE OUTCOME:

CO No.	CO Statements
CO 1	Develop methodologies for System Design and Project Development.
CO 2	Collect requirements to design and develop Applications.
CO 3	Exhibit the flow and the operations associated with the system as suitable diagram.
CO 4	Study the object oriented principles to avail the bottom-up architecture and Reusability features.
CO 5	Implement the design and development of the application and check for prior implementation activities.

MAPPING- CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	3	3	2	3	2
CO 3	3	3	3	2	2
CO 4	3	3	2	3	3
CO 5	2	3	2	3	2
Average	**2.6**	**2.8**	**2.2**	**2.6**	**2.2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Understanding of Analysis and Design Phases, Group Discussion, Brain Storming, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III

SOFTWARE PROJECT MANAGEMENT

TOTAL HOURS: 45Hrs **COURSE CODE: MCA18/3E1/ SPM**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Learn project planning for the software process.
2. Learn the cost estimation techniques during the analysis of the project.
3. Understand the quality concepts for ensuring the functionality of the software
4. Learn risk in project development and risk management process
5. Learn human resource characteristics models and ethical standards.

COURSE OUTLINE:

UNIT I : SOFTWARE PROJECT MANAGEMENT CONCEPTS

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- TQM, Six Sigma, and Software Quality: defining software quality, ISO9126, External Standards. **9 Hrs**

UNIT II : SOFTWARE EVALUATION AND COSTING

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods. **9 Hrs**

UNIT III : SOFTWARE ESTIMATION TECHNIQUES

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model. **9 Hrs**

UNIT IV : RISK MANAGEMENT

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring. **9 Hrs**

UNIT V : STAFFING IN SOFTWARE PROJECTS

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012

REFERENCE BOOKS:

1. Futrell , "Quality Software Project Management", Pearson Education India, 2008
2. Gobalswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill Publishing Company, 2003
3. Richard H.Thayer "Software Engineering Project Management", IEEE Computer Society
4. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition, 2013

JOURNALS:

1. https://www.sciencedirect.com/science/article/pii/S2212017315002491
2. https://ieeexplore.ieee.org/document/6772420
3. http://www.scirp.org/journal/articles.aspx?searchCode=+Software+Project+Management&searchField=keyword&page=1&SKID=0

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106/105/106105218/
2 https://www.smartzworld.com/notes/software-project-management-pdf-notes-spm-pdf
3 https://www.coursera.org/learn/software-processes
4 https://www.coursera.org/learn/uva-darden-project-management
5 https://www.coursera.org/learn/introduction-to-software-product-management

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Lear basic project management concept. Gain knowledge about quality standards.
CO 2	Learn software coasting models. Know about the tools regarding process models.
CO 3	Gain knowledge about software project planning, scheduling and estimation.
CO 4	Gain knowledge about risk management process. Know the importance of coast scheduling and monitoring.
CO 5	Know about the organizational structure and human resource.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	2	2	2	2	3
CO 3	2	2	2	2	3
CO 4	2	2	2	2	3
CO 5	2	2	2	2	3
Average	**2**	**2**	**2**	**2**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER III
COMPILER DESIGN

TOTAL HOURS:45 Hrs **COURSE CODE: MCA18/3E1/CDN**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:
To enable the post graduate students to

1. Introduce the major concept areas of language translation and compiler design
2. Develop an awareness of the function and complexity of modern compilers
3. Understand the phases of the compilation process and be able to describe the purpose and implementation approach of each phase.
4. Give students practical exposure to aspects of theoretical Computer Science including Languages, Grammars, and Machines.
5. Exercise and reinforce prior programming knowledge with a non-trivial programming project to construct a compiler.

COURSE OUTLINE:

UNIT I: Introduction: Basic concepts - Grammar - Language - Parts of a compiler – Grouping of phases - Compiler construction tools **9 Hrs**

UNIT II: Lexical Analyzer: Role of a lexical analyzer – Input buffering - Specification and recognition of tokens - Finite automata - Regular expression to finite automation – Optimization of DFA-based pattern matchers-Use of a tool for generating lexical analyzer. **9 Hrs**

UNIT III: Syntax Analyzer: Role of a parser - Context-free grammars - Top-down parsing – Bottom up parsing - Use of a tool to generate parsers. **9 Hrs**

UNIT IV: Intermediate Code Generation: Intermediate languages - Declaration - Assignment statements – Boolean expressions - Flow control statements – Back patching. **9 Hrs**

UNIT V: Code Generation: Introduction to optimization techniques - Issues in the design of a code generator - Run-time storage management - Design of a simple code generator. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman,"Compilers Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2011.

REFERENCE BOOKS:

1. Des Watson, "A Practical Approach to Compiler Construction", Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017

2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

JOURNALS:

1. http://www.serialspublications.com/journals/journal-detail.php?jid=66
2. https://link.springer.com/article/10.1007/s10766-005-35906
3. http://www.academia.edu/Documents/in/Compiler_Design

E-LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106108052/
2. https://www.coursera.org/lecture/nand2tetris2/unit-4-2-lexical-analysis-QM0lZ
3. https://www.coursera.org/lecture/nand2tetris2/unit-4-1-syntax-analysis-5pC2Z
4. https://nptel.ac.in/courses/106104072/
5. https://nptel.ac.in/courses/106104072/

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Demonstrate a working understanding of the process of semantic analysis through the construction of semantic records based on parse trees
CO 2	The construction of symbol tables,
CO 3	The organization of run time memory and the writing of a semantic analyzer for a compiler.
CO 4	Design, analyze, implement and test a working compiler for a small language
CO 5	Develop a compiler with all the phases

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	3
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CO 3	2	2	2	3	3
CO 4	3	2	3	3	2
CO 5	3	3	2	3	3
Average	**2.8**	**2.4**	**2**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of security problems, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

ACCOUNTING AND FINANCIAL MANAGEMENT

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/4E2/AFM**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Study the principles of accounting.
2. Classify the analysis and interpretation of accounts.
3. Learn the break even analysis and marginal costing.
4. Extend the preparation of functional budget characteristics.
5. Understand the methods behind the project appraisal.

COURSE OUTLINE:

UNIT I: Principles of Accounting : Principles of double entry-Assets and liabilities-Accounting records and systems-Trial balance and preparation of financial statements-Trading - Manufacturing, profit and loss accounts- Balance sheet including adjustments(simple problems only). **9 hrs**

UNIT II: Analysis and Interpreting Accounts and Financial Statements: Ratio analysis-Use of ratios in interpreting the final accounts (trading accounts and loss a/c and balance sheet)-final a/c to ratio as well as ratios to final accounts. **9 hrs**

UNIT III: Break Even Analysis and Marginal Costing: Meaning of variable cost and fixed cost-Cost-Volume – profit analysis-Calculation of breakeven point- profit planning-sales planning and other decision-making analysis involving break-even analysis-Computer Accounting and algorithm. (Differential cost analysis to be omitted) **9 hrs**

UNIT IV: Budget/Forecasting: Preparation of and characteristics of functional budgets-production- sales- purchases- cash and flexible budgets. **9 hrs**

UNIT V: Project Appraisal: Method of capital investment decision making-Payback method- APR method-Discounted cash flows-Net present values-internal rate of return-sensitivity analysis-cost of capital. **9 hrs**

RECOMMENDED TEXTBOOKS:

1. A.Murthy"Financial Management" Margham Publicatio,. 2017
2. Prof T.S.Reddy & Dr.Y. Hariprasa Reddy,"Management Accounting", 2017

REFERENCE BOOKS:

1. Man Mohan & S.N. Goyal,"Principles of Management Accounting",AryaSahitya Bhawan,1987.
2. Kuchhal S.C. "Financial Management",chaitanya,1980.
3. Shukla M.C and T.S.Grewal,"AdvancedAccounts",NewDelhi,S.Chand& Co. , 2012.
4. Gupta R.L &M.Radhaswamy,"Advanced Accounts(Vol II)",New Delhi,S.Chand& sons,2014.

JOURNALS:

1. http://www.science.smith.edu/~jcardell/Courses/EGR328/Readings/uProc%20Ovw.pdf.
2. http://angom.myweb.cs.uwindsor.ca/teaching/cs266/Lec26601.pdf.

E-LEARNING RESOURCES:

1 https://www3.risc.jku.at/education/courses/ss2002/compsys/slides/systems/slides-main.pdf.
2 https://en.wikibooks.org/wiki/IB/Group_4/Computer_Science/Computer_Organisation
3 http://pdplab.it.uom.gr/teaching/tanenbaum/2.pdf
4 https://www.elprocus.com/8085-microprocessor-architecture/
5 https://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Lecture_Notes/LNm1.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Acquire the conceptual knowledge of accounting principles
CO 2	Understand the concepts and standards underlying the analysis and interpreting the accounts.
CO 3	Have the comprehensive knowledge about the break even analysis and marginal costing.
CO 4	Gain expertise in Budget and forecasting.
CO 5	Interpret the elements related to project appraisal and capital investment decision making

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
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CO 3	3	2	2	2	3
CO 4	3	3	3	3	2
CO 5	3	2	3	3	3
Average	**2.8**	**2.4**	**2.4**	**2.4**	**2.6**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors-content, Realization of Microprocessor Instructions in Digital Trainer Kit, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV
STATISTICAL METHODS

TOTAL HOURS: 45 Hrs
CREDITS : 3

COURSE CODE: MCA18/4E2/STS
L-T-P : 3-0-0

COURSE OBJECTIVES:

To enable the post graduate students to

1. Develop knowledge over the statistical population and samples.
2. Recognize the univariate data through statistical measures.
3. Analyze the measures of dispersion and co-efficient of variation.
4. Know the significance of Moments and Raw moments.
5. Understand the correlation and its types.

COURSE OUTLINE:

UNIT I: Concepts of Statistical Population and Sample: Measurement of Scale, Nominal, Ordinal, interval, ratio. Collection and sources of statistical data – Formation of frequency distribution –discrete and continuous – cumulative frequency distribution (O'gives) – Classification and tabulation. Graphs and Diagrams – Bar diagrams, Histogram, Pie diagram.

9 Hrs

UNIT II: Univariate data: Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean – Inter Relationship between A.M, G.M and H. M – Weighted A.M – properties of a good Average.

9 Hrs

UNIT III: Measures of dispersion (absolute & relative): Range, Quartile Deviation, Mean Deviation and Standard Deviation – Inter Relationship between Q.D., M.D., and S.D. Co-efficient of Variation – Lorenz curve.

9 Hrs

UNIT IV: Moments: Raw moments, Central moments – Relation between raw and central moments - Measures of skewness – Karl Pearson's coefficient of skewness – Bowley's co-efficient of Skewness – Measures of Kurtosis. **9 Hrs**

UNIT V: Correlation: – types of correlation – Scatter diagram — Karl Person's co-efficient of correlation – properties – Spearman's Rank correlation co-efficient – Concurrent deviation Method - Correlation co-efficient for grouped data. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1.Gupta, S.C, and Kapoor, V.K, Fundamental of Mathematical Statistics, 2014 (11th edition),Sultan Chand & Sons, New Delhi.
2.Goon Gupta A.M and Das Gupta, Fundamentals of Statistics, 2013, The World Press Private Limited, Calcutta.

REFERENCE BOOKS:

1. S.P.Gupta, (2001). Statistical Methods, Sultan Chand & Sons, New Delhi.

JOURNALS:

1. https://www.tandfonline.com/loi/gsta20
2. http://www.scirp.org/journal/ojs/

E-LEARNING RESOURCES:

1 https://www.examrace.com/Study-Material/Statistics/Statistics-Free-Ebooks.html
2 https://gradeup.co/cds-statistics-tips-formulas-i
3 https://openstax.org/details/books/introductory-statistics
4 https://www.tandfonline.com/toc/cjas20/current
5 https://onlinelibrary.wiley.com/journal/20491573

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Extend adequate study over the measurement of scale and graphs and diagrams.
CO 2	Understand the functionality behind the measures of central tendency.
CO 3	Gain the insight into all the measures of dispersion.
CO 4	Interpret the conceptual knowledge of moments and its classification.
CO 5	Familiarize the types of correlation and co-efficient for grouped data.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	2
CO 2	3	2	2	2	2
CO 3	3	2	2	3	2
CO 4	3	2	2	2	2
CO 5	2	2	2	3	3
Average	**2.8**	**2**	**2**	**2.8**	**2.2**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of algorithms, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER IV

RESOURCE MANAGEMENT TECHNIQUES

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/4E2/RMT**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Develop Computational Skills
2. Develop Logical thinking in formulating industry oriented problems.
3. Apply these techniques in real life situations.

COURSE OUTLINE:

UNIT I: Linear Programming: Formulation – Solution to LPP by Graphical & Simplex Method – Artificial Variable Technique – Big M Method. **9 Hrs**

UNIT II: Transportation Problem – Assignment Problem – Travelling Salesman Problem. **9 Hrs**

UNIT III: Sequencing: Sequence Problem: Processing N Jobs on 2 machines & 3 machines –Game theory: Introduction – 2 persons zero – sum game – Max & Min Max principle – saddle point & value of game – Games without saddle points. **12Hrs**

UNIT IV: Construction of Network: Types of floats – Project Scheduling by Critical Path Method - Project Evaluation and Review Techniques – Difference between CPM and PERT **10 Hrs**

UNIT V: Interpolation: Definition: Newton Forward & Backward formulae for equally spaced arguments – Lagrange Formula for unequally spaced arguments. **5 Hrs**

RECOMMENDED TEXTBOOKS:

1. V.Sundaresan , K. Ganesan , K.S. Ganapathy Subramanian , "Resource Management Techniques Operation Research" , New Delhi , India , A.R. Publications 2016.
2. P.Kandasamy, K. Thilagavathy, "Calculus of Finite differences and Numerical Analysis", S.Chand ,2014.

REFERENCE BOOKS:

1. S.D.Sharma , " Operations Research – Theory , Methods & Applications", Kedarnath, 2016.
2. Kanti Swarup , P.K. Gupta , Man Mohan , " Operations Research", Sultanchand ,2014.
3. R.K.Gupta , " Operations Research ", Krishnan Prakashan, 33 edition,2014.
4. S.G. Venkatachalapathy, "Calculus of Finite differences and Numerical Analysis", Margham Publications , 2012.

JOURNALS:

1. https://www.journals.elsevier.com/european-journal-of-operational-research
2. https://www.journals.elsevier.com/operations-research-perspectives
3. https://www.inderscience.com/jhome.php?jcode=ijor
4. https://onlinelibrary.wiley.com/journal/18731317
5. https://www.scirp.org/journal/ajor/

E-LEARNING RESOURCES:

1. https://nptel.ac.in/courses/111102012/
2. http://edx-org-utaustinx.s3.amazonaws.com/UT501x/Summer2015/Notes/Week2.pdf
3. https://www.coursera.org/lecture/introduction-genomics/applications-of-sequencing-tkKs9
4. https://www.udemy.com/course/cpm-pert-for-project-management/
5. https://study.com/academy/lesson/interpolation-in-statistics-definition-formula-example.html

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Construct a real world problem into a mathematical problem.
CO 2	Identify the appropriate model to solve the problem.
CO 3	Explore the alternative models and justify on the selected model for representation
CO 4	Analyse and provide an optimal solution
CO 5	Construct the network and analyse the resources in network scheduling

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	3
CO 2	2	3	2	3	3
CO 3	2	3	3	3	3
CO 4	3	2	3	3	2
CO 5	3	3	3	3	3
Average	**2.4**	**2.6**	**2.8**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of logical thinking in formulating industry oriented problems, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V
CLOUD COMPUTING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5E3/CCG**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. This course provides a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
2. This Course Provides introduction and research to the state-of-the-art in Cloud Computing fundamental issues, Research technologies, applications and implementations.

COURSE OUTLINE:

UNIT I: Cloud Computing: Introduction – Components of Cloud – Cloud Types – Impact of Cloud Computing on Businesses **9 Hrs**

UNIT II: Virtualization: Introduction – Benefits – Virtualization Structure – Virtualization mechanism – Virtualization of CPU, Memory and I/O Devices **9 Hrs**

UNIT III: Types of Cloud Services: Software as a Service - Platform as a Service - Infrastructure as a Service – Database as a Service – Specialized Cloud Services. **9 Hrs**

UNIT IV: Cloud Types and Models: Private Cloud – Community Cloud – Public cloud – Case Study – Hybrid clouds – Comparisons **9 Hrs**

UNIT V: SLA with Cloud Service Providers: Concept of SLA – SLA Aspects and Requirements – Service Availability – Sample – Amazon S3 SLA, Google Apps SLA – Regulations for Clouds – PCI-DSS, ECPA **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Kailash Jayaswal, Jagannath, Donald J. Houde, Deven Shah, "Cloud Computing – Black Book", Dreamtech Press, 2015.
2. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, "Cloud Computing –A Practical approach", Tata McGraw Hill Education Pvt. Ltd, 2013.

REFERENCE BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing – Principles and Paradigms", Wiley Publications, 2014.
2. Michael Miller, "Cloud Computing – Web-Based Applications that change the way you work and Collaborate Online", Pearson Education, 2013.

JOURNALS:

1. https://journalofcloudcomputing.springeropen.com/
2. https://www.inderscience.com/jhome.php?jcode=ijcc
3. https://link.springer.com/journal/13677
4. http://www.imanagerpublications.com/journalsfulldetails/23/JournalonCloudComputing

E-LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106105167/
2. https://www.udemy.com/topic/virtualization/
3. https://www.edx.org/school/aws
4. https://aws.amazon.com/types-of-cloud-computing/
5. https://www.esds.co.in/blog/cloud-computing-types-cloud/#sthash.NdcMd32C.dpbs

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Demonstrate the different taxonomy of parallel and distributed computing
CO 2	Articulate the main concepts, key technologies, strengths and limitations of Virtualization and Cloud computing
CO 3	Compare and contrast the delivery and deployment models of cloud computing
CO 4	Analyze the core issues of cloud computing such as energy efficiency, security, privacy and interoperability
CO 5	Recognize the cloud file systems and their applications in industry. Identify problems, explain, analyze, and evaluate various cloud computing solutions

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	3
CO 2	2	3	2	3	3
CO 3	2	2	2	3	3
CO 4	3	2	3	3	2
CO 5	3	3	3	3	3
Average	**2.4**	**2.4**	**2.6**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Realization of security problems, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V
MOBILE COMPUTING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5E3/MCG**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Inspect the basics of wireless communication standards.
2. Discern the primary aspects of the Telecommunication Systems.
3. Study the Satellite systems and Wireless LAN.
4. Distinguish the importance of the Mobile Network Layer and its protocols.
5. Realize the variants of TCP and WAP.

COURSE OUTLINE:

UNIT I: Introduction: Wireless transmission–Frequencies for radio transmission–Signals – Antennas–Signal Propagation–Multiplexing–Modulations–Spread spectrum – DHSS - FHSS –Medium Access Control –SDMA–FDMA–TDMA – Fixed TDM – Classical Aloha – Slotted Aloha – CDMA – Comparative Study. **9 Hrs**

UNIT II: Telecommunication Systems: GSM– Mobile Services - System Architecture – Protocols – Localization and Calling –Hand over – Security – New Data Services - Case Study: DECT and TETRA. **9 Hrs**

UNIT III: Satellite Systems: - Applications – GEO-LEO-MEO- Wireless LAN–IEEE802.11 – System Architecture – HIPERLAN – WATM – BlueTooth – Architecture – Security.**9 Hrs**

UNIT IV: Mobile Network Layer: Mobile IP–Dynamic Host Configuration Protocol– MANET –Routing – DSDV – DSR **9 Hrs**

UNIT V: Mobile Transport Layer and Mobility Support: Traditional TCP – Indirect TCP–Snooping TCP – Mobile TCP–Fast Retransmit / Fast Recovery –Transmission/ Timeout Freezing -Selective Retransmission–Transaction Oriented TCP– WAP – WAP Architecture – WML Script– WAP 2.0. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1. Jochen Schiller,"Mobile Communications", Pearson Education, 2017.
2. William Stallings, "Wireless Communications &Networks", Pearson Education, 2014.

REFERENCE BOOKS:

1. Asoke Talukder, Hasa Ahmed and Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill Edition, 2013.
2. KavehPahlavan, Prasanth Krishnamoorthy,"Principles of Wireless Networks", second Edition, 2003,PearsonEducation.

JOURNALS:

1. https://www.inderscience.com/jhome.php?jcode=ijmc
2. https://link.springer.com/journal/11277

E-LEARNING RESOURCES:

1 http://ee.sharif.edu/~pr.wireless.comm/references/Schwartz.pdf

2 https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEC703%20%20-CELLULAR%20MOBILE%20COMMUNICATION.pdf

3 https://web.fe.up.pt/~mleitao/CMOV/Teoricas/CMOV_GSM.pdf

4 http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf

5 http://www.cse.iitd.ernet.in/~pkalra/OLD-COURSES/siv864-2010/session-08-12.pdf

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Study over the basics of telecommunication systems.
CO 2	Compose the functionality and operational architecture of GSM, DECT and TETRA.
CO 3	Examine the variants of Wireless LAN technologies and learn about Satellite systems.
CO 4	Develop the insight into the Mobile Network Layer and the Routing algorithms.
CO 5	Relate the coordination among the types of TCP and Discuss the WAP and WML script

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	2	3
CO 2	3	3	2	3	3
CO 3	2	2	2	3	3
CO 4	3	2	2	3	2
CO 5	3	3	2	3	3
Average	**2.8**	**2.4**	**2**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Understanding of Mobile Communication Standards, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and field visit.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V
ARTIFICIAL INTELLIGENCE

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5E3/AIE**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Learn the difference between optimal reasoning Vs human like Reasoning
2. Understand the notions of state space representation, exhaustive search, and heuristic search along with the time and space complexities.
3. Learn different knowledge representation techniques
4. Understand the applications of AI namely, Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing
5. Implement the use of AI to solve English Communication problems

COURSE OUTLINE:

UNIT I: INTELLIGENT AGENTS AND SEARCHING METHODS
Artificial Intelligence: Introduction : What is AI; Foundations of Artificial Intelligence- History of Artificial Intelligence- The state of Art; **Intelligent Agents:** Agent and Environments- Good Behavior- The Nature of Environments-The Structure of Agents- **Problem-solving:** Problem-solving agent; searching for solution; Uniformed search strategies; **Informed Search and Exploration:** Informed search strategies; Heuristic functions- Online Search agents and unknown environment; **Constraint Satisfaction Problems:** Constraint satisfaction problems-Backtracking search for CSPs- **Adversarial search**: Games; optimal decisions in Games; Alpha-Beta pruning. **9 Hrs**

UNIT II LOGIC -Logical Agents: Knowledge-based agents- The Wumpus World-Logic; propositional logic-Reasoning patterns propositional logic- Effective propositional Model checking-Agent based on propositional logic- **First-Order Logic**- Representation revisited-Syntax and semantics of first order logic-Knowledge engineering in first order logic- **Interference in First-Order Logic**-Propositional verses first-order interference; Unification and lifting-Forward Chaining-backward Chaining-Resolution **9 Hrs**

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UNIT III Knowledge Representation: Ontological engineering-Categories and object-events- Mental events and mental objects- The internet shopping world- Reasoning system for categories- Reasoning with default information- Classical **Planning: Algorithms for planning as** state-space search- Planning graphs **9 Hrs**

UNIT IV: Uncertainty: Acting under uncertainty- Interference using full joint distributions- Independence- Bayes's rule and its use-**Probabilistic Reasoning:** Representing knowledge in an uncertain domain-The semantic of Bayesian networks- Efficient representation of conditional distribution- Exact interference in Bayesian network **9 Hrs**

UNIT V: Learning: Forms of learning; Inductive learning; Learning decision tree; Ensemble learning- Computational learning theory **9 Hrs**

RECOMMENDED TEXTBOOKS:

1.Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2017.
2. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill, 3rd edition. 2013.

REFERENCE BOOKS:

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/PHI, 2002.

JOURNALS:

1. https://www.journals.elsevier.com/science-of-computer-programming
2. https://dl.acm.org/citation.cfm?id=576122

E-LEARNING RESOURCES:

1. https://www.springer.com/in/book/9783540167822
2. https://www.e-booksdirectory.com/listing.php?category=28
3. https://nptel.ac.in/courses/109101003/downloads/Lecture.../Lecture-19-20-21.pd
4. https://onlinecourses.nptel.ac.in/noc18_cs51
5. https://nptel.ac.in/courses/106106140

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Analyse the modern view of AI as the study of agents that receive precepts from the environment and perform actions
CO 2	Demonstrate awareness of informed search and exploration methods
CO 3	Demonstrate about AI techniques for knowledge representation, planning and uncertainty management
CO 4	Develop knowledge of decision making and learning methods
CO 5	Implement the use of AI to solve English Communication problems

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	3
CO2	2	3	2	3	2
CO3	2	2	3	3	3
CO4	2	0	3	3	3
CO5	3	3	3	3	3
AVERAGE	2.4	2.2	2.6	2.8	2.8

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V

DIGITAL IMAGE PROCESSING

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5E4/DIP**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Understand the fundamentals of Digital image processing.
2. Understand the different types of Image transform techniques.
3. Understand the different types of Image enhancement techniques in spatial and frequency domain.
4. Understand the different types of image degradation like linear image restoration techniques and nonlinear image restoration techniques.
5. Understand the image compression like lossy and lossless image compression techniques and also understand the need of image segmentation.

COURSE OUTLINE:

UNIT I: Digital Image Fundamentals: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, A Simple Image Formation Model, Image Sampling and Quantization, Relationships Between Pixels, Imaging Geometry. **9 Hrs**

UNIT II: : Image Transforms: 2-D Fourier Transform, Properties, FFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar transform, Slant transform. **9 Hrs**

UNIT III: Image Enhancement Spatial Domain: Introduction, Gray Level Transformations, Histogram Processing, Arithmetic and Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.- **Frequency Domain**: Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering. **9 Hrs**

UNIT IV: Image Restoration and Color Image Processing: Image Restoration - Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filters-**Color Image Processing:** Pseudo-color Image Processing, Full-color Image Processing. **9 Hrs**

UNIT V: Image Compression and Segmentation -Image Compression: Fundamentals, Image Compression Models, Elements of information Theory, Error Free Compression, Lossy Compression- **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds **9 Hrs**

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RECOMMENDED TEXTBOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing , Pearson Prentice Hall,Third Edition,2013.
2. Rafael C.Gonzalez, Richard E.Woods, Steven L.Eddins, Digital Image Processing Using MATLAB, McGraw Hill Education (India) Private Limited., 2014.

REFERENCE BOOKS:

1. A. K. Jain, "Fundamentals of Digital Image processing", Prentice Hall of India, New Delhi, 2nd Edition, 1997.
2. Rafael C. Gonzalez, "Digital Image processing using MATLAB", Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.
3. William K. Pratt, "Digital Image Processing", John Wiley & Sons, New Delhi, India, 3rd edition, 2004.
4. Arthur R. Weeks, "Fundamentals of Electronic Image Processing", SPIE Optical Engineering Press, New Delhi, India, 2nd Edition, 1996.

JOURNALS:

1. www.ciitresearch.org/dip.html
2. https://link.springer.com/journal/10278
3. https://sites.google.com/site/ijcsis/digital-image-processing

E-LEARNING RESOURCES

1. https://www.coursera.org/learn/digital
2. https://ufonline.ufl.edu/courses/gis4037-digital-image-processing/
3. http://www.eucourses.eu/en/courses-available/digital-extra
4. https://www.online.colostate.edu/courses/ECE/ECE513.dot
5. https://alison.com/tag/digital-image-editing

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Discuss the fundamentals of Digital image processing including the simple image formation and relationship between pixels
CO 2	Analyze the different types of Image transform techniques
CO 3	Outline the different types of Image enhancement techniques in spatial and frequency domain
CO 4	Understand the different types of image degradation like linear image restoration techniques and nonlinear image restoration techniques
CO 5	Apply the image compression like lossy and loss less image compression techniques and also understand the need of image segmentation

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	2	3
CO2	3	2	3	2	3
CO3	3	1	3	2	3
CO4	3	1	3	3	3
CO5	3	3	3	3	3
AVERAGE	3	1.8	3	2.4	3

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V
BIG DATA ANALYTICS

TOTAL HOURS: 45 Hrs **COURSE CODE: MCA18/5E4/BDA**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1 Concepts To explore the fundamentals of big data analytics , Intelligent analysis and various tools for analysis and reporting
2 Learn to analyze various big data streams and how to process the different types of streams.
3 Understand Hadoop platform and Map-reduce and able to explore how to implement them
4 Learn to use hadoop clusters and how hadoop is implemented in the cloud
5 Understand the applications of Pig and Hive , the database for hadoop Hbase and the various analysis and interaction techniques

COURSE OUTLINE:

UNIT I: **Introduction to Big Data Platform:** Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools **9 Hrs**

UNIT II: **Introduction To Streams Concepts:** Stream Data Model and Architecture - Stream Computing -Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. **9 Hrs**

UNIT III: **History of Hadoop:** The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFSBasics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features. **9 Hrs**

UNIT IV **Setting up a Hadoop Cluster:** Cluster specification - Cluster Setup and Installation –Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud. **9 Hrs**

UNIT V **Applications on Big Data Using Pig and Hive:** Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM Info Sphere Big Insights and Streams. Visualizations - Visual data analysis techniques, interaction techniques-Systems and applications. **9 Hrs**

RECOMMENDED TEXTBOOKS:

1 Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2 Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3 Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding BigData: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
4 Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5 Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
6 Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007

REFERENCE BOOKS:

1 Nathan Marz, , James Warren "Big Data: Principles and best practices of scalable realtime data systems" 1st Edition , Manning Publications, 2015
2 Martin Klepmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable,Scalable, and Maintainable Systems" , First Edition, O'Reilly , 2015
3 Big Data For Dummies; 1st edition (April 15, 2013)
4 Seema Acharya, Subhashini Chellappan , "Big Data and Analytics", Wiley Publications, 2015
5 Mayank Bhushan, "Big Data and Hadoop- Learn by Example", BPB publications 2018

JOURNALS:

1 https://journalofbigdata.springeropen.com/
2 https://www.journals.elsevier.com/big-data-research
3 https://link.springer.com/journal/40537
4 https://link.springer.com/journal/40537
5 https://www.scimagojr.com/journalsearch.php?q=21100791292&tip=sid&clean=0

E-LEARNING RESOURCES:

1 https://nptel.ac.in/courses/106104189/
2 https://www.coursera.org/mastertrack/big-data-asu
3 https://www.cloudera.com/products/open-source/apache-hadoop.html
4 https://hadoop.apache.org/docs/stable/
5 https://www.ibm.com › analytics › hadoop › big-data-analytics

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Demonstrate the challenge with Big Data and various modern Analytics Tools
CO 2	Interpret Big Data as stream, how to filter & analyze the stream
CO 3	Understand the Hadoop Architecture, how to run jobs, tasks
CO 4	How to develop map reduce applications.
CO 5	Experiment with Hadoop Architecture, its Applications

MAPPING-CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	1	2	1
CO2	3	2	3	2	1
CO3	2	2	3	3	3
CO4	3	2	3	3	3
CO5	2	3	2	2	3
AVERAGE	2.4	2.4	2.4	2.4	2.2

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, Presentations, MOOOCs e-Content,, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SEMESTER V
INTERNET OF THINGS

TOTAL HOURS : 45 Hrs **COURSE CODE : MCA18/5E4/IOT**
CREDITS : 3 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. Learn the concepts about Internet of things.
2. Understand and implement smart systems.
3. Understand the Architectural Overview of IoT.
4. Understand the IoT Reference Architecture and Real World Design constraints.
5. Deploy the resources into business.

COURSE OUTLINE:

UNIT I : **Introduction :** Definition & Characteristics of IoT - Physical Design of IoT : Things in IoT , IoT Protocols - Logical Design of IoT : IoT Functional Blocks , IoT Communication Models , Communication APIs - IoT Enabling Technologies : Wireless Sensor Networks , Cloud Computing , Communication Protocols, Embedded Systems.

9 Hrs

UNIT II : **Programming The Microcontroller For IOT:** Basics of Sensors and actuators – examples and working principles of sensors and actuators –Arduino/Equivalent Microcontroller platform – Setting up the board -Programming for IOT – Reading from Sensors Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using Wi-Fi / Ethernet. **9 Hrs.**

UNIT III : **M2M to IOT the vision**: Local and wide area networking – Data management – Business process in IOT – Everything as a service (XaaS) – M2M and IOT analytics.

9 Hrs

UNIT IV : **Architecture Reference Model:** Introduction, Reference Model and architecture, IoT reference Model .IOT reference architecture: Functional View, Information View, Deployment and Operational View. **9 Hrs**

UNIT V : **Real-World Design Constraints:** Introduction, Technical Design constraints-Data representation and visualization, Interaction and remote control. Industrial Automation – Commercial Building Automation – Smart cities.

9 Hrs

RECOMMENDED TEXTBOOKS:

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands - on approach, Universities Press, 2015 - (Unit 1)
2. Arduino Microcontroller GuideW. Durfee, University of Minnesota ver. oct-2011for (Unit 2)
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (Unit 3,4,5).

REFERENCE BOOKS:

1. Charalampos Doukas , Building Internet of Things with the Arduino, Create space, April 2002.
2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011.
3. Luigi Atzor et.al, "The Internet of Things: A survey, ", Journal on Networks, Elsevier Publications, October, 2010.
4. http://postscapes.com/
5. http://www.theinternetofthings.eu/what-is-the-internet-of-things.

JOURNALS:

1. https://www.journals.elsevier.com/internet-of-things
2. https://www.igi-global.com/journal/international-journal-hyperconnectivity-internet-things/157228
3. https://www.mdpi.com/journal/sensors

E-LEARNING RESOURCES:

1 www.me.umn.edu/courses/me2011/arduino/

2 https://www.coursera.org/learn/iot?specialization=iot

3 https://www.coursera.org/learn/raspberry-pi-platform?specialization=iot

4 https://www.guru99.com/iot-tutorial.html

5 https://nptel.ac.in/courses/106/105/106105166/

COURSE OUTCOMES:

CO No.	CO Statements
CO 1	Gain a clear understanding of the IOT and basic frame work of IOT and devices. Learn to know the IOT enabling technologies.
CO 2	Gain a clear understanding of the frame work of the various devices. Learn to connect devices with different mode.
CO 3	Gain to know the various services related to mobile and IOT . Understanding the business process in IOT.
CO 4	Understanding the various models of IOT and learn to deploy IOT models.
CO 5	Learn real world problems and make design constrains. Understand the limitations of IOT.

MAPPING-CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	2	3	2	3	3
CO 3	3	2	3	3	3
CO 4	2	2	2	3	3
CO 5	3	3	3	3	3
Average	**2.5**	**2.5**	**2.5**	**2.8**	**2.8**

Key: Strongly Corelated-3, Moderately Corelated-2, Weakly Corelated-1, No Corelation-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2 (REMEMBERING & UNDERSTANDING)	A – Answer ALL (10 x 2 = 20 marks) (Q.No 1- Q.No 10)	One or Two Sentences	20	100
K2, K3 (UNDERSTANDING & APPLYING)	B – Answer any FIVE out of SEVEN questions (5 x 6 = 30 marks) (Q.No 11 – Q.No 17)	250	30	
K4, K5 (ANALYSING & EVALUATING)	C – Answer any FIVE (Internal Choice) (5 x 10 = 50 marks) (Q.No 18- Q.No 22)	500	50	

SOFT SKILL

SEMESTER I

PERSONALITY ENRICHMENT

TOTAL HOURS : 30 Hrs **COURSE CODE: MCA18/1S1/PET**

CREDITS : 2 **L-T-P: 3-0-0**

OBJECTIVES:

To enable the PG students to

1. To make students understand the concept and components of personality, thereby applying the acquired knowledge to themselves and to march towards excellence in their respective academic careers.
2. To enable students to keep themselves abreast of general knowledge and current information.
3. To bring out creativity and other latent talents with proper goal setting so that self-esteem gets enhanced

COURSE OUTLINE:

UNIT I : **Introduction:** Definition of Personality, Determinants of Personality-biological, psychological and socio- cultural factors, Misconceptions and clarifications, Need for personality development

UNIT II : **Self-Awareness and Self-Motivation:** Self-analysis through SWOT and Johari window , Elements of motivation, Seven rules of motivation, Techniques and strategies for self-motivation, Motivation checklist and Goal setting based on principle of SMART, Self- motivation and life, Importance of self-esteem and enhancement of self-esteem.

UNIT III : **Memory and study skills:** Definition and importance of memory, Causes of Forgetting, How to forget (thought stopping), how to remember (techniques for Improving memory) The technique of passing exams-management of examination fear.

UNIT IV : **Power of Positive Thinking**: Nurturing creativity, decision-making and problem solving. Thinking power- seven steps for dealing with doubt ,Traits of positive thinkers and high achievers , Goals and techniques for positive thinking , Enhancement of concentration through positive thinking ,Practicing a positive life style

UNIT V : **General knowledge and current affairs:** Regional, national and international events, Geographical, political and historical facts, Information on sports and other recreational activities, Basic knowledge With regard to health and health promotion

BOOKS FOR REFERENCES:

1. Mile, D.J, Power of positive thinking. Delhi: Rohan Book Company, 2004.
2. Pravesh Kumar, All about self- Motivation. New Delhi: Goodwill Publishing House, 2005.
3. Dudley, G.A., Double your learning power. Delhi: Konark Press. Thomas Publishing Group Ltd, 2006.
4. Lorayne, H., How to develop a super power memory. Delhi: Konark Press. Thomas Publishing Group Ltd, 2004.

QUESTION PAPER PATTERN:

	Type of Question	Marks	Choice
PART A	Definition Multiple choice Match panel	40	**No choice** 20question x 2 mark = 40 marks
PART B	Self Awareness/ Motivation, Memory and study skills, positive thinking , General Knowledge	30	**Internal Choice** 5 questions x 6 marks = 30 marks
PART C	Application/Analysis Synthesis/Evaluation	30	**Two out of three Questions** 2 question x 15 marks = 30 marks

SEMESTER II
FRENCH FOR BEGINNERS

TOTAL HOURS: 30 Hrs **COURSE CODE: MCA18/2S2/FFB**
CREDITS : 2 **L-T-P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to
1. Learn the knowledge of a foreign language has become an indispensable tool.
2. Give an opportunity for students of other disciplines to get a basic knowledge of a widely used European language.
3. Provide a minimum vocabulary necessary and sufficient to develop elementary language skills in French.

COURSE OUTLINE:

UNIT I: Alphabets and numbers- Simple Grammar: Basics of French conversation (To greet a person- Introducing oneself- Asking basic information) **6 hrs**

UNIT II: Simple Grammar: Name and locate objects-colors and simple description of people.

6 hrs

UNIT III: Simple Grammar: Asking for directions- Giving suggestions. **6 hrs**

UNIT IV: Simple Grammar: Indicate date and time. Asking and giving information on one's profession and activities. **6 hrs**

UNIT V: Simple Grammar: Use of past tense. Narrating past events. Giving one's opinion.

6 hrs

RECOMMENDED TEXTBOOKS:

1."Taxi" – Guy Cappelle and Robert Menand.

JOURNALS:

1. https://digital-library.theiet.org/content/journals/iet-cdt
2. https://www.elsevier.com/books/an-introduction-to-digital-computing/george/

E-LEARNING RESOURCES:
1. www.fle.fr
2. www.bonjourdefrance.com

QUESTION PAPER PATTERN:

	TYPE OF QUESTION	MARKS	CHOICE
PARTA	Grammar (Definition and practical application of rules)	20	No choice5 questions (one from each unit) **(5 x 4 marks = 20 marks)**
PART B	Culture and Civilization, and Vocabulary (understanding and description of matter studies)	30	No Choice –10 questions covering all cultural components presented in the units. **(10x2 marks = 20 marks)** 2 questions Vocabulary required from all units **(2 x 5 marks = 10 marks)** Total : 30 marks
PART C	Comprehensive and Expression (Synthesis and evaluation of matter studies)	30	Either-or type 5 questions from all units **(3 x 10 marks=30 marks)**
PART D	Oral Examination	20	Description about themselves Describe the object shown

SEMESTER – III
BUSINESS COMMUNICATION

TOTAL HOURS: 30 Hrs **COURSE CODE: MCA18/3S3/BCN**
CREDIT : 2 **L T P : 3-0-0**

COURSE OBJECTIVES:

It is a skill based qualification. It gives the students the opportunity to learn practical language skills in four key areas: reading, writing, listening and speaking

COURSEOUTLINE:

	BEC Preliminary	**BEC Vantage**	**BEC Higher**
Reading	7 parts / 45 items	5 parts / 45 items 1 hour	6 parts/2 items 1 hour
Writing	2 tasks 1 hour 50 minutes (NB reading and writing)	2 tasks 45 minutes	2 tasks 1 hour 10 minutes
Listening	4 parts/50 items about 40 minutes including transfer time	3 parts / 50 items about 40 minutes including transfer time	3 parts / 50 items about 40 minutes including transfer time
Speaking	3 parts 12 minutes	3 parts 14 minutes	3 parts 16 minutes

RECOMMENDED TEXTBOOKS:

Materials from University of Cambridge

SEMESTER IV

TECHNICAL SEMINAR AND REPORT WRITING

TOTAL HOURS: 30 Hrs **COURSE CODE: MCA18/4S4/TSR**
CREDITS : 2 **L-T-P : 3-0-0**

COURSE OBJECTIVE:

To enable the post graduate students to

1. Provide a brief outline about any one field in information technology
2. Elaborate literature survey of the domain opted.
3. Reveal and apply any technique to obtain the desired output.
4. Present the paper in the review and write a technical paper.

COURSE OUTLINE:

The goal of this course is to train the students to critically evaluate a well-defined set of research subjects and to recapitulate the conclusion concisely in a paper of scientific quality. The paper will be evaluated based on the ability to understand a topic, communicate it and identify the issues. Results and Evaluation from this term paper will be presented to fellow students and a committee of faculty members of the department.

1. Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct prime sources.
2. Every student must write a short analysis of the topic and present it to fellow Students and faculty (discuss the topic – expose the flaws – scrutinize the issues) Every week.
3. The faculty should assess the short review and award marks with respect to the following:
    a. Has the student analyzed – not merely quoted – the most significant portions of the major sources employed?
    b. Has the student presented original and convincing insights?
    c. Plagiarism to be checked.
4. Every student should re-submit and present the review article including issues/ Comments / conclusions which had arisen during the previous discussion.
5. Every student should submit a final paper as per project specifications along with all short review reports (at least 5 internal reviews) and corresponding evaluation comments to the concerned staff members.

6. Every student should appear for a final external review exam to defend themselves.

COURSE OUTCOMES:

1. Obtain a thorough knowledge about a particular domain.
2. Initiate the research process.
3. Expertise in the field.
4. Able to recognize the issues of any particular field.

TOPICS:

1. Information Security 2. Digital Image Processing 3. Computer Networks
   4. Cloud Computing 5. Cryptography and Network Security

SEMESTER V
QUANTITATIVE APTITUDE

PAPER NO – XLII **COURSE CODE: MCA18/5S5/QAE**

Teaching Hours: 15 x 2 = 30 Hrs **L T P C : 0 2 0 2**

OBJECTIVES:

To enable the PG students to

1. This course prepares the students in areas like Quantitative Aptitude (including Data Interpretation & Data Sufficiency), Reasoning & Logical Ability (including Non-Verbal Reasoning), English Language & Grammar,
2. To test the reasoning abilities and mental aptitude of the students.
3. Designed to test the language abilities and understanding of English grammar

COURSE OUTLINE:

Reasoning:

- Critical reasoning- Visual reasoning- Assumption-Premise-Conclusion-Assertion and reasons- Statements and assumptions- identifying valid inferences - identifying Strong arguments and Weak arguments
- Statements and conclusions- Cause and Effect- Identifying Probably true-Probably false- definitely true- definitely false kind of statement- Linear arrangements- Matrix arrangements.
- Graphs can be Column graphs- Bar Graphs-gram- etc.
- Symbol Based problems- Coding and decoding- Sequencing - identifying next number in series- Puzzles- Syllogisms- Functions- Family tree - identifying relationship among group of people and etc.

QUESTION PAPER PATTERN:

50 Objective Type questions uniformly distributed among the entire syllabus and each question carries 2 marks

SEMESTER VI

ENTREPRENEURIAL SKILL DEVELOPMENT

TOTAL HOURS: 30 HRS **COURSE CODE: MCA18/6S6/ESD**
CREDIT : 2 **L T P : 3-0-0**

COURSE OBJECTIVES:

To enable the post graduate students to

1. This course enables the students to enhance their Entrepreneurial skills
2. Develop the knowledge of Project Preparation & Marketing analysis..
3. Understand the support of Institutions and Investment Procurement

COURSE OUTLINE:

Concept of Entrepreneurship: Entrepreneur -Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.

Project Preparation & Marketing analysis: Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.

Institutions Support : Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme

Investment Procurement: Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure –Loan procurement –Banking Processes.

BOOKS FOR REFERENCES

1. Buame, S, (2000) Entrepreneurial And Innovative Management, School of Administration
2. 2. Dwomo-Fokuo, E. (2003) Entrepreneurship Theory And Practice, Kumasi Polytechnic
3. Hisrich,R.D., Peters, M.P. (1995) Entrepreneurship Starting, Developing And Managing A New Enterprise, 3rd edition, Richard Dirwin Inc.
4. 4. Kuratko, D.F., hodgetts, R.M, (1992) Entrepreneurship, A Contemporary Approach, 2nd edition, the Dryden Press
5. Entrepreneurial Development and Small Business Management" by Dr P T Vijayashree & M Alagammai

QUESTION PAPER PATTERN:

Students have to prepare a case study and present the essentials of the case study
Viva voce will also be conducted.