सावित्रीबाई फुले पुणे विद्यापीठ

॥ यः क्रियावान् स पण्डितः ॥

Savitribai Phule Pune University, Pune

Faculty of Commerce and Management

Curriculum 2024 Pattern

Master of Business Administration – Information Technology (MBA - IT)

Revised 2-year, 4 Semester Full time Programme

Choice Based Credit System (CBCS) and Grading System

Outcome Based Education Pattern

Aligned with National Education Policy (NEP) 2020

MBA-IT 1st year effective from AY 2024 - 25

MBA-IT 2nd year effective from AY 2025 - 26

Master of Business Administration –(Information Technology)

MBA-(IT) – Revised Syllabus 2024

2 year, 4 Semester Fulltime Programme
Choice Based Credit System (CBCS) and Grading System
Outcome Based Education Pattern
Aligned with NEP
MBA I (IT)-effective from AY 2024-25
MBA II (IT)-effective from AY 2025-26

1.0 Preamble: The revised MBA-IT Curriculum 2024 integrates the National Education Policy, 2020 ethos with the Choice Based Credit System (CBCS) and Grading System and Outcome Based Education (OBE)

2.0 Credit : *In terms of credits ,for a period of one semester of 15 weeks:*

a) *Every ONE-hour session per week of L amounts to1 credit per semester*
b) *a minimum of TWO hours per week of T amounts to 1 credit per semester,*
c) *a minimum of TWO hours per week of P amountsto1 credit per semester*

Each credit is a combination of 3 components viz. Lecture(L) + Tutorials(T) + Practice (Practical /Project Work /Self Study) (P) i.e. LTP Pattern. Indicative LTP, for each course, is documented in the syllabus.
The course teacher may, with the consent of the Director / Head of the Department / Designated academic authority of the Institute, modify the LTP of the course in view of the course requirements, nature of the course, the level of learners and the type of pedagogy and assessment tools proposed.

2.1 Session: Each teaching-learning, evaluation session shall be of 60 minutes. However, institutes shall have the flexibility to define their time slots in a manner as to use their faculty and infrastructure resources in the best possible way and ensure effective learning & comply with the credit structure of the respective courses

2.2 Course Announcement: The institute shall announce the elective courses and specializations it proposes to offer the students out of the wider course basket. It is not mandatory to offer all the specializations and all the electives. However, in the spirit of Choice Based Credit System, institutes should offer choices to the students for the elective courses and not offer only the minimum number of electives.

2.3 Course Registration: It is mandatory for every student, to register every semester, for the courses opted for that semester. Each student, on admission shall be assigned to a Faculty Advisor who shall advise her/him about the academic programs and counsel on the choice of courses considering the student's profile, career goals and courses taken in the earlier semesters. With the advice and consent of the Faculty Advisor, the student shall register for a set of courses he/she plans to take up for the Semester. Students shall have to register for the courses for the semester within first week of Semester I and immediately after conclusion of the preceding term for subsequent Semesters II, III and IV.

3.0 MBA –IT Programme Focus

Programme Educational Objectives (PEOs):

PEO 1: Graduates will reveal the capacity to successfully lead and oversee IT departments and projects, using strategic thinking to match technological initiatives with corporate objectives and encourage commercial expansion.

PEO 2: Graduates will be able to use data-driven insights and emerging technologies to improve decision-making and operational efficiency. They will also be able to assess difficult business challenges and build innovative IT solutions.

PEO 3: Graduates will maintain the highest ethical standards and exhibit responsible management techniques in the field of information technology, guaranteeing adherence to legal and regulatory requirements and cultivating an integrity- and sustainability-focused culture.

PEO 4: Graduates will be able to effectively manage varied teams and projects in a multinational company environment because they will have a thorough awareness of cross-cultural dynamics and global IT trends.

PEO 5: Graduates will be proficient in articulating intricate IT ideas to stakeholders who are technical and non-technical, as well as in working cross-functionally to achieve project goals and organizational transformation.

3.2 Programme Outcomes (POs): At the end of the MBA (IT)- programme the learner will possess the

1. Generic and Domain Knowledge – Ability to articulate, illustrate, analyze, synthesize and apply the knowledge of principles and frameworks of management and allied domains to the solutions of real-world complex business issues
2. Problem Solving & Innovation - Ability to Identify, formulate and provide innovative solution frameworks to real world complex business and social problems by systematicallyapplyingmodernquantitativeandqualitativeproblemsolvingtoolsand techniques.
3. Critical Thinking - Ability to conduct investigation of multidimensional business problems using research based knowledge and research methods to arrive at data driven decisions
4. Effective Communication - Ability to effectively communicate in cross-cultural settings, in technology mediated environments, especially in the business context and with society at large. Leadership and Team Work - Ability to collaborate in an organizational context and acrossorganizationalboundariesandleadthemselvesandothersintheachievement of organizational goals and optimize outcomes for all stakeholders.
5. Global Orientation and Cross-Cultural Appreciation: Ability to approach any relevant business issues from a global perspective and exhibit an appreciation of

Cross Cultural aspects of business and management.

6. Ability to identify the opportunities and leverage managerial & leadership skills for founding, leading & managing start-ups as well as professionalizing and growing family businesses.
7. Environment and Sustainability - Ability to demonstrate knowledge of and need for sustainable development and assess the impact of managerial decisions and business priorities on the societal, economic and environmental aspects.
8. Social Responsiveness and Ethics - Ability to exhibit a broad appreciation of the ethical and value underpinnings of managerial choices in a political, cross-cultural, globalized, digitized, socio-economic environment and distinguish between ethical and unethical behaviors& act with integrity.
9. Social Responsiveness and Ethics - Ability to exhibit a broad appreciation of the ethical and value underpinnings of managerial choices in a political, cross-cultural, globalized, digitized, socio-economic environment and distinguish between ethical and unethical behaviors& act with integrity.
10. Life longLearning–Abilitytooperateindependentlyinnewenvironment,acquire new knowledge and skills and assimilate them into the internalized knowledge and skills.

3.3 Programme Specific Outcomes (PSOs):MBA(IT) Programme is mainly oriented towards professional augmentation taking place in the global as well as domestic business arena and the curriculum thus intends to reduce the gap between industry and academia, with the right blend of theory and practice, furthering students to nurture their talent for becoming good leaders and assets for an organization. Students shall gain an in-depth knowledge and analytical skills which will enable them to effectively and efficiently carry out various human resource and organizational development operations of an organization in the emerging globalized environment.

3.4 Programme Specific Outcomes (PSOs):

A) CLOUD COMPUTING

PSO CC1: Comprehensive Cloud Computing Knowledge : Graduates specializing in Cloud Computing for the MBA-IT programme will gain a strong understanding of cloud computing models (IaaS, PaaS, SaaS) and cloud architectures to effectively assess and implement business solutions.

PSO CC2: Strategic Cloud Adoption and Cost Optimization: Graduates specializing in Cloud Computing for the MBA-IT programme will develop the skills to design cost-effective cloud adoption strategies, optimizing resources and maximizing ROI for organizations.

PSO CC3: Cloud Security and Compliance Expertise : Graduates specializing in Cloud Computing for he MBA-IT programme will be equipped to address security, compliance, and governance challenges in cloud environments, ensuring business continuity and risk mitigation.

PSO CC4 :Hands-On Experience with Cloud Platforms : Graduates specializing in Cloud Computing for he MBA-IT programme will gain practical experience using leading cloud platforms (AWS, Azure, GCP) to integrate and deploy cloud-based solutions for business operations.

B) FULL STACK DEVELOPMENT

PSO FSD1: Proficiency in Front-End and Back-End Technologies : Graduates specializing in Full Stack Development for he MBA-IT programme will develop expertise in both front-end (HTML, CSS, JavaScript) and back-end (Node.js, Python, databases) technologies for building complete web applications.

PSO FSD2: Integration of Web Development with Business Needs : Graduates specializing in Full Stack Development for he MBA-IT programme will gain the ability to align full-stack development skills with business requirements, creating scalable and efficient solutions for business operations.

PSO FSD3: Effective Database Design and Management : Graduates specializing in Full Stack Development for he MBA-IT programme will learn to design, implement, and manage databases (SQL, NoSQL) to support dynamic, data-driven business applications.

PSO FSD4: Deployment and Maintenance of Web Applications : Graduates specializing in Full Stack Development for he MBA-IT programme will acquire practical skills in deploying and maintaining full-stack web applications, ensuring performance, security, and scalability for real-world business solutions.

C) CYBER SECURITY WITH DATA ANALYTICS

PSO CSDA1: Comprehensive Cybersecurity Knowledge : Graduates specializing in Full Stack Development for he MBA-IT programme will gain a strong understanding of cybersecurity principles, tools, and practices to protect business data and infrastructure from cyber threats.

PSO CSDA2 : Data-Driven Security Analysis : Graduates specializing in Full Stack Development for he MBA-IT programme will develop the ability to apply data analytics techniques to monitor, detect, and respond to security breaches, ensuring proactive threat management.

PSO CSDA3 : **Risk Management and Compliance Expertise** : Graduates specializing in Full Stack Development for he MBA-IT programme will learn to assess and manage cybersecurity risks, ensuring compliance with industry regulations and safeguarding sensitive business data.

PSO CSDA4 : Security Integration with Business Strategies : Graduates specializing in Full Stack Development for he MBA-IT programme will acquire the skills to integrate cybersecurity measures with business processes, supporting data-driven decision-making while maintaining organizational security.

3.5 Graduate Attributes(GAs): At the end of the MBA(IT) programme the learner shall exhibit:

GA1:Managerial competence

GA2:Proficiency in Communication, Collaboration, Teamwork and Leadership

GA3: Competence in Creativity & Innovation

GA4:Research Aptitude ,Scholarship & Enquiry

GA5: Global Orientation

GA6:Proficiency in ICT &Digital Literacy

GA7:Entrepreneurship &Entrepreneurship Orientation

GA8:Cross-functional&Inter-disciplinaryOrientation

GA9: Results Orientation

GA10:Professionalism, Ethical, Values Oriented & Socially Responsible behaviour

GA11: Life-Long Learning Orientation

4.0PG Diploma and PG Degree(MBA-IT) Programme Structure as per NEP

Year	Level	Semester (2Year)	Major		RM	OJT /FP	RP	Cumulative	Degree
			Mandatory	Electives					
I	6.0	Semester I	22 credits	4	-	-	-	26	
		Semester II	14 credits	4	4	4 FP	-	26	
Cumulative Credits for PG Diploma			**36**	**8**	**4**	**4**	**-**	**52**	**PGDiploma(after3 YearDegree)**
Exit option: PG Diploma 52 Credits after Three Year UG Degree (with additional 4 credits of OJT)									
II	6.5	Semester III	6	12	-	8 OJT	-	26	
		Semester IV	8	12	-	-	6 MP	26	

	14	**24**	**-**	**08**	**06**	**52**	**PG Degree (after 4 – Years UG)**
Cum.Cr.for 2 Year PG Degree	**50**	**32**	**4**	**12**	**6**	**104**	**PG Degree (after 3 – Years UG)**

PG Diploma Programme Structure as per NEP								
Type	**Semester**	**CourseType**	**Number ofCourses**	**Credits**	**Total Credits**	**FA**	**SA**	**Total**
Mandatory	I	Generic Core	6	3	18	300	300	600
Mandatory	I	Generic Core	2	2	4	0	100	100
Elective	I	Generic Elective	2	2	4	100	0	100
		TOTAL	**10**	**-**	**26**	**400**	**400**	**800**
Mandatory	II	Generic Core	4	3	12	200	200	400
Mandatory	II	Generic Core	1	2	2	0	50	50
Mandatory	II	Business Research Methods	1	2	2	-	50	50
Mandatory	II	Desk Research	1	2	2	50	0	50
Mandatory	II	Field Project	1	4	4	50	100	150
Elective	II	Generic Elective	2	2	4	100	0	100
		TOTAL	**10**	**-**	**26**	**400**	**400**	**800**
PG Diploma in Management after Three Year UG Degree(with additional 4 credits of OJT for Exit option)			**20**	**-**	**52**	**800**	**800**	**1600**

- The students can exit the Programme after one year of MBA-IT, but he has to take additional 4 Credits of On - job Training. To get **PG Diploma after Three Year UG Degree, he should earn total 52 + 4 = 56 Credits**
- Re-entry to complete the PG degree, after taking the exit option, will be permissible up to 05 years from the date of admission o t he PG program
- The institute may conduct bridge courses for the respective students at the discretion of Director / Head of the institutions

PG Degree Programme (MBA-IT) Structure as per NEP								
Type	**Semester**	**CourseType**	**Number of Courses**	**Credits**	**Total Credits**	**FA**	**SA**	**Total**
Mandatory	III	Generic Core	1	3	3	50	50	100
Mandatory	III	Subject Core	1	3	3	50	50	100
Mandatory	III	OJT(SIP)	1	8	8	100	100	200
Elective	III	Subject Elective	4	3	12	200	200	400
		TOTAL	**7**	**-**	**26**	**400**	**400**	**800**
Mandatory	IV	Generic Core	1	3	3	50	50	100
Mandatory	IV	Generic Core	1	2	2	0	50	50
Mandatory	IV	Subject Core	1	3	3	50	50	100
Mandatory	IV	Major Project	1	6	6	100	50	150
Elective	IV	Subject Elective	4	3	12	200	200	400
		TOTAL	**8**		**26**	**400**	**400**	**800**
PG Degree (MBA-IT) after Four-year UG Degree(LateralEntry)			**15**		**52**	**800**	**800**	**1600**
PGDegree(MBA-IT)afterThreeyearsUG Degree			**35**		**104**	**1600**	**1600**	**3200**

4.1Course Types

4.1.1 **Core courses** are the compulsory courses for all the students. Core courses are of two types: Generic Core & Subject Core.

4.1.2 **Generic Core:** This is the course which should compulsorily be studied by a candidate as a core requirement to complete the requirement of a degree in a said discipline of study. Therefore, Generic Core courses are mandatory and fundamental in nature. These courses cannot be substituted by any other courses. Such courses are also known as Hard Core Courses.

4.1.3 **Subject Core :**A Core course may be a Subject Core If there is a choice or an option for the candidate to choose from abroad category (grouping) of subjects(specializations).

4.1.4 **Elective Course:** Elective course is a course which can be chosen from a pool of courses. It may be:

a) Very Specialized or advanced course focusing on a specific aspect
b) Supportive to the discipline of study
c) Providing an extended scope
d) Enabling an exposure to some other discipline /domain
e) Nurturing candidate's proficiency/skills.

4.1.5 **Generic Elective :**An elective course which is common across disciplines /subjects is called a generic elective. 'Generic Elective' courses develop generic proficiencies amongst the students.

4.1.6 **Subject Elective:** A 'Discipline (specialization) centric' elective is called 'Subject Elective.' Subject Elective courses, in the Semester II, III and IV are focused on a specialization.

4.1.7 **Research Methodology Courses:** These courses are focused on various aspects of

Research. They include –Business Research Methods, Desk Research (DR) and Field Project (FP) in Semester II, On The Job Training (OJT) in Semester III and Major Project(MP) in Semester IV .***DR, FP, OJT and MP shall be specialization specific compulsory courses (subject core). BRM shall be a generic compulsory course.***

4.1.8 **Massive Open Online Courses(MOOCs)**: Massive Open Online Courses(MOOCs) are such online courses which are developed as per the pedagogy stated in the AICTE regulation (2016) or equivalent; following the four-quadrant approach and made available on the SWAYAM platform of Government of India. **Upto 40% credits are permitted through MOOCS. Any Course of 2 Credits can be taken in the form of SWAYAM**

/NPTEL MOOCS provided the student secures the certificate from SWAYAM/ NPTEL. MOOCs from other platforms shall not be considered valid. MOOCS cannot be opted for in case of a 3-credit course.

5.0 Open Elective(s):

1. There is no provision for Open Electives. Students may pursue additional specializations as per the relevant provisions.

6.0 Formative Assessment (FA)/Comprehensive Concurrent Evaluation(CCE)

The course teacher shall prepare the scheme of Comprehensive Concurrent Evaluation (Formative Assessment) be for commencement of the term.

1. The scheme of Comprehensive Concurrent Evaluation shall explicitly state the linkages of each FA/ CCE with the Course Outcomes and define the targeted attainment levels for each CO. Graduate Attributes may also be considered during the design of CCE scheme.
2. The Director / Head of the Department / designated academic authority shall approve the scheme of Formative Assessment (FA) Comprehensive Concurrent Evaluation with or without modifications.
3. The course teacher shall communicate to the students, the approved FA/ CCE scheme of the course and the same shall also be hosted on the Institute's website, not later than the first week of the term.
4. *Each FA/CCE item shall be of minimum 25 marks.*
5. *For a 3Credit Course there shall be a MINIMUM of three FA/CCE items .The final scores shall be converted to 50,usinganaverageorbesttwooutofthree formula.*
6. *For 2 Credit Course there shall be a MINIMUM of two CCE items. The final scores shall be converted to50.*
7. FA/ CCE shall be spread through the duration of course and shall be conceptualized, executed, assessed and documented by the course teacher along with student-wise and class-wise attainment levels of the COs and the attainment levels of the course.
8. The assessment outcome of each FA/CCE shall be duly signed by the course teacher, programme coordinator/ academic head and the Director/ Head of the Department /designated academic authority of the Institute.
9. A copy of the duly signed FA/CCE *outcome* shall be communicated to the students, within a week of the assessment and course teachers shall guide the students on a need basis.
10. Institute may conduct additional makeup/remedial FA/CCE items at its discretion.
11. At the end of the term aggregate FA/CCE scores / grades shall be calculated and the CO attainment levels shall be calculated by the course teacher. The same shall be communicated to the students within a week.

6.1 Formative Assessment(FA) / Comprehensive Concurrent Evaluation Methods:

Course teachers shall opt for a combination of one of more CCE methods listed below.

Group A (Individual Assessment)– Notmorethan1per course

1. Class Test
2. Open Book Test
3. Written Home Assignment
4. In-depth Viva-Voce

Group B(Individual Assessment)– Atleast1per course

1. Case Study
2. Caselet
3. Situation Analysis
4. Presentations

Group C(Group Assessment)–Not more than1 per course

1. Field Visit/Study tour and report of the same
2. Small Group Project & Internal Viva-Voce
3. Model Development
4. Role Play
5. Story Telling
6. Fish Bowls

Group D (Creative-Individual Assessment)–Notmorethan1percourse

1. Learning Diary
2. Scrap Book/Story of the week /Story of the month
3. Creating a Quiz
4. Designing comic strips
5. Creating Brochures/Bumper Stickers/Fliers
6. Creating Crossword Puzzles
7. Creating and Presenting Posters
8. Writing an Advice Column
9. Library Magazines based assessment
10. Peer assessment
11. Autobiography/Biography
12. Writing a Memo
13. Work Portfolio

Group E (Use of Literature/Research Publications-Individual Assessment)–Not more than1per course

1. Book Review
2. Drafting a Policy Brief
3. Drafting an Executive Summary
4. Literature Review
5. Term Paper
6. Thematic Presentation
7. Publishing a Research Paper
8. Annotated Bibliography
9. Creating Taxonomy
10. Creating Concept maps

Group F (Use of Technology-Individual Assessment) – Notmorethan1percourse

1. Online Exam
2. Simulation Exercises
3. Gamification Exercises

4. Presentation based on Google Alerts
5. Webinar based assessment
6. Creating Webpage/Website/Blog
7. Creating infographics/infomercial
8. Creating podcasts/Newscast
9. Discussion Boards

6.2 Rubrics: The course teacher shall design Rubrics for each FA/CCE. Rubrics are scoring tools that define performance expectations for learners. The course teacher shall seek approval for the rubrics from the Director /Head of the Department/other designated competent academic authority of the institute. The course teacher shall share the approved Rubrics with the students at the start of the course. The rubric shall detail the following:

- Linkages of the FA/CCE to COs.
- A description of the assessment - brief concept note 3
- Criteria that will be assessed - the expected learning outcomes.
- Descriptions of what is expected for each assessment component - the expectations from the student.
- Substantive description of the expected performance levels indicating mastering of various components - the assessment criteria.
- The team composition, if applicable.
- The format and mode of submission, submission timelines
- Any other relevant details.

6.3 Safeguards for Credibility of FA /CCE: The following practices are encouraged to enhance transparency and authenticity of concurrent evaluation:

- Involving faculty members from other management institutes.
- Setting multiple question paper sets and choosing the final question paper in a random manner.
- One of the internal faculty members (other than the course teacher) acting as jury during activity based evaluations.
- InvolvementofIndustrypersonnelinevaluatingprojects/fieldbasedassignments.
- Involvement of alumni in evaluating presentations, role plays, etc.
- 100%moderation of answersheets, in exceptional cases.

6.4 Retention of FA/CCE Documents: Records of FA/CCE shall be retained for 3 years from the completion of the Academic Year. i.e. **Current Academic Year(CAY) +3years.**

7.0 End Semester Evaluation(ESE)/ Summative Assessment (SA)

- The End Semester Evaluation (Summative Evaluation) shall be conducted by the Savitribai Phule Pune University.
- The ESE/SA shall have 5 questions each of 10 marks.
- All questions shall be compulsory with internal choice within the questions.
- The broad structure of the ESE/SA question paper shall be as follows:

Question Number	COGNITIVE ABILITIES EVALUATED	Nature
Q.1	REMEMBERING	Answer any 5 out of 8 (2 marks each)
Q.2	UNDERSTANDING	Answer any 2 out of 3 (5 marks each)
Q.3	APPLYING	Answer 3 (a) or 3 (b) (10marks)
Q.4	ANALYSING	Answer 4 (a) or 4 (b) (10marks)
Q.5	EVALUATING	Answer 5 (a) or 5 (b) (10marks)
	CREATING	

8.0 Programme Flexibility:

8.1 Dropping an Elective Course:

- Students who opt for an elective course and fail to earn the credits for the elective course (generic / subject / open) are permitted to opt for another elective course (generic / subject / open) in case they feel to do so.
- In such a case they shall be said to have dropped the original course and opted for a new one.
- Generic Core (GC), Subject Core (SC) CANNOT be dropped.
- Generic Elective & Subject Elective can be dropped and replaced with equivalent alternative courses
- Not more than four courses can be dropped and replaced with equivalent alternative courses during the entire MBA programme.

8.2 Credit Transfer for MOOCs:

- Since MOOC is a guided self study course 40 - 45 hours of work shall be equivalent to one credit. The faculty shall oversee the progress of the learner as well as evaluate the learner for 50 marks / 2 credits.
- Students shall apply to the Director / Head of the Department / other designated competent academic authority of the institute in advance and seek permission for seeking credit transfer for the proposed MOOCs, he/she wishes to pursue.
- For claiming these credits - SWAYAM / NPTEL course / MOOC completion certificate submission to the institute shall be mandatory

9.0 Passing Standards:

- A student shall be said to have earned the credits for a course if he/she earns minimum 40% marks.
- Formative Evaluation and Summative Evaluation shall be separate heads of passing.

10.0 Grading System:

The Indirect and Absolute Grading System shall be used, i.e. the assessment of individual Courses in the concerned examinations will be on the basis of marks. However, the marks shall later be converted into Grades by a defined mechanism wherein the overall performance of the learners can be reflected after considering the Credit Points for any given course. The overall evaluation shall be designated in terms of Grade. The 10-point standard scale mandated by UGC shall be used.

The performance of a student will be evaluated in terms of two indices, viz.
(a) Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester.
(b) Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in time.

Sr. No.	% of Max. Marks	Grade Point	Grade Letter
1	90≤ Marks ≤ 100	10	O (Outstanding)
2	75≤ Marks ≤ 89	9	A+ (Excellent)
3	60≤ Marks ≤ 74	8	A (Very Good)
4	55≤ Marks ≤ 59	7	B+ (Good)
5	50≤ Marks ≤ 54	6	B (Above Average)
6	45≤ Marks ≤ 49	5	C (Average)
7	40≤ Marks ≤ 44	4	D (Pass)
8	Marks < 40	0	F (Fail)
9	Nil	0	Ab (Absent)
10	--	0	FX (detained, Repeat the course)
11	--	0	IC (Incomplete Course- Absent for Exam but Continue for the course)
12	--	0	AC (Audit Course Completed)
13	--	--	ACN (Audit Course Not Completed)

11.0 Miscellaneous

11.1 Scaling Down of CCE/FA Scores: The marks obtained by the student for the CCE/FA SHALL BE SCALED DOWN, to the required extent, if percentage of the marks of CCE/FA exceeds the percentage of marks scored in the ESE (End Semester University Examination) by 25% for the respective course.

11.2 Degree Requirements: The degree requirements for the MBA programme are completion of minimum 104 credits.

11.3 Maximum Attempts per Course:

1. A student shall earn the credits for a given course in maximum FOUR attempts.

11.4 Maximum Duration for completion of the Programme: The candidates shall complete the MBA Programme within 4 years from the date of admission.

11.5 Attendance: The student must meet the requirement of 75% attendance per semester per course for grant of the term. The institute may condone the shortage in attendance in exceptional circumstances, up to a maximum of 10%. The institute shall have the right to withhold the student from appearing for examination of a specific course if the above requirement is not fulfilled.

11.6 Text Books and Reference Books refer to the latest edition.

11.7 Medium of Instruction: The medium of Instruction & Evaluation shall be English.

11.8 Grade Improvement:

1. A Candidate who has secured any grade other than F (i.e. passed the MBA programme)

and desires to avail the Grade Improvement option, may apply under Grade Improvement Scheme within five years from passing that Examination.

2. He/she can avail not more than three attempts, according to the syllabus in existence, for grade improvement.
3. He /she shall appear for University Evaluation of at least 1/3rd of the Generic Core / Subject Core Courses (except SIP) for the purpose of Grade Improvement.

Annexure 1 – LIST OF COURSES

OFFERED IN EACH SEMESTER

SEMESTER I							
	Sem Code	**Course Code**	**Course**	**Credits**	**FA**	**SA**	**Marks**
Mandatory	101	FIT501MJ	Fundamentals of Information Technology	3	50	50	100
Mandatory	102	OOS502MJ	Object oriented software engineering	3	50	50	100
Mandatory	103	PPM503MJ	Principles and Practices of Management	3	50	50	100
Mandatory	104	PRC504MJ	Programming in C	3	50	50	100
Mandatory	105	ADB505MJ	Advanced Data Base Management System	3	50	50	100
Mandatory	106	BBA506MJ	Basics of Business Analytics	3	50	50	100
Mandatory	107	ECO507MJ	E-Commerce	2	0	50	50
Mandatory	108	IKS508MJ	Indian Knowledge Systems	2	0	50	50
	CORE TOTAL		**8**	**22**	**300**	**400**	**700**
Semester I Generic Electives - Any 2 Courses to be Opted from the following list							
Elective	109	ICC509MJ	Introduction to cloud computing	2	50	0	50
Elective	110	FCS510MJ	Fundamentals of Cyber Security	2	50	0	50
Elective	111	IST511MJ	Introduction to Software Testing	2	50	0	50
Elective	112	SNV512MJ	Startup & New Ventures	2	50	0	50
Elective	113	BC513MJ	Business Communication-I	2	50	0	50
Elective	114	FAN514MJ	Fundamental of Animation	2	50	0	50
Elective	115	EGI515MJ	E-Governance & its applications	2	50	0	50
	ELECTIVE TOTAL		**2**	**4**	**100**	**0**	**100**
	SEMESTER TOTAL		**10**	**26**	**400**	**400**	**800**

SEMESTER II							
	Sem Code	**Course Code**	**Course**	**Credits**	**FA**	**SA**	**Marks**
Mandatory	201	BPD551MJ	Business Process Domain	3	50	50	100
Mandatory	202	DMA552MJ	Digital Marketing	3	50	50	100
Mandatory	203	ERP553MJ	Enterprise Resource Planning	3	50	50	100
Mandatory	204	ORA554MJ	Oracle	3	50	50	100
Mandatory	205	OBE555MJ	Organisation Behaviour	2	0	50	50
	CORE TOTAL		**5**	**14**	**200**	**250**	**450**
Mandatory	206	BRM556MJ	Business Research Methodology	2	0	50	50
Mandatory	207	CER557MJ	Cases in ERP	2	50	0	50
Mandatory	208	IT581MP	Mini Project	4	50	100	150
	RESEARCH TOTAL		**3**	**8**	**100**	**150**	**250**
Semester II Specialization Electives - Any 2 Courses to be Opted from the respective elective list							
Elective	209	ITH559MJ	Internet of Things	2	50	0	50
Elective	210	TPB560MJ	Tableau & Power BI	2	50	0	50
Elective	211	BDA561MJ	Big Data Analytics	2	50	0	50
Elective	212	BCO562MJ	Business Communication-II	2	50	0	50
Elective	213	ACD563MJ	Advanced C & Data structure	2	50	0	50
Elective	214	LAD564MJ	Linux Administration	2	50	0	50
Elective	215	ISA565MJ	Information System Audit	2	50	0	50
	ELECTIVE TOTAL		**2**	**4**	**100**	**0**	**100**
	SEMESTER TOTAL		**10**	**26**	**400**	**400**	**800**

SEMESTER III							
	Sem Code	**Course Code**	**Course**	**Credits**	**FA**	**SA**	**Marks**
Mandatory	301	SPM601MJ	Software Project Management	3	50	50	100
Mandatory	302			3	50	50	100
	CORE TOTAL		**2**	**6**	**100**	**100**	**200**
Mandatory	303	IT603OJT	On the Job Training	8	100	100	200
	SIP TOTAL		**1**	**8**	**100**	**100**	**200**
Semester III Generic Electives - Any 4 Courses to be Opted from the respective elective list							
Elective	304	SE 01		3	50	50	100
Elective	305	SE 02		3	50	50	100
Elective	306	SE 03		3	50	50	100
Elective	307	SE 04		3	50	50	100
Elective	308	SE 05		3	50	50	100
Elective	309	SE 06		3	50	50	100
Elective	310	SE 07		3	50	50	100
Elective	311	SE 08		3	50	50	100
	ELECTIVE TOTAL		4	12	200	200	400
	SEMESTER TOTAL		7	26	400	400	800

SEMESTER IV							
	Sem Code	**Course Code**	**Course**	**Credits**	**FA**	**SA**	**Marks**
Mandatory	401	MIS651MJ	Management Information System	3	50	50	100
Mandatory	402	DWA652MJ	Data Warehousing	2	0	50	50
Mandatory	403			3	50	50	100
		CORE TOTAL	**3**	**8**	**100**	**150**	**250**
Mandatory	404	MPR681MJP	Major Project	6	100	50	150
		RESEARCH PROJECT TOTAL	**1**	**6**	**100**	**50**	**150**
	Semester IV Specialization Electives - Any 4 Courses to be Opted from the following list						
Elective	405			3	50	50	100
Elective	406			3	50	50	100
Elective	407			3	50	50	100
Elective	408			3	50	50	100
Elective	409			3	50	50	100
Elective	410			3	50	50	100
Elective	410						
Elective	410						
		ELECTIVE TOTAL	**4**	**12**	**200**	**200**	**400**
		SEMESTER TOTAL	**8**	**26**	**400**	**400**	**800**
		PROGRAMME TOTAL	**35**	**104**	**1600**	**1600**	**3200**

Cloud Computing							
Specialization Core Courses							
Sem Code	**Course Code**	**Course**	**Semester**	**Credits**	**FA**	**SA**	**Marks**
302	CIS602MJ	Cloud Infrastructure & Services	III	3	50	50	100
403	CCT653MJ	Cloud Computing Tools & Techniques	IV	3	50	50	100
	CORE TOTAL	**2**		**6**	**100**	**100**	**200**
Specialization Elective Courses - Semester III (Any 4 to be opted for)							
304	BNE604MJ	Basics of Networking	III	3	50	50	100
305	NSE605MJ	Network Security	III	3	50	50	100
306	SDT606MJ	Server & Desktop Technology	III	3	50	50	100
307	CST607MJ	Cloud Storage	III	3	50	50	100
308	CCW608MJ	Cloud Computing with AWS	III	3	50	50	100
309	CRM609MJ	Cloud Risk Management	III	3	50	50	100
310	CSP610MJ	Cloud security and Privacy	III	3	50	50	100
311	CCU611MJ	Cloud Computing Using Azure	III	3	50	50	100
	ELECTIVE TOTAL	**4**		**12**	**200**	**200**	**400**
Specialization Elective Courses - Semester IV (Any 4 to be opted for)							
405	CCM655MJ	Cloud Computing Management	IV	3	50	50	100
406	CIE656MJ	Cloud Innovations and Emerging Technologies	IV	3	50	50	100
407	IWV657MJ	Interfacing with Virtualization	IV	3	50	50	100
408	CMM658MJ	Cloud Migration and management	IV	3	50	50	100
409	CCS659MJ	Cloud Computing Security Architecture	IV	3	50	50	100
410	FSD660MJ	Fundamentals of Storage and Data Centers	IV	3	50	50	100
411	CCD661MJ	Cloud computing &Devops	IV	3	50	50	100
412	CAN662MJ	Cloud Analytics	IV	3	50	50	100

Full Stack Development							
Specialization Core Courses							
Sem Code	**Course Code**	**Course**	**Semester**	**Credits**	**FA**	**SA**	**Marks**
302	PPR602MJ	Python Programming	III	3	50	50	100
403	AJP653MJ	Advance Java Programing	IV	3	50	50	100
	CORE TOTAL	**2**		**6**	**100**	**100**	**200**
Specialization Elective Courses - Semester III (Any 4 to be opted for)							
304	PDW604MJ	Program and Design with ASP.NET	III	3	50	50	100
305	BMA605MJ	Basics Mobile application development	III	3	50	50	100
306	PHP606MJ	PHP Programming	III	3	50	50	100
307	TCD607MJ	Test case and design techniques	III	3	50	50	100
308	MDA608MJ	Mongo Database	III	3	50	50	100
309	SQA609MJ	Software Quality Assurance	III	3	50	50	100
310	JSC610MJ	JavaScript	III	3	50	50	100
311	AML611MJ	AI & Machine Learning	III	3	50	50	100
	ELECTIVE TOTAL	**4**		**12**	**200**	**200**	**400**
Specialization Elective Courses - Semester IV (Any 4 to be opted for)							
405	MDE655MJ	MERN Development	IV	3	50	50	100
406	AJS656MJ	Angular JS	IV	3	50	50	100
407	RJS657MJ	React JS	IV	3	50	50	100
408	RPR658MJ	R Programing	IV	3	50	50	100
409	AWD659MJ	Advance Web Development	IV	3	50	50	100
410	FAD660MJ	Fundamentals of Agile Development	IV	3	50	50	100
411	STP661MJ	Software Test Planning and Documentation	IV	3	50	50	100
412	DMI662MJ	Data Mining	IV	3	50	50	100

Cyber Security with Data Analytics							
Specialization Core Courses							
Sem Code	**Course Code**	**Course**	**Semester**	**Credits**	**FA**	**SA**	**Marks**
302	ECS602MJ	Essentials of Cyber Security	III	3	50	50	100
403	DAN653MJ	Data Analytics	IV	3	50	50	100
	CORE TOTAL	**2**		**6**	**100**	**100**	**200**
Specialization Elective Courses - Semester III (Any 4 to be opted for)							
304	IED604MJ	Innovation and Entrepreneurship Development	III	3	50	50	100
305	FDP605MJ	Fraud detection & prevention	III	3	50	50	100
306	EHA606MJ	Ethical Hacking	III	3	50	50	100
307	BTE607MJ	Blockchain technologies	III	3	50	50	100
308	CLA608MJ	Cyber Laws	III	3	50	50	100
309	ETC609MJ	Emerging technology in cyber security	III	3	50	50	100
310	BDA610MJ	Big Data Analytics	III	3	50	50	100
311	MAN611MJ	Marketing Analytics	III	3	50	50	100
	ELECTIVE TOTAL	**4**		**12**	**200**	**200**	**400**
Specialization Elective Courses - Semester IV (Any 4 to be opted for)							
405	TFC655MJ	Trends & Future in Cloud Computing	IV	3	50	50	100
406	CSG656MJ	Cryptography & Network security	IV	3	50	50	100
407	CNS657MJ	Cyber space & Governance	IV	3	50	50	100
408	WAN658MJ	Web Analytics	IV	3	50	50	100
409	DFO659MJ	Digital forensic	IV	3	50	50	100
410	CET660MJ	Cyber Ethics	IV	3	50	50	100
411	CRM661MJ	Cyber risk management	IV	3	50	50	100
412	CCC662MJ	Cyber crimes& case studies	IV	3	50	50	100

COURSE WISE DETAILED SYLLABUS

FIT201MJ: Fundamentals of Information Technology		
Semester – I **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand the basics of what makes up a computer system.
- To learn about the types of code that help computers run.
- To explore different kinds of microprocessors and how they are used.
- To get familiar with various operating systems and their roles.
- To understand the basics of different programming languages and networking

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Identify and recall the different types of computers and their various peripheral devices.
CO2	Remember, Understand, Analyze, Apply	Understand the different types of computer code and their specific uses
CO3	Remember, Understand	Learn about the advancements in microprocessors and the differences between them
CO4	Remember, Understand, Analyze, Apply	Gain knowledge about operating systems and the functions of various types of operating systems.
CO5	Remember, Understand, Apply	Understand the various types of networking and the topologies

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Introduction to Computer Systems** Computer definition, Characteristics of Computers, Computer Generations (with example), Types of Computers, Digital Block Diagram and function of each unit of block diagram**. Input and Output Units**1.**Input devices** (I : Keyboard, II : Pointing devices - Mouse, Joystick, Touch Screen, Light Pen, Stylus) III : Scanning devices (Optical Scanners, Bar Code readers,MICR, OCR, OMR) IV : Image capturing devices (Digital Camera, Digital video camera) V: Audio input devices- Microphone. **Output devices** (I : Monitors – Cathode ray tube, Flat panel monitor, II : Printers (Ink jet printer, Laser printer, Thermal	20	12

	printer, 3D printer, Plotter, Photo printer) III : Audio output device – Speakers, Head phones)c. **Storage devices**(I : Types of Memory – Primary and Secondary / RAM and ROM) II (Storage Capacity : Bit, Byte, MB, KB, GB, TB) III : Primary Storages (RAM, ROM, PROM, EPROM, Cache Memory, function of Cache Memory, Virtual Memory), IV : Secondary Storages (Magnetic Disk, CD, DVD, Hard Disk, Pen Drive, SD Card)		
2	**Number System and Coding System**. **Number Systems** (I : Types - Non Positional Number System, Positional Number System (Binary, Octal, Hexadecimal Number Systems),II : Conversion of One Number System to Another, III : Coding systems : BCD, EBCDIC ASCII, Unicode	20	5
3	**Micro Processors and Operating System**. **Process Devices** : (I : Microprocessor, II: Types of Processor III : Specialty processor – (Graphics coprocessor, Parallel processor)b. **Operating System** : Definition and Functions(Process Management, CPU Scheduling, Memory Management, File Management etc), Types of Operating System, Difference between Window sand Open source OS**,** Introduction to Android, IOS	10	8
4	**Software System and Computer Language**. **Software** : I - Definition, II - Types of Software, III -Batch Processing, Spooling, Multiprocessing ,Multiprogramming, Time-Sharing, On-Line Processing, Real-Time Processing **Computer Languages** : High Level Language, Low Level Language, Object Oriented Languages II. Language Converter: Compiler, Interpreter, Assembler	25	8
5	**Computer Networking** Networking, I : Computer network and its benefits II : Types of networks - LAN, WAN, MAN, Internet, Intranet, Extranet III : Network Topologies, IV : OSI Model (Seven layers) V : Introduction to Communication Media	15	7

Learning Resources

References:

1. Computer Fundamentals by P.K. Sinha,BPB Pub,6thEd.
2. Introduction to Computers by Peter Norton 6th Ed.
3. Computer Fundamental by Rajaraman,PHI,4thEd.
4. Operating System by Galvin,TMH,8thEd.
5. Operating System by AchyutGodbole,TMH, 2ndEd.
6. Computer Networks by Andrew S. Tanenbaum, Pearson,6thEd.
7. Fundamentals of computer networks by SudakshinaKundu

Website Links:

1. www.olearyseries.co
2. https://testbook.com/computer-awareness/computer-fundamentals
3. https://www.geeksforgeeks.org/computer-fundamentals-tutorial/

OOS502MJ: Object Oriented Software Engineering		
Semester – I **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand the foundational concepts of software engineering.
- To examine the phases of the Software Development Life Cycle (SDLC) and various process models.
- To acquire skills in requirement analysis and system design.
- To become proficient in agile software development methodologies.
- To understand software testing and maintenance approach

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand, Analyze	Differentiate between various software development process models
CO2	Remember, Understand, Analyze, Apply	Create a software requirements specification (SRS) for defined problem scenarios in a software system
CO3	Remember, Understand, Analyze, Apply	Apply software engineering analysis and design expertise to propose solutions for hypothetical problems
CO4	Remember, Understand, Analyze, Apply	Identify and explain contemporary trends in software engineering.
CO5	Remember, Understand, , Analyze, Apply	Evaluate project requirements and formulate an initial design

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Overview of Software Development** 1.1 Software development approach Basic System Development Life Cycle with different users and their role in SDLC. 1.2 Different Approaches and SDLC Models for System Development.	20	12

	1.3 Introduction Requirement Determination & Specification**.** Types of Requirements – Functional and Non-Functional 1.4 Software requirement Specification (SRS) - Structure and contents of the requirements specification, IEEE SRS Format		
2	**Overview of Software Development with OOAD** 2. Introduction to Object orientation and basic concept of development approach with OOAD 2.1 Object and Classes 2.2 Abstraction and Encapsulation 2.3 Methods and Message 2.4 Interfaces, Inheritance and Polymorphism 2.5 Associations and links 2.6 Aggregation , Composition and containment 2.7 Inheritance, Sub Types and IS-A hierarchy 2.8 Introduction to UML 2.8.1 Use-case Driven Object oriented Analysis - The UML approach, Develop use-case Model & Description of Use case Diagram. 2.8.2 Class Diagram 2.8.3 Activity Diagram 2.8.4 Sequence diagram and Collaboration Diagram. 2.8.5 State Transition Diagram. 2.8.6 Deployment Diagram. Case studies should be covered on the above topic	30	8
3	**User Interface Design** 3. Introduction to User Interface Design-Input Design and Output Design. Eight golden rules for design. 3.1 User Interface design: Elements of good design, design issues, Features of modern GUI, Menus, Scroll bars, Windows, Buttons, Icons, Panels, Error Messages etc. 3.2 Design of output, Design Types of Output.	10	4
4	**Software Process And Agile Development** 4 Introduction to Software Engineering, Software Process, Perspective and specialized Process Models 4.1 Introduction to Agility-Agile process Extreme programming -XP Process	25	5
5	**Software Testing And Maintenance** Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking	15	5

Learning Resources

References:

- Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.
- Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, Mc Graw-Hill International Edition, 2014.
- Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
- Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
- Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016
- Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
- Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 2010.
- Software Engineering Pressman, TMH,7thEd.
- System Analysis and Design Jalote, Narosa Pub, 3rdEd
- Software Engineering Sommerville, Pearson,8thEd
- Software Engineering W S Jawadekar, TMH.
- Software Engineering with UML, Mohammad Ali Shaikh, ISBN 9781643243566
- System Analysis & Design methods Whiten, Bentley, ,TMH,7thEd.
- System Analysis & Design Elias Awad, GalgotiaPub,
- Object Oriented Modelling& Design James Rumbaugh,PHI.
- Analysis & Design of Information System James Senn, TMH, 2ndEd.
- Analysis & Design of Information System V. Rajaraman, ,PHI,3rdE

Website Links:

1. https://www.mooc-list.com/course/object-oriented-design-coursera
2. https://nptel.ac.in/courses/106101061/
3. https://learning.tcsionhub.in/
4. https://www.agilealliance.org
5. https://github.com/topics/kanban
6. https://www.opensourcescrum.com/
7. https://www.scrum.org/resources
8. https://www.tutorialspoint.com/agile/index.htm
9. https://www.atlassian.com/agile
10. https://www.javatpoint.com/agile
11. https://www.guru99.com/agile-testing-course.html
12. https://www.visual-paradigm.com/tutorials/agile-tutorial/

PPM503MJ: Principles and Practices of Management		
Semester – I **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories.
- To understand group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations.
- To understand the organizational system, including organizational structures, culture, human resources, and change.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand, Analyze	Describe and analyze the interactions between multiple aspects of management
CO2	Remember, Understand, Analyze, Apply	Analyze the role of planning and decision making in Organization
CO3	Remember, Understand, Analyze, Apply	MAKE USE OF the principles of goal setting and planning for simple as well as complex tasks and small projects
CO4	Remember, Understand, Analyze, Apply	COMPARE and CONTRAST various organizational structures of variety of business and not-for-profit entities in a real world context

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Essence of Management** The need, scope, Meaning and Definition The process of Management, Managerial levels/Hierarchy, Managerial Function, Planning Organizing Staffing, Directing Controlling Managerial skills Technical Conceptual Human Resource Historical perspective-Classical Theories, Taylor Fayol Behavioral Science and Approach HR Approach Management Science Approach System approach-with reference to management, organization and MIS, Contingency Approach	15	9

2	**Current issues in management**: Managing innovation, Corporate governance, Globalization.	20	6
3	**Development of management thought**: Different Schools of management – Introduction, Classical Theories: F. W. Taylor, Modern theories, Behavioral Approach, Quantitative School of Management,	15	9
4	**Functions of Management**: A-Planning: Introduction, Nature, Factors affecting planning, Myths about Planning , Tools for Planning: Importance/Need/Of Planning: Benefits of planning/ disadvantages of Planning, Steps in Planning Function, Types of Plans, MBO B-Organizing: Organizing – concept, name , importance, principles, centralization, decentralization, organization structures,, line and staff authority, functional, product matrix, geographical, customer, virtual, - Organizations as networks, - types of network , Organizational design for change and innovation. C-Staffing: Nature and Importance of Staffing Function, Steps in Staffing Process: Manpower planning, Need of Manpower Planning, Types of Recruitment, Selection, Placement, Training, Remuneration, Concept of Knowledge workers D-Directing: Concept , Nature/Characteristics, Importance, Role of a supervisor, Functions of a supervisor Leadership, Motivation - Supervision and communication E-Controlling: Concept: What is Controlling ?Features, nature, importance, process, techniques, Co-ordination , Planning and Controlling	25	10
5	**Decision Making**: Introduction to decision making, meaning, nature, Components , steps in decision making, Decision making environment, Decision making conditions, Types of Decisions, styles, Decision making tools/Models, Constraints on Decision Making	15	7

Learning Resources

References:

- Principles and Practices of Management-Shejwalkar
- Essential of management- 7th edition Koontz H &Weitrich HTMH
- Management Today Principles And Practices - Burton &Thakur
- Harold Koontz & Heinz Weihrich :Essentials of Management, Tata McGraw Hill
- Principles & Practice of management: L.M.Prasad. Management Concepts & Practices – Hannagan
- Management, 11/E Stephen P. Robbins, San Diego State University, Mary Coulter, Missouri State University – Pearson Principles of Management – Tony Mordem, Ashgate Publishing, Ltd
- Peter Drucker, Widely recognized as the father of modern management. "Concept of the Corporation" Gary Hamel, author of "Leading the Revolution"

PRC504MJ: Programming in C		
Semester – I **LTP : 2:1:2**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To learn the problem-solving techniques by solving small problems.
- To learn features of the C programming language .
- To enhance problem solving and programming skills in C with extensive programming projects.
- To understand and write programs by using C language along with basic concepts of Data Structures

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand, Analyze	Use the algorithm paradigms for problem solving.
CO2	Remember, Understand, Analyze, Apply	Develop programs with features of the C programming language.
CO3	Remember, Understand, Analyze, Apply	Develop simple applications using C

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**C Fundamentals** A Brief History of C, C is middle-level Language, C is a Structured Language, C Character Set, Identifiers and Keywords under ANSI C. Data Types, Constants: int, float, double, char. Qualifiers: long, short, unsigned and signed. Escape sequences (like\n,\b etc.). Arithmetic Expressions and different built-in Operators. Pre-processor directives (like #include, #define), concept of header files, Symbolic constants, Comments, size of, steps involved in translation of C Program. Concept of typedef for renaming a built-in data type	8	3
2	**Flow Charts and Decision Table Flow Diagram**, Flow Chart symbols and their use, System flowcharts, program flowcharts, outline flowcharts, detail flowcharts, flowcharts and signs of communications, flow lines, process decisions, connectors, terminals, flowcharts for simple programs-problems.	7	9

	Built-in operators and functions. Console based I/O and related built-in I/O functions: printf(), scanf(), getch(), getchar(),putchar(), gets(), puts(). Decision and Case Control Structure if statement, if-else construct, use of logical operators and Compound Relational Tests, Nested if statements, The else if construct, the relational operators, the conditional expression (ternary) operator. The Switch Statement with or without break, concept of a case label, goto statement, concept of a goto label, comparison between goto and case labels		
3	Automatic, Register, Static (local and global),External. Scope rules. **Arrays** Concept of a collection, types of collections supported by 'C', Array collection and its features, concept of indexing, index variable, index type, positional value of a member of array collection, concept of dimension and size of an array, 'C' syntax for declaration of array, name of the array and its type, Referring individual elements, Entering data into an array, reading data from an array, concept of Array initialization and list of initializers, size option, Bounds checking, the concept of two dimensionarrays and related syntax, similarities between dimension and nesting String	4	7
4	Functions Concept of a subprogram, the interface of a subprogram, role of a interface,Arguments of a subprogram, kinds of subprograms supported by C, return statement as an interface, local variables, Default Return type and the type void, Passing values between functions through interfaces, Declaration of function type, iterative and recursive subprograms, Recursion, concept of call by value, call by reference, return and their underlying implementation should be explained, similarities and differences between Function & Macros, concept of nested macros and their use, recursion as a special nestedcall. Pointers Concept of Pointers, Pointer as an address variable, concept of a pointer data type and its syntax, built-in address operator, Pointers to existing variables of different data types and their uses, use of indirection operator, the name of the array as a pointer variable, Pointers and Arrays, Pointers arithmetic, use of unary operators (++, --), One Dimension Arrays and Pointer, concept of array of pointers and simple use, command line arguments for the main, pointer as a return type of a function **Structures** Structure as a homogeneous and heterogeneous collection, possible applications, syntax of declaring structure, Initializing structures, structure variables, accessing structure elements using member operator, Arrays of Structures, and array as member of structure, conceptual difference between array and structure collection, Functions and Structures, nested structures, concept of anonymous structures and their use, Concept of self referential structure,	20	15

	pointer as member of structure and pointer to structure use of member selector operator(->), comparison between indirection (*) operator and member selector operator (->), structure as an argument to function and return type of a function		
5	**File based I/O** Concept of a file, text files in 'C', concept of a predefined FILE pointer and its definition as given in header file stdio.h, meanings of different members of the structure representing FILE, Disk I/O Functions: High level file I/O or standard functions- fopen(), putc(), getc(), fclose(), fgets(),fputs(),feof(), simple file based programs showing the working of different members of FILE structure Bitwise Operator Concept of modifying the value using bit shifting, builtin bit shift operators left bit shift operator(<>) their uses, limitations of bitwise operators, use of bitwise relational operators Dynamic Memory Allocation and Memory functions Concept of dynamic environment as run time environment, concept of dynamic memory management, use of built-in dynamic memory management tools of 'C' viz. malloc(), free(), simple programs using malloc ( ) and free()	25	15

Learning Resources

References:

- Let us C by YashwantKanetkar, BPB,10thEdition
- C Programming by Balgurusamy, Tata Mc-Graw Hill,5thEdition
- Turbo C/C++ - The Complete reference by H.Schildt.
- Programming in C by S.Kochan,CBS
- Born to code in C by H. Schildt.
- The Art of C by H. Schildt.
- C Programming by Kerninghan and Ritchie – PHI pub,2nd Edition. Programming in ANSI C by Agarwal
- C Programming with Problem Solving by Jacqueline A Jones, Keith Harrow

Web links

- https://www.geeksforgeeks.org/c-program-to-create-hard-link-and-soft-link/
- https://www.tutorialspoint.com/explain-about-link-and-definition-section-in-c-language
- https://randerson112358.medium.com/link-c-programs-7282712fca1f
- https://www.techonthenet.com/c_language/compiling_linking.php

ADB505MJ: Advanced Data Base Management System		
Semester – I **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand the fundamental concepts and applications of Database Management Systems.
- To understand the relational database design principles.
- To get familiar with Data Collection and Design techniques.
- To acquire the skillset to use flexible databases for real world applications.
- To design Database Management Systems for projects.
- To relate different DB languages like MySQL, Noe4J, Risk, MongoDB

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Apply	Demonstrating the concept of fundamentals of relational database systems include: data models database & DDBS architectures
CO2	Understand,	Understand the concepts of transaction concurrency control, Query Processing and Security aspects
CO3	Apply	Apply SQL & NoSQL development tools on different types of Schemas
CO4	Apply	Demonstrate database design and Computation techniques for parallel and distributed database Technology.
CO5	Apply	Implement Real Time applications using Database tools

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Database Design and SQL Query Processing** 1.1 Introduction to Database, Data Models and Architecture of DBMS (Views of data: Schemas and Instances, Data Independence) 1.2 Data Modelling using ER Diagram: Representation of Entities, Attributes, Relationships and their Types, Cardinality, Generalization, Specialization, Aggregation. 1.3 Relational Data Model: Structure of Relational Database Model, Referential Integrity Constraints & its types, Codd's rules 1.4 Database Design using E-R, E-R to Relational Tables Conversion, Database design using Normalization – Normal forms - 1NF, 2NF, 3NF - Case Studies 1.5 Introduction to SQL Query Processing (DDL, DML, Aggregate Functions and Joins)	20	10

2	**Transaction and Concurrency Control** 2.1. Concept of Transaction and Transaction processing, ACID properties, Transaction States 2.2 Concurrency control, Problems in concurrency Control 2.3 Scheduling of Transactions, Serializability and Testing of Serializability 2.4 Concurrency Control Protocols: Lock-Based Protocol and Time Stamp-based ordering protocols 2.5 Deadlock in DBMS , Deadlock Handling Method20	20	8
3	**Database Recovery and Security Techniques** 3.1 Failure Classification 3.2 Storage Structure 3.3 Recovery and Atomicity 3.4 Log-Based Recovery (Deferred Database Modification, Immediate Database Modification) 3.5 Check Points, Shadow Paging 3.6 Introduction to Database backup, factors of database backups, Types of backups, steps to create database backup plan, Recovery from catastrophic failures 3.7 Database Security in DBMS, Importance of Database Security, Security Threats, Challenges in Database Security 3.8 Discretionary access control based on grant & revoking Privilege 3.9 Mandatory access control and role-based access control for Multilevel security 3.10 Encryption- its types & Public & Private key Infrastructure	20	10
4	**Parallel and Distributed Database** 4.1 Parallel Database System: Parallel Database Architectures; Parallel query processing and optimization; Load balancing; database clusters 4.2 Introduction to Distributed DBMS & Architecture, Characteristics 4.3 Distributed Data Processing, Promises of DDBMSs, Problem Areas. 4.4 Distributed data storage (Fragmentation, Replication & Transparency) 4.5 Query Processing: Objectives, Query decomposition; Localization of distributed data	25	12
5	**NOSQL database for Business Applications** 5.1 Introduction to NOSQL Database: Overview, History of NoSQL Databases, The Definition of the Four Types of NoSQL Databases.	15	8

Learning Resources

References:

- Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke Third Edition
- Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan Seventh Edition
- Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7th edition
- Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015.• (ISBN13: 978-9332557338)

- Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the• Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978- 9351192022)
- Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)
- Meier & Kaufmann. SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, 1st ed. Springer, 2019
- Bradshaw & Chodorow. MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, 3rd ed. O'Reilly, 2019

Recommended Learning Material

- https://www.geeksforgeeks.org/sql-concepts-and-queries/
- https://www.udemy.com• https://www.w3schools.com/sql/
- https://www.codecademy.com/article/sql-commands
- https://www.w3schools.com/sql/sql_intro.asp• https://www.javatpoint.com/sql-tutorial
- https://www.geeksforgeeks.org/introduction-to-nosql/
- https://www.edx.org/learn/nosql• http://libguides.regis.edu/tutorials.
- https://www.mongodb.com/resources/basics/databases/nosql-explained
- https://www.oracle.com/in/database/nosql/what-is-nosql/
- https://www.javatpoint.com/nosql-databases
- https://www.mysql.com/products/cluster/nosql.html
- https://firebaseopensource.com/• https://nptel.ac.in/courses/106/105/106105175/
- https://onlinecourses.nptel.ac.in/noc21_cs04/ 3.

BBA506MJ: Basics of Business Analytics		
Semester – I **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • Understand the role and importance of business analytics in decision-making. • Differentiate between various types of analytics: descriptive, diagnostic, predictive, and prescriptive. • Learn methods for collecting and organizing data from various sources • Understand data quality, data cleaning, and data preparation techniques. • Use statistical methods to summarize and describe data		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the fundamental concepts and terminologies in business analytics
CO2	Understand,	Explain the differences between business analytics and related fields (e.g., business analysis, business intelligence, data science),

		as well as the ethical considerations and quality of data in business analytics and key applications of business analytics
CO3	Apply	Utilize basic tools of business analytics, such as data exploration and visualization tools, to perform basic exploratory data analysis and data cleaning tasks
CO4	Analyze	Break down business problems into key questions and analyze data to derive meaningful insights for decision-making in various business domains like marketing, finance, HR, operations, health care, and agribusiness
CO5	Evaluate	Assess the effectiveness of different data-driven strategies and analytical techniques in improving business performance across different sectors through case studies
CO6	Create	Design and propose data-driven solutions and strategies to address complex business challenges, integrating knowledge from marketing, finance, HR, operations, health care, and agri-business analytics

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Business Analytics Basics: Definition of analytics**, Evolution of analytics, The Growing Role of Business Analytics, Business analytics vs business analysis, Business intelligence vs Data Science, Data Analyst Vs Business Analyst, Types of Analytics - Descriptive, Diagnostic, Predictive, Prescriptive, Concept of insights. Importance of data in business analytics, Differences between data, information and knowledge, Quality of data, 5Vs of Big Data, Big Data Collection and Ethics, Data sources and collection methods, Data privacy, security, and ethical considerations	20	10
2	**Analytical decision-making**: Analytical decision-making process, characteristics of the analytical decisionmaking process. Breaking down a business problem into key questions that can be answered through analytics, Characteristics of good questions, Skills of a good business analyst, The Basic Tools of Business Analytics - Data exploration and visualization (using tools like Excel, Tableau, or Power BI), Concept of Statistical analysis and hypothesis testing (Hypothesis testing numerical / tests not expected) Data Visualization: Concept of Data Visualization, Popular Data Visualization tools, Exploratory Data Analysis(EDA), Data Cleaning, Data Inspection	20	8
3	**Business Analytics in Marketing and Finance**: Marketing Analytics, Customer segmentation, targeting, and positioning, Campaign management and ROI measurement, Data-driven marketing strategies. Financial Analytics - Risk management and credit scoring, Financial forecasting and planning, Case studies: Financial performance improvement	20	10

	through analytics (Non-Statistical - Conceptual Treatment only)		
4	**Business Analytics in HR and Operations**: HR Analytics, Workforce planning and talent management, Employee engagement and performance measurement, Case studies: Enhancing HR practices with analytics. Operations Analytics - Process optimization and efficiency improvement, Supply chain analytics and logistics management, Case studies: Operational excellence through analytics Non-Statistical - Conceptual Treatment only)	20	9
5	**Business Analytics in Health Care and Agri Business**: Health Care Analytics - Patient care optimization and resource management, Predictive analytics for health outcomes, Case studies: Improving health care delivery with analytics. Agri Business Management Analytics - Crop yield prediction and supply chain management, Market analysis and risk management in agriculture, Case studies: Enhancing agricultural productivity with analytics NonStatistical - Conceptual Treatment only).	25	15

Learning Resources

References:

- Provost, F., & Fawcett, T. (2013). “Data science for business: What you need to know about data mining and data-analytic thinking”. O'Reilly Media.
- Sharda, R., Delen, D., & Turban, E. (2019). “Business intelligence, analytics, and data science: A managerial perspective” (4th ed.). Pearson.
- Hastie, T., Tibshirani, R., & Friedman, J. (2009). “The elements of statistical learning: Data mining, inference, and prediction” (2nd ed.). Springer.
- Davenport, T. H., & Harris, J. G. (2007). “Competing on analytics: The new science of winning”. Harvard Business School Press
- Pearl, J., & Mackenzie, D. (2018). “The book of why: The new science of cause and effect”. Basic Books.
- Lewis, M. (2016). “Marketing data science: Modeling techniques in predictive analytics with R and Python”. Pearson FT Press.
- Siegel, E. (2016). “Predictive analytics: The power to predict who will click, buy, lie, or die”. Wiley.
- Winston, W. L. (2014). “Marketing analytics: Data-driven techniques with Microsoft Excel”. Wiley.
- Narayanan, A., & Bhattacharya, A. (2023). “Big data in finance: Data analytics in financial services and banking”. Wiley.

ECO507MJ: E-Commerce		
Semester – I **LTP : 2:1:1**	**Credit: 02**	**Examination Scheme:** **External (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • To understand an entire flow of E-Commerce • To demonstrate awareness of ethical, social and legal aspects of E-Commerce • Analyze features of existing E-Commerce businesses and propose future directions or innovations for specific business		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Identify and apply relevant problem solving methodologies
CO2	Understand, Create	Design components, systems and/or processes to meet required specifications for a web presence
CO3	Apply, Analyse	Demonstrate research skills
CO4	Remember, Analyze	Communicate effectively in ways appropriate to the discipline, audience and purpose

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Introduction to E-Commerce**: Defining Commerce; Main Activities of Electronic Commerce; Benefits of E-Commerce; Broad Goals of Electronic Commerce; Main Components of E-Commerce; Functions of Electronic Commerce – Communication, Process Management, Service Management, Transaction Capabilities	10	4
2	**Process of E-Commerce**; Types of E-Commerce; Role of Internet and Web in E-Commerce; Technologies Used; Pre-requisites of E-Commerce; Scope of E-Commerce; E-Business Models	10	4
3	**E-Commerce Activities**: Various Activities of E-Commerce; Various Modes of Operation Associated with ECommerce;	15	4
4	**The Backbone for E-Commerce**: Early Ages of Internet; Networking Categories; Characteristics of Internet; Components of Internet – Internet Services, Elements of Internet, Uniform Resource Locators Internet Protocol; Shopping Cart, Cookies and ECommerce;	15	4
5	**Implementation of E-Commerce**: WWW.EBAY.COM - B2C Website – Registration Growth of eBay; PayPal – New Trend in Making Payments Online; National Electronic Funds Transfer	20	4

Learning Resources

References:

- Introduction to E-commerce and Social Commerce Turban
- Electronic Commerce by HosseinBidgoil
- E-COMMERCE BRAND BUILDING : "build A billion dollar e-commerce brand from scratch"
- by Rishi Kandari
- E-COMMERCE by S.J. JOSEPH, P.T.

IKS508MJ: – Indian Knowledge Systems		
Semester – I **LTP : 2:0:0**	**Credit: 02**	**Examination Scheme:** **External (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • Understand the scope and significance of IKS in the context of Indian culture and history. • Explore the historical evolution and foundational principles of Indian knowledge traditions • Explore the relevance of IKS in modern education, technology, and global discourse		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	RECALL key teachings and themes from the Bhagavad Gita, and identify significant events and principles from the life of Shivaji Maharaj.
CO2	Understand, Create	EXPLAIN the role of values, ethics, and spirituality in leadership and organizational culture as taught in the Bhagavad Gita, and summarize Shivaji Maharaj's leadership qualities
CO3	Apply, Analyse	APPLY principles of self-awareness, self-management, and emotional intelligence from the Bhagavad Gita to real-world leadership scenarios
CO4	Remember, Analyze	COMPARE and contrast Indian Knowledge Systems (IKS) with Western Management Theories (WMT), particularly in terms of leadership styles, decision-making frameworks, and ethical considerations
CO5	Evaluate	EVALUATE the effectiveness of Jugaad innovations in various sectors and assess the impact of family and community roles in Indian business practices
CO6	Create	DESIGN strategic leadership plans that integrate the principles of the Bhagavad Gita and Shivaji Maharaj’s governance strategies to address contemporary organizational challenges

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Leadership and Organizational Behavior from Bhagavad Gita**: Overview of the Bhagavad Gita, Historical and cultural context, Key themes and teachings, Role of values, ethics and spirituality in leadership and organizational culture, Motivation, Self-awareness and self-management principles, Developing resilience and emotional intelligence, Inspiring and motivating teams, Team dynamics and conflict resolution in Indian traditions, Gita-based decision-making frameworks, Conflict resolution strategies, Servant leadership principles, Building high-performance teams, Ethical dilemmas and decision-making, Reflection and personal growth exercises	10	6
2	**Insights and Lessons from the life of Shivaji Maharaj**: Overview of Shivaji Maharaj's life, historical context, Dharma, Raj Dharma, and Artha, Leadership qualities of Shivaji Maharaj - Leadership in adversity, Leadership styles and effectiveness in different contexts, Shivaji Maharaj's strategic vision and planning, Innovative strategies in warfare and governance, Principles of governance in Shivaji's kingdom, Administration structures and decisionmaking processes, Efficient and ethical governance, Shivaji Maharaj as an entrepreneur and nation-builder, Economic policies and trade strategies, Cultural values in Shivaji's leadership, Balancing tradition with modernity in leadership, Relevance of Shivaji Maharaj's leadership in contemporary management and leadership	10	6
3	**Comparative Analysis of Indian Knowledge Systems and Western Management Theories**: Overview of IKS: Vedas, Upanishads, Darshanas, Overview of Western management theories (WMT), Philosophical foundations and cultural contexts; Individualism (IKS) vs. Collectivism (WMT), Hierarchical structures (IKS) vs. egalitarianism (WMT) , Holistic decision-making (IKS) vs. analytical approaches (WMT), Intuition and gut feelings (IKS) vs. data-driven decision-making (WNT), Work-life balance: Concepts of Karma and Dharma vs. Western work ethic, IKS emphasis on sustainability vs. Western focus on short-term gains, Strategic alignment with societal goals: IKS principles vs. shareholder value maximization in the West, Synergies and integration of IKS and Western management practices	15	6
4	**Indigenous Management Practices and Frameworks** – Jugaad: Jugaad - Definition and Principles, Key principles of frugal innovation, Historical context and cultural significance in India; The Jugaad Mindset, Characteristics of a Jugaad innovator, Comparison with conventional innovation models, Importance of resourcefulness and	15	6

	creativity, Case Studies of Jugaad Innovation, Analysis of successful Jugaad innovations in India, impact on communities and industries, Sector-Specific Case Studies – Healthcare, Agriculture, Automobiles, Education, etc., Scaling Jugaad Innovations, Sustaining Jugaad Innovations, Frugal innovation in other countries, Emerging trends and technologies in frugal innovation		
5	**Indigenous Management Practices and Frameworks** - The role of family and community in Indian business: Historical context of family and community roles in Indian business, Joint family systems, Community Networks, Characteristics of family-owned businesses, Leadership styles, Cooperative movements in India, Social enterprises and their impact on local communities, Role of community support in business sustainability, Cultural values and their influence on business ethics, Role of traditional values in contemporary business practices, Ethical decisionmaking influenced by family and community, Corporate Social Responsibility in the Indian context, Community engagement strategies, Challenges faced by family and community businesses, Succession planning, leadership transition, Conflict resolution, Opportunities for growth and innovation, Adapting traditional practices to modern business environments, Emerging trends and their impact on family and community roles, Technology and globalization's influence on traditional practices.	20	6

Learning Resources

References:

- "The Bhagavad Gita: A New Translation" by Stephen Mitchell
- "The Essence of the Bhagavad Gita: Explained by Paramhansa Yogananda" by Swami Kriyananda
- "The Bhagavad Gita: A New Commentary" by Swami Sivananda
- "Bhagavad Gita: A New Translation" by Swami Satchidananda
- "The Bhagavad Gita for Executives" by Swami Parthasarathy
- "Bhagavad Gita: A New Interpretation for Modern Times" by Stephen Cope
- "Shivaji: The Great Maratha" by Ranjit Desai
- "Shivaji and His Times" by Jadunath Sarkar
- "The Life and Times of Shivaji Maharaj" by Kalpana Roy
- "Chhatrapati Shivaji Maharaj" by A.K. Priolkar

Indicative Case Studies

1. Amul: The Cooperative Movement - Focus: Cooperative model, rural empowerment, supply chain management.
2. The Dabbawalas of Mumbai - Focus: Operational excellence, Six Sigma, traditional logistics systems, Supply chain efficiency, customer satisfaction.
3. Fabindia: Crafting Success- Focus: Handicrafts, sustainable sourcing, social

entrepreneurship.
4. Tata Group: Pioneering Corporate Social Responsibility- Focus: CSR practices, ethical business, community development.
5. Jaipur Foot: Affordable Prosthetics - Focus: Social innovation, frugal engineering, inclusive growth.
6. Patanjali: Revolutionizing FMCG - Focus: Ayurvedic products, brand positioning, market disruption.
7. SEWA (Self-Employed Women's Association): Empowering Women - Focus: Women empowerment, microfinance, cooperative movement.
8. ITC's e-Choupal: Digitizing Rural India - Focus: E-commerce, rural development, supply chain integration.
9. Lijjat Papad: Women's Cooperative - Focus: Women entrepreneurship, cooperative model, business sustainability.
10. Haldiram's: Traditional Snacks, Modern Business - Focus: Brand evolution, quality management, market expansion.
11. Reliance Jio: Disrupting Telecom - Focus: Market disruption, technology adoption, customer acquisition.
12. Tata Nano: The World's Cheapest Car - Focus: Frugal innovation, product development, market challenges.
13. Biocon: Building a Global Biotech Company - Focus: Research and development, strategic alliances, global expansion.
14. Shahnaz Husain: Globalizing Ayurveda - Focus: Brand building, international marketing, traditional knowledge.
15. Cafe Coffee Day: Creating a Coffee Culture - Focus: Brand positioning, customer experience, market expansion.
16. Mahindra & Mahindra: Driving Innovation - Focus: Product diversification, innovation strategies, global expansion.
17. Godrej: From Locks to Consumer Goods - Focus: Diversification, brand evolution, sustainability practices.
18. Infosys: Leadership and Growth - Focus: Corporate governance, employee empowerment, innovation
19. Tata Steel: Global Expansion and CSR - Focus: Globalization, corporate social responsibility, sustainable practices.
20. Zomato: Revolutionizing Food Delivery in India - Focus: Technology integration, customer engagement, market expansion.

Generic Electives (GE)– Any 2 Courses to be opted

ICC509MJ: – Introduction to Cloud Computing		
Semester – I **LTP : 2:0:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • Understand the fundamental concepts and principles of cloud computing • Learn about the different cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) • Understand various cloud deployment models: public, private, hybrid, and community clouds		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Explain the benefits and challenges associated with cloud computing
CO2	Understand,	Distinguish between different cloud service models (IaaS, PaaS, SaaS) and identify appropriate use cases for each.
CO3	Apply, Analyse	Recommend suitable deployment models based on organizational needs and requirements
CO4	Remember, Analyze, Evaluate	Evaluate the strengths and limitations of each service model.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Definition and essential characteristics A brief history and evolution of Cloud Technological Influences, and Operational Influences	10	5
2	Cloud Delivery models, The SPI Framework, Cloud Software as a Service (SaaS) , Cloud Platform as a Service(PaaS), Cloud Infrastructure as a Service(IaaS), Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Alternative Deployment models, Expected benefits	10	6
3	Cloud Computing Software Security fundamentals: Cloud Information Security Objectives Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering, Cloud Security Policy Implementation	15	6
4	Cloud Computing Risk Issues: The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider risks	15	6

5	Cloud Computing Security challenges: Security Policy Implementation, Policy Types, and Computer Security Incident Response Team (CSIRT)	20	6

Learning Resources

References:

- John W. witinghouse james F.Ransome, "Cloud Computing Implementation, Management and Security" , CRC Press.
- Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer
- Charles Badcock, "Cloud Revolution" , TMH
- Cloud Computing: Concepts, Technology & Architecture, 1/e by Erl
- Cloud Computing and Beyond : A Managerial Perspective, 2ed | e by Sanjiva Shankar Dubey

FCS510MJ: – Fundamentals of Cyber Security		
Semester – I **LTP : 2:1:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • This course will cover the concept of security, types of attack experienced, encryption and authentication for deal with attacks, what is Network Perimeter Security, Access Control Lists and Virtual Private Networks		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Understand the broad set of technical, social & political aspects of Cyber Security
CO2	Understand	Appreciate the vulnerabilities and threats posed by criminals to national infrastructure
CO3	Apply, Analyse	Understand the nature of secure software development, operating systems and data base design
CO4	Remember, Analyze, Evaluate	Recognized the role security management plays in cyber security.
CO5	Understand	Understand the security management methods to maintain security protection

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Pre-requisites in Information and Network Security 1.1 Overview of Networking Concepts Basics of Communication Systems Transmission Media Topology and Types of Networks TCP/IP Protocol Stacks Wireless Networks 1.2 Information Security Concepts Information Security Overview: Background and Current Scenario Types of Attacks Goals for Security E-commerce Security Computer Forensics Steganography 1.3 Security Threats and Vulnerabilities Overview of Security threats Weak / Strong Passwords and Password Cracking Insecure Network connections Malicious Code Programming Bugs Cyber Crime and Cyber terrorism Information Warfare and Surveillance 1.4 Cryptography / Encryption Introduction to Cryptography / Encryption Digital Signatures Public Key infrastructure Applications of Cryptography Tools and techniques of Cryptography	20	12
2	Security Management 2.1 Security Management Practices Overview of Security Management Information Classification Process Security Policy Risk Management Security Procedures and Guidelines Business Continuity and Disaster Recovery Ethics and Best Practices 2.2 Security Laws and Standards Security Assurance Security Laws IPR International Standards Security Audit SSE-CMM / COBIT etc	20	11
3	Information and Network Security 3.1 Access Control and Intrusion Detection Overview of Identification and Authorization Overview of IDS Intrusion Detection Systems and Intrusion Prevention Systems Server Management and Firewalls User Management Overview of Firewalls Types of Firewalls DMZ and firewall features 3.2 Security for VPN and Next Generation Technologies VPN Security Security in Multimedia Networks Various Computing Platforms: HPC, Cluster and Computing Grids Virtualization and Cloud Technology and Security	30	9
4	System and Application Security 4.1 Security Architectures and Models Designing Secure Operating Systems Controls to enforce security services Information Security Models 4.2 System Security Desktop Security email security: PGP and SMIME Web Security: web authentication, SSL and SET Database Security 4.3 OS Security OS Security Vulnerabilities, updates and patches OS integrity checks Anti-virus software	20	8

	Configuring the OS for security OS Security Vulnerabilities, updates and patches 4.4Wireless Networks and Security Components of wireless networks Security issues in wireless		

Learning Resources

References:

1. Cyber Security for Beginners
2. Cyber Security: Law and Guidance
3. Cyber Security for Seniors
4. Cyber Security: Threats and Responses for Government and Business
5. Cybersecurity: What You Need to Know About Computer and Cyber Security, Social Engineering, The Internet of Things + An Essential Guide to Ethical Hacking for Beginners
6. Ghost in the Wires: My Adventures as the World's Most Wanted Hacker

IST511MJ: – Introduction to Software Testing		
Semester – I **LTP : 2:1:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • To study basic concepts of Software Testing • To learn & understand the various Principles, Levels and Control of Software Testing • To manage security in Software Testing • To aware the new technologies in Software Testing		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	To aware the Software Testing Life Cycle and its phase
CO2	Understand	To aware the usability of Software Testing Levels and it importance's
CO3	Apply, Analyse	To apply Testing Process, Techniques and Environment in Software Testing.
CO4	Remember, Analyze, Evaluate	Recognize and describe the security controls in Software Testing
CO5	Understand	To adopt the new techniques in Software Testing

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Software Testing Principle Fundamentals of testing, Principle, Objectives and Purpose, Defect or Bug, Its life cycle, Fundamental of Test Process, Factors affecting software testing, Testing constraints, Life cycle of testing, Tester's workbench, Level of Testing, Verification and	10	10

	Validation Functional and structural testing Static and dynamic testing, V Concept of testing with testing stages		
2	Testing Process and Techniques Software testing process Structural testing techniques Functional testing techniques White box and black box testing Incrementaltesting Thread testing, Requirement tracing	10	6
3	Testing software developed by contractor Building Test Environment, Managements support Test work processes Test Tools, Challenges in testing acquitted software COTS Software Test Process, Contracted software test process	10	8
4	Testing Software Controls&Security Controls Principles and concepts of Internal controls Internal control models, Testing of internal controls Building a Penetration Point Matrix Creation of security awareness policy, strategy, Technique to test security	10	8
5	Testing new Technologies Testing Web Based , distributed Applications Testing Wireless Technologies Testing e-Commerce application	10	8

Learning Resources

References:

1. CSTE Common Body of Knowledge (www.softwarecertifications.org)
2. 2 Software Engineering, R. Pressmen,TMH,7thEd.
3. Software Engineering, Sommerville,Pearson,8thEd
4. IntroducingSoftwareTesting, LouiseTamres
5. Effective Methods for software Testing WilliamPerry
6. Software Testing inRealWorld, EdwardKit
7. Software Testing Techniques, Boris Beizer, dreamTech pub,2ndEd

SNV512MJ: – Startup & New Ventures		
Semester – I **LTP : 2:1:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • To instill a spirit of entrepreneurship among the student participants • .To provide an overview of the competences needed to become an entrepreneur • To give insights into the Management of Small Family Business		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	DESCRIBE the strategic decisions involved in establishing a startup
CO2	Understand	EXPLAIN the decision making matrix of entrepreneur in establishing a startup
CO3	Apply, Analyse	IDENTIFY the issues in developing a team to establish and grow a startup

CO4	Remember, Analyze, Evaluate	FORMULATE a go to market strategy for a startup
CO5	Create	DESIGN a workable funding model for a proposed startup.
CO6	Create	DEVELOP a convincing business plan description to communicate value of the new venture to customers, investors and other stakeholders

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	1.1 **Concept and Definitions: Entrepreneur** &Entrepreneurship, Entrepreneurship and Economic Development; A Typology of Entrepreneurs 1.2 Entrepreneurial Competencies: The Entrepreneur's Role, Task and Personality - Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; McClelland's N-Ach theory, personal efficacy, culture & values, risk-taking behaviour, technology backup. 1.3 Factor Affecting Entrepreneurial Growth: Economic Non-Economic Factors; EDP Programmes; Entrepreneurial Training; 1.4 Traits/Qualities of an Entrepreneurs: Entrepreneur; Manager Vs. Entrepreneur, The Early Career Dilemmas of an Entrepreneur, Defining Survival and Success,Entrepreneurship as a Style of Management, The Entrepreneurial Venture and the Entrepreneurial Organization. Entrepreneurial Process. 1.5 Steps of entrepreneurial process: Deciding – Developing – Moving – Managing – Recognizing	20	7
2	**2.1 Opportunity / Identification and Product Selection**: Entrepreneurial Opportunity Search and Identification; 2.2 Product Selection: Criteria to Select a Product 2.3 Conducting Feasibility Studies: Project Finalization; Sources of Information. 2.4 Entry strategies: New product, Franchising, Partial Momentum, Sponsorship and Acquisition. 2.5 Intellectual Property: Creation and Protection.	20	7
3	**3.1 Small Enterprises and Enterprise Launching Formalities**: Definition of Small Scale; Rationale; Objective; Scope; Role of SME in Economic Development of India; SME; Registration; NOC from Pollution Board; Machinery and Equipment Selection. 3.2Project Report Preparation: Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM; Methods of Project Appraisal - economic viability and market feasibility, requirements of financial institutions, projected financial statement preparation	20	8
4	**3.1 Small Enterprises and Enterprise Launching Formalities**: Definition of Small Scale; Rationale;	20	7

	Objective; Scope; Role of SME in Economic Development of India; SME; Registration; NOC from Pollution Board; Machinery and Equipment Selection. 3.2Project Report Preparation: Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM; Methods of Project Appraisal - economic viability and market feasibility, requirements of financial institutions, projected financial statement preparation		
5	**Case Studies**: Diagnostic case studies of successful / unsuccessful entrepreneurs explaining success /failures	20	5

Learning Resources

References:

1. New Venture Management: The Entrepreneur's Roadmap (Entrepreneurship Series), Donald F. Kuratko and Jeffrey S. Hornsby, Pearson

2. The Manual for Indian Start-ups: Tools to Start and Scale-up Your New Venture, Vijaya Kumar Ivaturi, Meena Ganesh, Penguin Random House India.

3.Managing New Ventures, AnjanRaichoudhuri, Prentice-Hall of India Pvt.Ltd

4. Develop Your Idea!: Get Off to a Flying Start With Your Startup. Guided Exercises, Templates & Resources for Exploring New Business Ventures, K. N. Kukoyi

5. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.

6. Entrepreneurship: New Venture Creation by David H. Holt

7. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant , Himalaya Publishing House, Delhi

8. Entrepreneurship and Small Business Management by Siropolis

9. Lead like an Entrepreneur by Neal Thornberry

BC513MJ: – Business Communication-I		
Semester – I **LTP : 2:1:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Prerequisites		
Course Objectives • To encourage the all round development of students by focusing on soft skills • To make student aware about the importance, the role and the content of soft skills through instruction, knowledge acquisition, and practice etc.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Face any challenges in Interviews
CO2	Understand	To present themselves with proper way
CO3	Apply, Analyse	To expand their innovations

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Team Building To know the nature of the team, To understand personal as well as professional goals of the members of the group, To work effectively in a team through building relation and interpersonal communication	10	3
2	Art of Negotiation To understand what is negotiation, Ways of negotiating and being successful in it, To understand the power of language and nonverbal communication	10	3
3	Dress for Success To learn selection of proper attire as per the situation, How to carry one's self, How to project one's self in the right frame and spirit	10	3
4	Table Manners To learn the manners during professional meetings over lunch/dinner, Basics of the table manner	10	3
5	Organizing Meetings How to call the meeting, How to organize a meeting in the smooth manner, How to design the agenda and prepare minutes of the meeting	10	3
6	Time Management Goal setting, To make students understand the importance of time, How to prepare the time line and allocate time to complete different tasks, How to successfully follow the prepared time-schedule	20	03
7	Multi-Tasking How to prioritize the work, Importance of multi-tasking and concerns related to multi-tasking, To identify what to multitask	10	03

8	Presentation Skills To learn the skill of presentation, How to prepare the presentation ,handle audience, use multimedia presentation	20	03

Learning Resources

References:

1. The Hard Truth about SoftSkillsby Peggy Klaus,The hard truth publishing

2. Effective Communication and SoftSkills byNitinBhatnagar, Pearson publishing

3. TeamBuilding by Peter Mears,Taylor& Francis publishing

4. Personality Development & Soft skills by BarunMitra,Oxford publishing

FAN514MJ: – Fundamental of Animation		
Semester – I **LTP : 2:1:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • To make the students with various approaches, methods and techniques of Animation • To develop competencies and skills needed for becoming an effective Animator • Exploring different approaches in computer animation • To enable students to create Animation Projects 3-D characters • To develop expertise in life-drawing and related techniques.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	identify the 12 principles of animation
CO2	Understand	Define and apply design principles and theories to animation production
CO3	Apply, Analyse	Demonstrate skills in the use of industry standard tools for animation
CO4	Remember, Understand	Create traditional and computer generated animation based on current industry trends.
CO5	Remember, Understand, Analyze	Critically analyze your creative work and the work of others

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions

1	Basic Introduction & system configuration Introduction computers , algorithm & flowcharts , Operating system , HTML , and Graphics.	10	4
2	Fundamental of Visual Arts Introduction, Elements of Design Art, colour, shape, texture , space, form of Drawing , Graphics software.	10	4
3	Basic element of drawing Introduction, Elements of drawing, Principles of Design , harmony, Balance, hierarchy, contrast, scale , emphasis, rhythm .	10	4
4	Fundamental Perspective Basics of graphics hardware and software, Graphics display devices, Hard copy technologies, Display technologies, Raster and random scan display systems.	10	4
5	Animation Concept applications Introduction, animation concepts., Principles of animations , Types of animation, script writing.	20	8
6	Storyboard Introduction & Context for 3 D Studio Max, Exploring the Max Interface, 3DS Max Workflow	15	6

Learning Resources

References:

1. Fundamental of Computers – By P. K. Sinha

2. The Animator's Survival Kit by Richard Williams Expanded Edition.

3. The Complete Animation course by Chris Patmore, By – Barons Educational Series .

4. Anatomy of the Artist – Thompson & Thompson.

5. Figure Study Made Easy By- Aditya Chari -- Grace Publication

6. Flash CS4 Professional Bible Published by Wiley Publishing (Robert R & Snow D.)

7. FLASH MX For PC/Mac Published by – FIREWALL MEDIA – Laxmi Publications

EGI515MJ: – E-Governance & Its Applications		
Semester – I **LTP : 2:1:0**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives • To develop knowledge of e-governance and e-government • To know different e-governance models and infrastructure development • To implement security and use data warehousing and mining in e-governance		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Understand the concept, importance and different models of E-Governance
CO2	Understand	Evaluate various plans and issues of E- Governance
CO3	Apply, Analyse	Demonstrate various e – governance initiatives through presentations and learn to seek services from Administration.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	***Introduction to E-Government and E-Governance*** Difference between E-Government and E-Governance; E-Government as Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance	10	5
2	***Models of E-Governance*** Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models	20	10
3	***E-Government Infrastructure Development.*** Network Infrastructure; Computing Infrastructure; Data centers; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness	10	4
4	***Security for e-Government*** Challenges and Approach of E-government Security; Security Management Model; E-Government Security Architecture; Security Standards	10	5
5	***Applications of Data Warehousing and Data Mining in Government*** Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining: Agriculture, Rural	20	8

	Development, Health, Planning, Education, Commerce and Trade, Other Sectors		
6	***Case Studies*** E-Government Initiatives in Nepal, Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, NICNET, Collectorate , Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and Capacity Monitoring System, Computerization in Andra Pradesh, Ekal Seva Kendra, Sachivalaya Vahini, Bhoomi, IT in Judiciary, E-Khazana , DGFT, PRAJA, E-Seva, E-Panchyat, General Information Services of National Informatics, Centre E-Governance initiative in USA, E-Governance in China, E-Governance in Brazil and Sri Lanka	25	10

Learning Resources

References:

- Richard Heeks, Implementing and managing e-Government
- C.S. R Prabhu, e-Governance: Concepts and Case studies, prentice hall of India Pvt. Ltd.
- J. Satyanarayana, e-Government, , prentice hall of India Pvt. Ltd
- Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001

SEMESTER - II

BPD551MJ: Business Process Domain		
Semester – II **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To learn and understand the processes and practices in business and their applications. • To know the work order management • To understand the sales analysis and market segments with Customer order Processing • To learn the financial aspect of business and management. • To introduce advance business applications like CRM and SCM.		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember, Understand	**Learn the Business Process and its application with respect to ERP**
CO2	Remember, Understand, Analyze, Apply	**Know how work order management carried out**
CO3	Remember, Understand	**Know the different steps in customer order processing**
CO4	Remember, Understand, Analyze, Apply	**Learn financial and HR aspects of Business**
CO5	Remember, Understand, Apply	**Understand how Supply Chain works**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**Weightage in %**	**No of Sessions**
1	**Manufacturing:** Product Life Cycle(PLC, PLC Management, BOM processing with product configuration, MPS, Capacity Requirements Planning for Equipment, Manpower and Time, MRP, Production Planning - work order management - EOQ, EBQ, Shop floor control - calculation of labourefficiency and productivity with example, Material procurement - Indenting, Purchasing, Vendor analysis, supplier's, Bill passing and receipt of material.	25	10
2	**Sales And Distribution:** Sales Budgeting - Market segments / Customers / Products Customers Enquiry and preparation of Quotation Customer Order processing - from Order acknowledgement to dispatch and	25	10

	invoicing Pending Customer orders - follow up. Sales Analysis Network of Sales outlet - Distributed Databases While explaining this application consider an organization manufacturing multiple products with sales outlets spread across the country. Retail Marketing- New trends – Growth		
3	**Human Resource:** 3.1 Employee Database3.2 Recruitment – Techniques3.3 Employee Appraisal – Performance, efficiency Leave Accounting and Payroll – Salary calculation and reporting, Income Tax calculation and reporting, Loan Accounting, PF and gratuity, Bonus, Ex-Gratia, Incentive, Super-annuation, Arrears Calculation.3.4 Introduction- E-HR	15	5
4	**Financial Accounting** 4.1 Double Entry Accounting system, Concepts and conventions in accounting, Accounting process, Depreciation4.2 Journal Entries – Rules for Journal entries, posting in a Ledger, subsidiary books, preparation of Trial balance4.3 Ratio Analysis – Types of ratio with examples4.3 Final Accounts – Preparation of Trading and profit and loss, Account and Balance sheet of a Proprietary Firm.	20	8
5	**Supply Chain Management(SCM)** 5.1 Introduction, Concept, Scope and advantages5.2 Customer Relationship management (CRM) – Introduction, Concept, Scope and advantages5.3Forecasting : Demand forecasting and Planning	7	15

Learning Resources

References:

1. Supply Chain Management - Strategy, Planning & Operation by Sunil Chopra, Peter Meindl, D. V.
Kalra, Pearson Education.
2. Management Information Systems by Jaiswal and Mittal, Oxford University Press
3. Personnel/ Human Resource Management by David DeCenzo, Stephen Robbins, Prentice Hall of India,2008, 3rd Edition
4. Human Resource Management by J. John Bernardin, Tata McGraw Hill Publishing, 4thEdition
5. Personnel Management C B Mammoria, Himalaya, 29th Ed.
6. Management Accounting Khan and Jain, TMH

DMA552MJ: Digital Marketing		
Semester – II **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- Get strategic understanding of Digital Marketing.
- Understand its advantages & limitations.
- Become familiar with Best Practices, Tools & Technologies available for Digital Marketing.
- Blend digital and social marketing with offline marketing.
- Understanding the concept of Youtube Marketing
- Plan and manage digital marketing budget.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	**Basic concepts related to Digital Marketing**
CO2	Remember, Understand, Analyze, Apply	**Tools and technologies for Digital Marketing**
CO3	Remember, Understand	**Digital marketing concepts on social media marketing**
CO4	Remember, Understand, Analyze, Apply	**Effect of digital marketing**
CO5	Remember, Understand, Apply	**Marketing analytics through Digital Marketing**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Digital Marketing and Social Networks –** a. **Social Networks** :Enterprise Social Networks, The Benefits and Limitations of Social Commerce, Benefits to Customers, Retailers, Employees, players in the ecosystem. Social Collaboration (Collaboration 2.0) - Essentials of Social Collaboration, Consumer-to-Consumer(C2C) Electronic Commerce, Person-to-Person models. b. **Digital Marketing:** History of Digital Marketing, Importance of Digital Marketing, Effective use of Digital Marketing, Effects of wrong Digital Marketing, Digital Marketing to develop brands, Digital Marketing for sales, Digital Marketing for product and service development.	20	6
2	**Mobile Marketing and e-Mail Marketing** Shopping and Advertising. M- Commerce: M- Commerce, M Business(Enterprise), Mobile Business Networks, Social Media, Platforms for digital media ; Digital Media Marketing, Enterprise	25	6

	2.0, Improved Business Models. Entrepreneur Networks. Techniques for effective Email Marketing and pitfalls, Various online email marketing platforms such as Campaign Monitor and Mail Chimp, Web content, web usability, navigation and design, Bookmarking and News Aggregators, Really Simple Syndication (RSS),Blogging, Live Chat, User Generated Content (Wikipedia etc),Multi-media - Video (Video Streaming, YouTube etc),Multimedia - Audio & Podcasting (iTunes etc), Multi-media - Photos/Images (Flickr etc),Google Alerts and Giga Alert (Brand, product and service monitoring online),Crowdsourcing, Virtual Worlds**.**		
3	**Search Engine Optimization (SEO)**Search Engine Optimization (SEO) tips and techniques, Google Adwords, Google various applications such as 'Google Analytics', Maps, Places etc to enhance a brand's products, services and operations	15	6
4	**Social Media Marketing** Facebook &LinkedIn and other Social Media for a real marketing, Utilizing Facebook and LinkedIn's Advertising functionality and Applications, Brand reputation management techniques, Systems for 'buzz monitoring' for brands, products and services, Effective Public Relations (PR) online and business development.	20	8
5	**YouTube Marketing:** Video Flow, Google Pages for YouTube Channel, Verify Channel, Webmaster Tool –AddingAsset, Associated Website Linking, Custom Channel URL, Channel ART, Channel Links, Channel Keywords, Branding Watermark, Featured Contents on Channel, Channel Main Trailer, Uploading Videos, Uploading Defaults, Creator Library, Case Studies. Channel Navigation, Video Thumbnail, CTA –Annotation, CTA –Extro, CTA –Cards for Mobile, Redirect Traffic to Website, Post Upload Enhancements, Live Broadcasting, Managing Playlists, Managing Comments, Managing Messages, Monetization with Adsense, Paid YoutubeChannel, Channel Analytics, Real Time Analytics, Case Studies.	20	6

Learning Resources

References:

1. Digital Marketing for Dummies, By Ryan Deiss, Russ Henneberrywiely Publications
2. VandanaAhuja, Digital Marketing, Oxford Press, ISBN: 9780199455447, 1 stEdition.
3. Email Marketing: An Hour a Day, Wiley, Jeanniey Mullen, David Daniels, David GilmourISBN: 978-0- 470-38673-6, 1 stEdition.
4. The New Rules of Marketing and PR, David Scott, Wiley India, ISBN: 978-1-119-07048-1, 1 St Edition.
5. Introduction to E Commerce & Social Commerce, Turban E , Whiteside J , King D, Outland J Springer
6. Digital Marketing for Dummies, By Ryan Deiss, Russ Henneberrywiely Publications
7. Social Media Marketing All-In-One for Dummies, Jan Zimmerman and Deborah

Websites: https://www.investopedia.com/terms/d/digital-marketing.asp

ERP553MJ: Enterprise Resource Planning		
Semester – II **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

1. To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
2. To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
3. To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
4. To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	**With the basic concepts of ERP systems for manufacturing or service companies, and the differences among (Material Requirement Planning) MRP, MRP II, and ERP systems.**
CO2	Remember, Understand, Analyze, Apply	**Apply the principles of ERP systems, their major components, and the relationships among these components**
CO3	Remember, Understand	**With the knowledge of typical ERP systems, and the advantages and limitations of implementing ERP systems.**
CO4	Remember, Understand, Analyze, Apply	**To comprehend the technical aspects of ERP systems .**
CO5	Remember, Understand, Apply	**To be able to map business processes using ERP concepts and techniques**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Introduction to Enterprise Resource Planning** Introduction of the term Business Process Reengineering(BPR) ,BPR Methodology, Current BPR Tools ,Introduction to material requirement planning (MRP), Definition of Enterprise Resource Planning (ERP); Evolution of ERP; Characteristics, Features, Components and needs of ERP; ERP Vendors; Benefits & Limitations of ERP Packages	20	8
2	**Enterprise Modeling and Integration of ERP** Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration.	20	8

3	**ERP Architecture and Implementation Methodology of ERP**Generic Model of ERP system; Core Modules functionality; Types of ERP architecture, Client Server Architecture, Web-based Architecture, Service Oriented Architecture (SOA) ; Difficulty in selecting ERP, Approach to ERP selection, Request for Proposal approach, Proof-of-Concept approach; General Implementation Methodology of ERP, Vanilla Implementation; Evaluation Criteria of ERP packages; Project Implementation Team Structure	15	6
4	**Introduction to SAP , Oracle APPS**SAP, Integrated SAP Model, SAP Architecture, SAP R/3 System & mySAP, SAP Modules; Oracle Apps, Oracle AIM Methodology, Oracle Fusion Modules; A Comparative assessment of ERP Packages.	20	8
5	**ERP for Supply Chain Management and Customer Relationship Management Supply Chain Management and ERP** Definition of Supply Chain Management (SCM); Supply Chain Council's SCOR Model; Stevens Model of Supply Chain Management; Aims of SCM; SCM Key Drivers; Collaborative Design & Product Development; Benefits of SCM; ERP Vs SCM; Key SCM Vendors **Customer Relationship Management and ERP** Definition of Customer Relationship Management (CRM); CRM Evolution; CRM Delivery Processes, CRM support Processes; CRM Analysis Processes; CRM Components; Key CRM Vendors	30	10

Learning Resources

References:

1. Enterprise Systems For Management, Luvai F. Motiwalla, Jeff Thompson, Pearson Education., 2nd
Ed., 2011. ISBN-10: 0132145766 | ISBN-13: 978- 0132145763.
2. Enterprise Resource Planning, Ravi Shankar, S.Jaiswal, Galgotia Publication Pvt. Ltd., 1st Ed., 1999.
ISBN 81-203-0417-9.
3. Enterprise Resource Planning – Alexis Leon – Second Edition – TMH.
4. ERP in practice – Vaman – TMH
5. Daniel E.O'Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002.

Websites:

- https://www.geeksforgeeks.org/introduction-to-erp/
- https://www.techtarget.com/searcherp/tutorials
- https://www.blogs.horizontechsolutions.co.in/

ORA554MJ: Oracle		
Semester – II **LTP : 2:2:1**	**Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives **1.** Equip participants with the knowledge and skills needed to install, configure, and administer Oracle databases. **2.** Develop proficiency in writing SQL queries and PL/SQL programming for Oracle databases. **3.** To create and manage databases**.** **4.** To build Oracle Database Solutions by providing an overview of database topics and developmen		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	**Write simple and advanced SQL queries.**
CO2	Remember, Understand, Analyze, Apply	Describe the features and syntax of PL/SQL
CO3	Remember, Create, Understand	Use PL/SQL programming constructs and conditionally control code flow (loops, Control structures, and explicit cursors)
CO4	Remember, Understand, Analyze, Apply	**The student will also become familiar with the internals of PL/SQL and will be able to compile PL/SQL for super-fast performance**
CO5	Remember, Create, Understand, Apply	**Able to use advanced features such as cursors, Triggers and bulk fetches**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Queries & SQL Functions:** Select with all options Operators Arithmetic Comparison Logical (in, between, like, all, %, _, any, exists, is null, and ,or, not, Distinct) Order by clause Date Functions -Sys_date , next_day, Add_months, last_day, months_between,Numeric Functions -round, trunc, abs, ceil, cos, exp, floor Character Functions -initcap, lower, upper, ltrim, rtrim, translate, length, lpad, rpad, replaceConversion Functions - to_char, to_date, to_number Miscellaneous Functions -Uid, User, nvl, vsize, decode, rownum Group functions -avg, max, min, sum, count, with Group by and Having Clause Nested functions **Joins:** Simple join Equi join Non equi join Self join Outer joinSet operators (Union, union all, intersect, minus) **Sub queries and Correlated query**	20	10

2	**DML statements** (Insert, Update, Delete with Where clause)**TCL (Commit, Rollback, Savepoint) Locks in Oracle**DDL Statements **DDL :** Create, Alter, Drop, Truncate, Rename Constraints (Primary key, Foreign Key, Unique Key, Check, Default, Not Null, On delete, Cascade) Column level and Table level constraints **Oracle Objects: Table** Views, Sequences, Synonyms, Index (Define, Alter and Drop) **Data Types:** Character -Char, Varchar/varchar2, Long Number Number (p) - fixed point, Number (p ,s) - floating point Long raw Introduction to LOB data types (CLOB,BLOB, BFILE)	20	12
3	**PL / SQL:** Introduction to PL/SQLAdvantages of PL/SQL PL/SQL Character Set Data types -Character, Raw, rowid, boolean, binary, integer,number, Variable, constantPL/SQL blocksAttribute - % type, % rowtype operators function comparison, numeric, character, date control structure sequential - goto Error handling concept of exception -pre defined exceptions -no_data_found, cursor_allready_open,program_error,zero_divide, invalid_cursor,login_denied,invalid_number, too_many_rows, dbms_output, user_defined exceptions **Composite Data Types**Record, Declaration, refer, record assignmentTable declaration, table attributes (count, delete, exists, first,last, next, prior)	20	15
4	**Database Triggers** Types of Triggers Enabling, disabling Predicates- inserting, updating, deleting **Cursor**: Explicit & implicit Cursor, Cursor for loop, Parametric cursor, Declaring cursor variables - cursor variables, Opening a cursor variable from a query, Closing cursor variables, Restrictions using cursor variables **Procedures and Functions** Definition, Implementation and Execution **Packages**	20	12
5	**Introduction to Oracle Architecture** **Creating an Oracle Database:** Use DBCA to create a database, to delete a database, to manage templates **Managing the Oracle Instance** Use Enterprise Manager Use SQL*Plus and iSQL*Plus to access the Oracle Database Modify database initialization parameters Describe the stages of database startup Describe the database shutdown options View the database alert log Use dynamic performance views	20	10

Learning Resources

References:

1. SQL - The complete Reference by Groff James & Weinberg Paul.,TMH,2nd Ed.
2. SQL for Professionals by Kishore Swapna&NaikRajesh,TMH.
3. SQL from the ground up by Pyofinch Mary
4. SQL Unleashed by Ladanyi Hans.
5. Oracle 7 by Ivan Bayross,BPB Pub.

6. Understanding SQL by Gruber Martin,BPB Pub.
7. Teach yourself SQL in 14 days by Morgan Bryan & Perkins Jeff
8. Oracle PL/SQL Programming by Scott Urman
9. Teach yourself PL/SQL in 21 days by Lucus Tom,techmedia,2nd Ed.
10. OCP: Oracle 10g Certification Kit (1Z0-042 and 1Z0-043)
11. Oracle Database 10g OCP Certification All-In-One Exam Guide (Oracle Database 10g Handbook) by DamirBersinic, John Watson
12. Oracle Database 10g DBA Handbook by Kevin Loney, Bob Bryla, PublisherMcGraw-Hill

Websites:

- http://education.oracle.com

OBE555MJ: Organisation Behaviour		
Semester – II **LTP : 2:1:1**	**Credit: 02**	**Examination Scheme:** **External (TH)** : 50 Marks **Total :50 Marks**

Course Objectives

1. Recognize and discuss the different perspectives of working culture in organizations..
2. Interpret key concepts and theories with regard to individual differences and apply these appropriately to specific situations.
3. Interpret the key concepts and theories with regard to group behaviour and apply these appropriately to specific situations**.**
4. Understand how organizational performance can be improved through the effective management of human resources

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	DESCRIBE the major theories, concepts, terms, models, frameworks and research findings in the field of organizational behaviour**.**
CO2	Remember, Understand, Analyze, Apply	EXPLAIN the implications of organizational behaviour from the perspectives of employees, managers, leaders and the organization.
CO3	Remember, Create, Understand	MAKE USE OF the Theories, Models, Principles and Frameworks of Organizational behaviour in specific organizational settings
CO4	Remember, Understand, Analyze, Apply	DECONSTRUCT the role of individual, groups, managers and leaders in influencing how people behave and in influencing organizational culture at large.
CO5	Remember, Create, Understand, Apply	FORMULATE approaches to reorient individual, team, managerial and leadership behaviour in order to achieve organizational goals.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Fundamentals of OB**: Understanding OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework	20	10

	(cognitive, behaviourist and social cognitive), Limitations of OB. **Dynamics of People and OB**: Disciplines that contribute to the field of OB (psychology, social psychology, sociology, anthropology),Relationship with the function in an organization, Behavioral approach to management. **Models of OB:** How to develop models of OB (understanding dependent and independent variables), Decision-making model, Robin's OB model, Feudal, Autocratic, Supportive, Collegial and Custodian models, Human value model and contingency model. **OB and organizational performance:** What are organizations, perspectives of organizational Effectiveness - organizational earning perspective, stake holder perspective, high performance work practices perspective. Task Performance, organizational citizenship, counter productive work Behaviors Meaning and importance, Setting goals for organizational performance, Role of people in organizational performance		
2	Individual Process And Behavior: **A-Ability**: Meaning and significance of matching right abilities to the right job, Intellectual and physical abilities and the effects of disabilities. **B-Learning**: Definition of learning and significance of continuous learning in an organization, Theories of learning, Action learning, Learning from individuals and learning from the environment. **C-Attitude**: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes **D-Personality and values**: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality & job – fit theory), Personality Tests and their practical applications. **E-Perception**: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect). **F-Motivation**: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories- Equity Theory of Work Motivation. **G-Emotional Intelligence**: emotions in the work Place, Emotions , Attitudes and Behavior, Emotional Intelligence Concepts of Employee Engagement, empowerment	20	12

3	Interpersonal Processes And Behavior, Team And Leadership Development: **A-Foundations of Group Behavior**: The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five -Stage Model of Group Development. **B-Managing Teams**: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building. **C-Managing Conflict**: Meaning of Conflict, Types of Conflicts (Intergroup Conflict, Intra-Individual Conflict and Interpersonal Conflict), Johari Window, and Overcoming Conflict. **D-Leadership**: Concept of Leadership, Styles of Leadership, Trait Approach, Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformational leadership, Contemporary issues in leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.	20	15
4	**Organization System:** **Foundations of Organization Structure**: Concept of Organization & Organizational Structure, Basic elements in designing OS. **Organizational Culture**: Meaning & Definition of Organizational Culture, Creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft vs. Hard Culture & formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.	20	12
5	**Managing Change:** **Organizational Change**: Meaning, definition & Nature of Organizational Change, Types of Organizational change, Forces that acts as stimulants to change. **Implementing Organizational Change**: How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's - Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.	20	10

Learning Resources

References books:

1. Organizational Behviour by Robin
2. Organizational Behaviour by Nelson & Quick Organizational Behaviour by Fred Luthans
3. Organizational Behaviour by Stephen Robins, Timothy Judge, Neharika Vohra

4. Organizational Behaviour by M N Mishra Organizational Behaviour by K Ashwathappa
5. Understanding OB by Uday Pareek
6. Change & Knowledge Management by Janakiram, Ravindra and Shubha Murlidhar

Websites:

- http://www.nwlink.com/~donclark/leader/leadob.html
- https://papers.ssrn.com/sol3/DisplayAbstractSearch.cfm

BRM556MJ: Business Research Methodology		
Semester – II **LTP : 1:1:1**	**Credit: 02**	**Examination Scheme:** **External (TH)** : 50 Marks **Total :50 Marks**
Course Objectives **1. To understand an overview of Research Methodology including basic concept** **2. Along with research to learn new computer applications for research**		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	DEFINE various concepts & terms associated with scientific business research
CO2	Remember, Understand, Analyze, Apply	EXPLAIN the terms and concepts used in all aspects of scientific business research.
CO3	Remember, Create, Understand	MAKE USE OF scientific principles of research to SOLVE contemporary business research problems.
CO4	Remember, Understand, Analyze, Apply	EXAMINE the various facets of a research problem and ILLUSTRATE the relevant aspects of the research process from a data driven decision perspective.
CO5	Remember, Create, Understand, Apply	JUDGE the suitability of alternative research designs, sampling designs, data collection instruments and data analysis options in the context of a given real-life business research problem from a data driven decision perspective.
	Remember, Create, Understand, Apply	FORMULATE alternative research designs, sampling designs, data collection instruments, testable hypotheses, data analysis strategies and research reports to address real-life business research problems.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Foundations of Research**: Definition of Research, Need of business research, Characteristics of scientific research method, Typical Research applications in business and management. **Questions in Research**: Formulation of Research Problem – Management Question – Research	20	10

	Question – Investigation Question. **The process of business research**: Literature review - Concepts and theories - Research questions - Sampling - Data Collection - Data analysis - Writing up - The iterative nature of business research process, Elements of a Research Proposal. Practical considerations: Values – researcher & organization. Ethical principles - Harm to participants, Lack of informed consent, Invasion of privacy, Deception, Reciprocity and trust, Affiliation and conflicts of interest. Legal considerations - Data management, Copyright		
2	**Research Design**: Concept, Features of a robust research design. Exploratory, Descriptive, Quasi Experimental, Experimental research designs, Concept of Cause and Effect, Difference between Correlation and causation. Types of Variables – Independent, Dependent, concomitant, mediating, moderating, extraneous variables, Basic knowledge of Treatment & Control group, Case study design. Cross-sectional and Longitudinal designs, Qualitative and Quantitative research approaches, Pros and Cons of various designs, choice of a research design. **Hypothesis:** Definition, research Hypothesis, Statistical hypothesis, Null hypothesis, Alternative Hypothesis, Directional Hypothesis, Non-directional hypothesis. Qualities of a good Hypothesis, Framing Null Hypothesis & Alternative Hypothesis. Concept of Hypothesis Testing - Logic & Importance.	20	12
3	**Data & Measurement**: Meaning of data, Need for data. **Secondary Data**: Definition, Sources, Characteristics, Advantages and disadvantages over primary data, Quality of secondary data - Sufficiency, adequacy, reliability and consistency. **Primary Data**: Definition, Advantages and disadvantages over secondary data. **Measurement**: Concept of measurement, What is measured? Problems in measurement in management research - Validity and Reliability, Levels of measurement - Nominal, Ordinal, Interval, Ratio. **Attitude Scaling Techniques**: Concept of Scale – Rating Scales viz. Likert Scales, Semantic Differential Scales, Constant Sum Scales, Graphic Rating Scales – Ranking Scales – Paired Comparison & Forced Ranking - Concept and Application. **Questionnaire**: Questionnaire Construction - Personal Interviews, Telephonic survey Interviewing, Online questionnaire tools.	20	15
4	**Sampling: Basic Concepts:** Defining the Universe, Concepts of Statistical Population, Sample, Characteristics of a good sample. Sampling Frame, determining the sample frame, Sampling errors, Non-Sampling errors, Methods to reduce the errors, Sample Size constraints, Non-Response. **Probability Sample**: Simple Random Sample, Systematic Sample, Stratified Random Sample, Area Sampling & Cluster Sampling. **Non-Probability Sample**: Judgment	20	12

	Sampling, Convenience Sampling, Purposive Sampling, Quota Sampling & Snowballing Sampling methods. **Determining size of the sample**: Practical considerations in sampling and sample size, (sample size determination formulae and numericals not expected)		
5	**Data Analysis & Report Writing**: **Data Analysis**: Cleaning of Data, Editing, Coding, Tabular representation of data, frequency tables, Univariate analysis - Interpretation of Mean, Median Mode; Standard deviation, Coefficient of Variation. **Graphical Representation of Data**: Appropriate Usage of Bar charts, Pie charts, Line charts, Histograms. **Bivariate Analysis**: Cross tabulations, Bivariate Correlation Analysis - meaning & types of correlation, Karl Person's coefficient of correlation and spearman's rank correlation. Chi-square test including testing hypothesis of association, association of attributes. Linear **Regression Analysis**: Meaning of regression, Purpose and use, **Linear regression**; Interpretation of regression co-efficient, Applications in business scenarios. Test of Significance: Small sample tests: t (Mean, proportion) and F tests, Z test. Non-parametric tests: Binomial test of proportion, Randomness test. **Analysis of Variance**: One way and two-way Classifications. **Research Reports**: Structure of Research report, Report writing and Presentation.	20	10

Learning Resources

References books:

1. Business Research Methods, Donald Cooper & Pamela Schindler, TMGH.
2. Business Research Methods, Alan Bryman & Emma Bell, Oxford University Press
3. Research Methods for Social Work, Allen, Earl R. Babbie, Cengage
4. Research Methods in Business Studies: A Practical Guide, Pervez Ghauri, Dr Kjell Gronhaug, FT Prentice Hall
5. Business Research Methods, William G. Zikmund, Barry J. Babin, Jon C. Carr, Mitch Griffin, Cengage Learning
6. Approaches to social research, Royce Singleton, Bruce C. Straits, Margaret Miller Straits, Oxford University Press
7. Research Methods: The Basics, Nicholas S. R. Walliman, Nicholas Walliman, Routledge,
8. Research Methodology In Management, Dr.V.P. Michael

CER557MJ: Cases in ERP		
Semester – II **LTP : 1:1:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives 1. To understand the basic concept of ERP systems 2. To study the steps and activities in the ERP life cycle 3. To develop a process driven thinking towards business processes		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Explain the scope of common enterprise systems
CO2	Remember, Understand, Analyze, Apply	Describe the selection, acquisition and implementation related to ERP systems.
CO3	Remember, Create, Understand	Identify and describe common functionalities in an ERP system and explain the steps and activities in the ERP life cycle.
CO4	Remember, Understand, Analyze, Apply	Demonstrate a good understanding of the basic issues in ERP systems
CO5	Remember, Create, Understand, Apply	Design the ERP implementation strategies
CO6	Remember, Create, Understand, Apply	Analyse the strategic options for ERP identification and adoption

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Case Study in Manufacturing Sector	20	10
*Mapping of Course Outcomes for Topic 1: CO Analyze, Apply, Understand, Remember			
2	Case Study in Service Sector	20	12
*Mapping of Course Outcomes for Topic 2: CO Apply, Understand, Remember			
3	Case Study in Banking Sector	20	15
*Mapping of Course Outcomes for Topic 3: CO Apply, Understand, Remember			
4	Case Study of Success Story and Failure of Processing Sector	20	12
*Mapping of Course Outcomes for Topic 4 CO Analyze, Apply, Understand, Remember			
5	ERP case study 1: Cadbury – A Sweet Success ERP case study 2: Nestle SA – Integration Excellence ERP Case study 3: ERP in Rolls-Royce	20	10
*Mapping of Course Outcomes for Topic 5: CO Apply, Understand, Remember			

Learning Resources

References Websites:

1. https://www.umassd.edu/media/umassdartmouth/businessinnovationresearchcenter/publications/erp_rolls-royce.pdf
2. https://www.erpfocus.com/erp-implementation-case-studies.html
3. https://www.oracle.com/erp/what-is-erp/erp-implementation-case-study/

IT581MP: Mini Project / Field Project		
Semester – II **LTP : 1:1:1**	**Credit: 04**	**Examination Scheme:** **Internal (TH): 50 Marks** **External (TH)** : 100 Marks **Total :150 Marks**

Course Objectives

1. Enhance programming skills, software development methodologies and proficiency in relevant technologies/tools
2. Gain experience in project planning, requirement analysis, design, implementation, testing, and documentation
3. Enhance problem solving capability through implementation
4. Improve presentation skills by effectively communicating project goals, methodologies, results and conclusions to peers, faculty, and potentially external stakeholders
5. Foster teamwork and collaborative skills through group-based project work, including division of tasks, coordination, and communication
6. Encourage creative thinking and innovation in designing solutions that meet specified requirements and constraints

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	REMEMBERING	Recall and list key management concepts and frameworks relevant to their specialization specific field project.
CO2	UNDERSTANDING	Demonstrate an understanding of the specific management theories and frameworks to real-world business issues.
CO3	APPLYING	Apply theoretical knowledge to practical situations in their chosen field of specialization and demonstrate data driven decision making approach.
CO4	ANALYSING	Analyze quantitative and qualitative data collected from the field to identify patterns, trends, and insights relevant to their specialization.
CO5	EVALUATING	Evaluate the effectiveness of different management strategies and approaches by comparing their field project findings with

		existing literature and industry practices from the respective specialization / domain.
CO5	CREATING	Create a comprehensive field project report and presentation that integrates their findings, analysis, and recommendations, demonstrating a professional and result-oriented approach

A] Preamble:

1. To integrate theory and practice by providing students with the opportunity to work on real-world issues.

2. To provide experiential learning opportunities that go beyond traditional textbooks and classroom learning.

3. To provide a platform to explore the functional aspects of each specialization.

4. To deepen students' understanding of management concepts and frameworks.

5. To develop application-oriented approach by bridging the gap between theory and practice.

6. To foster the development of critical skills, a professional mindset, and a result-oriented approach.

7. To highlight the insights from the business environment of the geographical region.

B] Guidelines for the Field Projects/ Mini Project

B - 1] Nature of the Field Project/ Mini Project:

1. Field Project/ Mini Project must be related to the intended specialization of the student.

2. Field Project/ Mini Projects must be done individually. Group projects are not permitted.

3. The project should involve fieldwork; online projects are not permitted.

4. Primary data collection is mandatory.

5. Field Project/ Mini Projects can be quantitative / qualitative in nature or even use mixed approaches.

6. Field Project/ Mini Projects can involve surveys, interviews, case studies, visits or observation studies.

7. For surveys, the sample size should be between more than or equal to100 participants.

8. For in-depth interviews (lasting at least 45-60 minutes), the sample size should be a minimum of 25 participants.

9. Total Hours of Effort Expected: 160 Hours, (This can be completed during the Semster, Saturdays, Sundays, Public holidyas, Winter vacation in between Sem-I and Sem-II)

B - 2] Permissible Partner Organizations:

Students have the flexibility to conduct their Field Project/ Mini Projects with any of the following organizations:

a) Companies listed on either NSE or BSE in India /abroad

b) Unlisted subsidiaries of Listed Companies.

c) Government / Semi-Government Undertaking / PSU

d) Government Offices

e) Consultancy Firms

f) Start Ups with an existence of 3 years or more and manpower more than 25.

g) Family managed businesses with an existence of 5 years or more and manpower more than 25.

h) Cooperative Societies

NOTE: Students can also carry out the Field Work without being associated to a specific organization. Such projects may involve quantitative / qualitative fieldwork related to

a) Contemporary issues of businesses

b) Specialization specific concepts

c) Local or regional concerns

d) Matters of national importance

B - 3] Linkage with specialization: The Field Project/ Mini Project topic must be aligned with the specialization chosen and specialization electives offered in Semester II.

It can address local, national, or global issues relevant to the specialization, as guided by the faculty guide / mentor.

B – 4] Selecting a Relevant Topic: Consider current trends, issues, or challenges within the domain / specialization across various business (industry) sectors when conducting their project.

B – 5] Identifying the Scope: Define the project's scope to ensure it is manageable within the given timeframe and resources. Set realistic expectations regarding the project's depth and breadth.

B – 6] Project Objectives - Clearly outline the objectives of your Field Project/ Mini Project.

B – 7] Project Planning and Proposal: Students shall define the scope and objectives of the specialization-specific Field Project/ Mini Project, develop a project proposal, and gain approval from the institute.

B –8] Reporting and Presentation: Prepare a professional report & presentation that outlines your project, methodology, findings, and recommendations as per the outline given below. Your report should be clear, well structured, visually appealing & the presentation must be delivered professionally

Presentation could be through any of the enlisted formats: (this is an indicative list and innovative formats if any beyond this list may be adopted) –

1. Traditional Slide Deck Presentation

2. Infographics

3. Video presentation

4. Paper presentation

5. Poster presentation

6. Webinar or online presentation

7. TED-style presentation

8. Storytelling Presentation etc

B – 10] Indicative break up of hours (160 hours)

1. 120 hours - On fieldwork (The Field Project/ Mini Project shall be spread throughout the second semester, can be start immediatly after Sem-I exam Winter vacation)

2. 40 hours – Pre and post-field work including proposal making, analysis, report writing, etc.

C] Field Project/ Mini Project Proposal Outline

The Field Project/ Mini Project proposal, ranging from three to five pages, outlines the development plan for the project. It includes one or two paragraphs for each of the following components:

1. Field Project/ Mini Project Introduction: Provide an overview of the project, including its context and scope.

2. Statement of the Problem: Clearly define the problem the project aims to address.

3. Purpose of the Project: Explain the main objectives and goals of the project.

4. Significance of the Project: Discuss the importance and potential impact of the project.

5. Plan for Developing / Executing the Project: Describe the approach and steps to be taken in developing / executing the project.

6. Review of the Literature: Include an initial literature review of one or two pages.

D] Field Project/ Mini Project Report Outline The Field Project/ Mini Project report includes the components mentioned below. 1. Title Page

2. Declaration by student

3. Acknowledgement by student

4. Certificate by the Guide on Institutional Letter Head

5. Certificate by the Partner Organization on Letter Head (if applicable)

6. Table of Contents

7. List of Tables (if needed)

8. List of Figures (if needed)

9. Abstract

D – 1] Chapter I - Introduction:

1. Statement of the Problem

2. Purpose /Objectives of the Project

3. Theoretical Framework

4. Significance of the Project

5. Definition of Terms (optional)

D-2] Chapter II - Review of the Literature:

1. Review the existing body of knowledge available on the problem or topic.

D -3] Chapter III Method:

1. Describes how the study was completed / conducted, including a specific description of subjects, procedures, equipment, materials, and other information pertinent to the study,

D-4] Chapter IV – Data Collection and Analysis:

1. Collecting relevant data from primary and secondary sources.

2. Analyzing data using appropriate analytical tools and techniques.

3. Justify your project with UML Diagrams.

D – 5] Chapter V – Results / Findings & Suggestions:

1. Identifying key issues, opportunities, trends etc. based on data analysis.

2. Develop / propose feasible solutions or recommendations.

3. Reflect on the experience, lessons learned, and scope for further work / improvement

D - 6] Annexures

1. Questionnaires

2. Observation Sheets

3. Field Maps

4. Exhibits

5. Geo Tagged Photos with Sample respondents

6. Any other relevant documents

E] Evaluation Pattern:

Total Marks: 150

Formative Assessment: 50 Marks

Summative Assessment: 100 Marks

E – 1] Formative Assessment Weightage (50 marks):

1. Project Proposal - 5 marks

2. Interim Progress review I / Report I - 5 marks

3. Final Project Report - 10 marks

4. Final Presentation (30 marks with break up as indicated below)

    a) Project Objectives - 5 marks

    b) Quality of Analysis and Research - 5 marks

    c) Problem Solving and Decision Making - 5 marks

    d) Innovation and Impact - 5 marks

e) Documentation and Reporting - 5 marks

f) Reflection - 5 marks

E – 2] Summative Assessment Weightage (100 marks):

1. There shall be a panel of 2 examiners for the Final Viva-Voce
2. University shall nominate External Examiners
3. Director shall nominate Internal Examiner
4. Presentation by each student along with a spiral bound report is mandatory
5. Students will deliver a 15 minutes presentation about their Field Project/ Mini Project.
6. The panel will evaluate the presentation for 50 marks and the viva-voce shall have a weightage of 50 marks.
7. The presentation & the External viva voce shall evaluate the Field Project/ Mini Project on:
    a. Project Objectives
    b. Quality of Analysis and Research
    c. Problem Solving and Decision Making
    d. Innovation and Impact
    e. Documentation and Reporting
    f. Reflection

ITH559MJ: Internet of Things		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Prerequisites		
Course Objectives 1. To Understand the definition and significance of the Internet of Things 2. Discuss the architecture, operation, and business benefits of an IoT solution 3. Examine the potential business opportunities that IoT can uncover 4. Explore the relationship between IoT, cloud computing, and big data		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	**Understand the vision of IoT from a global context.**
CO2	Remember, Understand, Analyze, Apply	**Understand the application of IoT.**
CO3	Remember, Create, Understand	**Determine the Market perspective of IoT.**
CO4	Remember, Understand, Analyze, Apply	**Use of Devices, Gateways and Data Management in IoT**
CO5	Remember, Create, Understand, Apply	**Building state of the art architecture in IoT**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Introduction to IoT**Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs	20	6
2	**IoT & M2M**Machine to Machine, Difference between IoT and M2M, Software define Network	20	6
3	**Network & Communication aspects**Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	20	6
4	**IoT Architecture -State of the Art –**Introduction, State of the art **Architecture Reference Model-** Introduction, Reference Model and architecture, IoT reference Model,**IoT Reference Architecture-** Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	20	6

5	**a.** Domain specific applications of IoT**Home automation, Industry applications, Surveillance applications, Other IoT applicationsb.**Internet of Things Privacy, Security and Governance **Introduction, Overview of Governance, Privacy and Security Issues**	20	6

Learning Resources

References Websites:

1. WPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann
4. Internet of Things : A hands- on Approach by ArshdeepBahga, Vijay Madisetti
5. IoT Programming: A Simple and Fast Way of Learning IOT by David Etter

TPB560MJ: Tableau & Power BI		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives 1. Learn how to use charts, graphs, and maps to create visually appealing dashboards 2. Install and use Tableau and Power BI. 3. Create different types of diagrams and charts, such as Maps, Bar-charts and more 4. Create calculated columns in Tableau and Power BI Desktop.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Connect to various data sources with Power BI & Tableau
CO2	Remember, Understand, Analyze, Apply	Clean and transform data with Power BI & Tableau
CO3	Remember, Create, Understand	Analyse data with Power BI & Tableau
CO4	Remember, Understand, Analyze, Apply	Create data visualization with Power BI & Tableau

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Introduction to Tableau, What is BI, Data Visualization, Tableau Files, Versions, Tableau Public Installation, Data Source Options All basic charts with formatting, Filters, Calculations	20	6
2	Relationships and Custom Charts & Dashboard Creation Parameters, Trend Lines, Forecasting, Reference Lines Actions in Dashboards	20	6
3	Getting started with Power BI: Introduction to Power BI Desktop understanding Power BI using Microsoft Gallery Installation of power BI and setting configuration under Option and settings Data loading and understanding Navigator frame. Connecting data from web for web scrapping	20	6
4	Analysis with Power BI: Introduction to visual interaction, Using world happiness report to present analysis, sing color format to represent more detailed visual, Understanding toolip	20	6
5	Power BI Desktop Visualizations: Colour and conditional formatting, Setting sort order, Scatter and bubble charts and play axis, Chart within chart, Slicers, timeline Slicers and sync Slicers, Visual, Page and Report level filters, Drill down/up, Hierarchies, Constant LinesRDBMS in power BI and intro to power BI web	20	6

Learning Resources

References Websites:

1. WPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann
4. Internet of Things : A hands- on Approach by ArshdeepBahga, Vijay Madisetti
5. IoT Programming: A Simple and Fast Way of Learning IOT by David Etter

BDA661MJ: Big Data Analytics		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives 1. Understand the Big Data Platform and its Use cases 2. Provide an overview of Apache Hadoop 3. Apply analytics on Structured, Unstructured Data. 4. Identify Big Data and its Business Implications		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing
CO2	Remember, Understand, Analyze, Apply	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce in big data analytics.
CO3	Remember, Create, Understand	Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
CO4	Remember, Understand, Analyze, Apply	Achieve adequate perspectives of big data analytics in various applications like recommender systems and social media applications.
CO5	Remember, Create, Understand, Apply	Evaluate and apply appropriate principles, techniques and theories to large-scale data science problems using various databases with analytics and visualizations.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	Big Data and Analytics: Introduction to Big Data, Big Data Characteristics, Types of BigData, Traditional Versus Big Data Approach, Technologies Availablefor Big Data, Infrastructure for Big Data, Use of Data Analytics, Big Data Challenges.	18	8
2	Data Collection, Sampling and Preprocessing: Types of Data Sources Sampling, Types of Data Elements ,VisuaData Exploration and Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data, Categorization, Weights of Evidence Coding, Variable Selection, Segmentation	18	8
3	Predictive Analytics, Descriptive Analytics & Survival Analysis: Predictive Analytics: Target Definition, Linear Regression, Logistic Regression, Decision Trees, Neural Networks, Support Vector Machines, Ensemble Methods, Multiclass Classification Techniques, Evaluating Predictive Models Descriptive Analytics: Association Rules, Sequence Rules, Segmentation Survival Analysis: Survival Analysis Measurements, Kaplan Meier Analysis, Parametric Survival Analysis, Proportional Hazards Regression, Extensions of Survival Analysis Models, Evaluating Survival Analysis Models	18	8
4	Introduction to Hadoop and Hadoop Architecture: Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization	18	8

5	HDFS, HIVE AND HIVEQL, HBASE: HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper	18	8

Learning Resources

References Websites:

1. Bart Baesens , Analytics in a Big Data World: The Essential Guide to DataScience and its Applications, ,Wiley, 2014

2. Xyz Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014.

3. Chuck Lam, Hadoop in Action, December, 2010.

4. Leskovec, Rajaraman, Ullman, Mining of Massive Datasets, CambridgeUniversity Press.

5. I.H. Witten and E. Frank, Data Mining: Practical Machine learning tools andtechniques.

Web material:

1. https://cognitiveclass.ai/

2. https://codelabs.developers.google.com/

BCO562MJ: Business Communication-II		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives 1. To encourage the all round development of students by focusing on softskills. 2. To make student aware about the importance, the role and the content of soft skills through instruction, knowledge acquisition, and practiceetc.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	**Face any challenges in Interviews**
CO2	Remember, Understand, Analyze, Apply	**To present themselves with proper way**
CO3	Remember, Create, Understand	**To expand their innovations**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Self Development and Assessment**Self-Assessment Self-Awareness, Perception and Attitudes Values and Belief System Personal Goal Setting Career Planning, Self-Esteem, Building of Self-Confidence	10	5
2	**Stress Management**Introduction, Stress Management Techniques (Games, Yoga, and Music Therapy), Emotional Quotient, Dealing With People, Failure, Issues (difference of opinions), Discrimination on the grounds of Ethnicity, Nationality, Gender, Sexual Orientation, Zero and No Tolerance Zones, Team Work, Creating and Maintaining Impression, Counseling, Motivation.	10	5
3	Predictive Analytics, Descriptive Analytics & Survival Analysis: Predictive Analytics: Target Definition, Linear Regression, Logistic Regression, Decision Trees, Neural Networks, Support Vector Machines, Ensemble Methods, Multiclass Classification Techniques, Evaluating Predictive Models Descriptive Analytics: Association Rules, Sequence Rules, Segmentation Survival Analysis: Survival Analysis Measurements, Kaplan Meier Analysis, Parametric Survival Analysis, Proportional Hazards Regression, Extensions of Survival Analysis Models, Evaluating Survival Analysis Models	18	8
4	Introduction to Hadoop and Hadoop Architecture: Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization	18	8
5	HDFS, HIVE AND HIVEQL, HBASE: HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper	18	8

Learning Resources

References Websites:

1. Bart Baesens , Analytics in a Big Data World: The Essential Guide to DataScience and its Applications, ,Wiley, 2014

2. Xyz Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014.

3. Chuck Lam, Hadoop in Action, December, 2010.

4. Leskovec, Rajaraman, Ullman, Mining of Massive Datasets, CambridgeUniversity Press.

5. I.H. Witten and E. Frank, Data Mining: Practical Machine learning tools andtechniques.

Web material:

1. https://cognitiveclass.ai/

2. https://codelabs.developers.google.com/

ACD563MJ: Advanced C & Data structure		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objectives 1. The fundamental design, analysis, and implementation of basic data structures.. 2. Basic concepts in the specification and analysis of programs. 3. Principles for good program design, especially the uses of data abstraction 4. Significance of algorithms in the computer field		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember, Understand	Understand the basic principles and operations of data structures.
CO2	Remember, Understand, Analyze, Apply	Apply Hashing, Disjoint sets and String Matching techniques for solving problems effectively.
CO3	Remember, Create, Understand	Apply the concepts of advanced Trees and Graphs for solving problems effectively.
	Remember, Analyse, Understand	Analyze the given scenario and choose appropriate Data Structure for solving problems.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**Weightage in %**	**No of Sessions**
1	Hashing – General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.	10	5
2	Priority Queues (Heaps) – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations. Binomial Queues: Binomial Queue Structure, Binomial Queue Operations, Implementation of Binomial Queue, Priority Queues in the Standard Library	10	5

3	Trees – AVL: Single Rotation, Double Rotation, B-Trees. Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion..	30	10
4	Graphs Algorithms – Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm.	30	10
5	Disjoint Sets – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm. String Matching – The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm..	10	10

Learning Resources

References Websites:

- Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.
- Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, 2009, The MIT Press.
- Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahani and Rajasekharam, 2nd Edition, 2009, University Press Pvt. Ltd.
- Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018.

LAD564MJ: Linux Administration		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**
Course Objective • To impart knowledge and skills on various practical and theoretical aspects of Linux operating system (OS) basics and Linux OS based server configuration, management and administration		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Implement file, user and group permission management in operating system environment
CO2	Remember, Understand, Analyze, Apply	Apply configuration files and parameters of DNS and web servers for different web services.

CO3	Remember, Create, Understand	Distinguish KVM and bare metal virtualization performance in Linux environment
	Remember, Analyse, Understand	Design RC & shell scripts to control core and booting system service (Create).

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Management of File using Command Line**Introduction to BASH, Command-line shortcuts, File Types, Ownership and Permissions, File management and manipulation, Moving users & its directories, Miscellaneous Tools, Editors	10	5
2	**Managing Users and Groups**Creating and managing user/s and group commands, User management Tools, Users and Access Permissions, Updating users and group attributes, PAM (Pluggable Authentication Modules).	10	5
3	**Booting and Shutting down**Boot Loaders, Theinit process, rc scripts, enabling and disabling services, Booting in recovery mode **File Systems**Makeup of file systems, Managing file systems, Adding a new disk, Volume Management, Creating file systems.	30	10
4	**Core System Services**The init Daemon, xinetd and inetd, The Logging Daemon, Configuring Logging Daemon, The CRON program **Compiling the Linux Kernel**Kernel concepts, Finding Kernel Source Code, Building the Kernel, Patching the Kernel	30	10
5	**Apache Web Server**HTTP Protocol, Installing Apache HTTP Server, Starting up and shutting down apache, Testing Apache Installation, Configuring Apache, Troubleshooting Apache **Virtualization**Virtualization Implementation, Kernel based Virtual Machines (KVM)	10	10

Learning Resources

References Websites:

1. E Steve Shah and Wale Soyinka " Linux Administration: A Begineer's Guide", 4th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN: 978-0072262599.
2. Susan Lauber, Philip Sweany, Rudolf Kastl and George Hacker, "REDHAT System Administration 1Student Work book", REDHAT Inc. 2014

ISA565MJ: Information System Audit		
Semester – II **LTP : 2:2:1**	**Credit: 02**	**Examination Scheme:** **Internal (TH)** : 50 Marks **Total :50 Marks**

Course Objective

1. To study basic concepts of Information System
2. To learn & understand the Threats in Information System Security.
3. To manage security treats in the Organization for their Information System.
4. . To get acquainted with the Physical Security, Network Security and Biometric Security.
5. To aware the various Information System Audits.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand	Distinguish different types of Information System with different approaches.
CO2	Remember, Understand, Analyze, Apply	Finding threats and applies the different tools and techniques in their Organizational Information System.
CO3	Remember, Create, Understand	Recognize and describe Information security best practices.
CO4	Remember, Analyse, Understand	To analyze Security models, frameworks and standards in their Organizational Information System.
CO5	Remember, Understand, Analyze, Apply	Apply Privacy Fundamentals, business practices' in different Information System Services.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	Weightage in %	No of Sessions
1	**Global information systems** and their evolution, basics of information systems, role of the Internet and the World Wide Web. Understanding about the threats to information systems security Building blocks of InfoSec, How Organizations manage security of theirinformation systems	10	5
2	**Information Security Management in Organizations** Information Security Management (ISM), Security Policy, Standards, Guidelines & Procedures ISMS. The 3 pillars CIA of Information Security Information Classification. Risk Analysis & Management, Security considerations for the mobile work force.	10	5

	Cryptographic techniques and Encryption, Intrusion Detection Systems and Firewalls, security of virtual private networks		
3	**Security models and frameworks :**A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model. introduction to the ISO 27001, SSE-CMM (systems security engineering - capability maturity model), COBIT (Control Objectives for Information and related technologies) and the SarbanesOxley Act(SOX) and SAS 70 (statement on auditing standards)	30	10
4	**Information security best practices** :Privacy Fundamentals, business practices' impact on data privacy, technological impact on data privacy, privacy issues in web services and applications based on web services. Staffing, audits, disaster recovery planning and business continuity planning and asset Management. Ethical issues and intellectual property concerns for information security professionals - copy right, data protection etc. matters	30	10
5	**Auditing for Security** Security Audits what are they? Need for Security audits in organizations Auditors responsibility in Security audits Types of Audits & approaches to Audits. Technology based Audits – vulnerability scanning and penetration testing. Resistance to Audits. Key success factors for Security Audits	10	10

Learning Resources

References Websites:

1. Information security policies, procedures and standards by ThomasPettier.
2. Information security Management Hand book- 5th Edition-HAROLD F.TIPTON
3. Computer security by Alfred Basta, Wolf Halton
4. Information security policies- Thomas R.Peltier, Peltier R.Peltier
5. Electronic Signature law by LPadmavathi
6. Network Security by AnkitFadia
7. Security Plus study guide by Michael Cross, NorrrisJohnson
8. Information systems control and Audit by Ron Weber, PearsonPub.
9. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : NinaGobole
10. Information Security policies made easy version 10: Charles Cresson Wood

SEMESTER - III

Generic Core (GC) - Compulsory

SPM601MJ: Software Project Management		
Semester – III **Sem Code: 301** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH): 50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**

Course Objectives

- To understand different aspects of Software Project Management as an important field of practice under IT Management.
- To understand some problems and concerns of software project managers.
- To explain the main elements of the role of management.
- To learn process of software project management, cost estimation, tools and techniques of Software Project Management and configuration management
- To understand importance of, and learning techniques to ensure software quality.
- To learn to use a Software Package for Software Project Management

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Understand the scope of Software Project management
CO2	Understand	Aware distinguish between software and other types of development project.
CO3	Analyze	Escalates the need for careful planning, monitoring and control
CO4	Apply	Identify the stakeholders of a project and their objectives and ways of defining the success in meeting those objectives.
CO5	Remember, Understand	Make students aware with the changes in technologies, applications and systems around us

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Software Project Management** Software Projects Vs. Other Projects Contract Management and Technical Project Management Activities under technical project management Plans, Methods and Methodology Stakeholders Role of - Project Manager, Team members, Client & Users in project management	6
2	**Project Planning, Evaluation and Program Management** Steps in Project Planning and Project Evaluation Strategic and Technical Assessment Cost Benefit Analysis Cash Flow Forecasting Process Models and Prototyping Dynamic Systems Development	**6**

	Extreme Programming2.8 Managing Iterative Processes.	
3	**Software Effort Estimation** Estimation Techniques, Expert Judgment and Analogy. Function Point Analysis – Object Points, Procedural Codes COCOMO Model Activity Planning, Delphi Technique. Project Schedules – Sequencing and Scheduling – Using Gantt Chart Network Planning – Using PERT and CPM for activity planning – Forward Pass – Backward Pass Activity-on-arrow networks Managing Contracts	**7**
4	**Risk Management in Software Projects** Nature and Types of risk Managing risks – Risk Analysis, Planning, Process and Control Strategies for risk reduction, Risk Closure. PERT as a tool of Risk Management Resource Monitoring and Control Creating Control Framework and Reporting for Control	**6**
5	**Software Quality Management & Control, Quality Assurance & Standards:** The SEI Capability Maturity Model CMM; Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, Quality assurance & Validation plan (SQA Activities , reviews, walkthroughs, inspection, testing) Automation to improve Quality in testing Defect Management Configuration management & Maintenance plan Change Management Version and Release Management Configuration Management Tools	**8**

Learning Resources

References:

- Software Project Management, 5th Edition, Hughes, Cotterel, Rajib Mall, Tata McGraw
- Hill
- Software engineering principles and practice, McGraw-Hill, Waman S. Javadekar
- Effective software project management, Willy india edition, Robert K. Wysocki
- Software quality, producing practical, consistent software, Mordechai Ben-Menachem
- Software project management in practice, Pearson, PankajJalote
- Software testing and quality assurance , Theory and practice, Willy-India edition, KshirsagarNaik
- Software project management, A Concise Study, S. A. Kelakar.
- Software Project management in practice by PankajJalote
- Software project management by Rajendra Mishra
- Step by Step - Microsoft Project 2013 (Paperback, Carl Chatfield, Timothy Johnson)
- Planning and Control Using Microsoft Project and PRINCE2, by Paul E. Harris

Website Links:

- https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/
- https://www.smartsheet.com/content/software-project-management?srsltid=AfmBOorMTFkoYeoMKYLbhnE-m5TlktgQZ-yC7k3dzq927GR1OetN_GaP
- https://www.javatpoint.com/software-project-management

SPECIALIZATION CORE COURSES (SC) -Compulsory

CLOUD COMPUTING

CIS602MJ: –Cloud Infrastructure and services		
Semester – III **Sem Code: 302** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH): 50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**
Course Objectives • To understand the fundamental concepts of cloud computing, including infrastructure and service models • To explore various cloud deployment models such as public, private, and hybrid clouds. • To examine cloud services including IaaS, PaaS, and SaaS, and their applications in business. • To analyze the challenges and best practices in implementing and managing cloud infrastructure. • To evaluate security, privacy, and regulatory issues related to cloud computing.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Recall the key concepts, models, and types of cloud computing and infrastructure.
CO2	Understand	Explain the differences between cloud service models (IaaS, PaaS, SaaS) and their applications.
CO3	Apply	Apply cloud computing concepts to design and deploy cloud infrastructure solutions.
CO4	Analyze	Analyze the challenges of cloud security, privacy, and compliance and propose mitigation strategies.
CO5	Evaluate	Evaluate the performance, security, and scalability of cloud services and infrastructure.
CO6	Create	Design and implement effective cloud infrastructure and management strategies for businesses

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction** **Cloud Computing Concepts**: Definition, characteristics, and benefits of cloud computing. **Cloud Computing Models**: IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service). **Cloud Deployment Models**: Public, Private, Hybrid, and Community Clouds. **Cloud Architecture**: Components of cloud infrastructure, including virtualized environments, storage, and networking	7
2	**Cloud Service Models** **IaaS (Infrastructure as a Service)**: Virtual machines, storage, and networking in cloud environments. **PaaS (Platform as a Service)**: Development platforms and tools offered by cloud providers. **SaaS (Software as a Service)**: Application-level services and their integration in businesses. **Comparison of IaaS, PaaS, and SaaS**: Benefits and challenges of each model.	6
3	**Cloud Infrastructure and Virtualization** **Virtualization Technologies**: Hypervisors, Virtual Machines, Containers. **Cloud Storage Models**: Block storage, object storage, and file storage. **Cloud Networking**: Virtual networks, SDN (Software-Defined Networking), and network virtualization. **Resource Allocation and Management**: Auto-scaling, load balancing, and orchestration tools.	6
4	**Cloud Security and Privacy** **Cloud Security Issues**: Data breaches, security risks in multi-tenant environments. **Encryption and Authentication in Cloud**: Protecting data confidentiality and integrity. **Privacy Concerns**: Compliance with regulations like GDPR, data sovereignty issues. **Best Practices for Cloud Security**: Identity management, firewalls, and access controls	7
5	**Cloud Service Management and Future Trends** **Cloud Service Management**: Monitoring, scaling, and managing cloud services. **Cost Management in the Cloud**: Pricing models, budgeting, and optimization of cloud resources. **Emerging Trends in Cloud Computing**: Edge computing, serverless computing, AI integration in cloud services. **The Future of Cloud Infrastructure**: Innovations and trends shaping the future of cloud services.	7

Learning Resources

References

- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini.
- "Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski.
- "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis.
- "Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti.

SPECIALIZATION ELECTIVE COURSES (SE)

SEMESTER III

(Any 4 to be Opted for)

CLOUD COMPUTING

BNE604MJ: Basics of Networking		
Semester – III **Sem Code: 304** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: **50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**
Course Objectives • To understand Networking Concepts and Terminology: • To learn the Architecture of Networks: • To explore the Integration of Networking with Business Applications: • To develop Networking Configuration Skills:		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Students will be able to define and explain core networking concepts, including IP addressing, network topologies,
CO2	Understand,	Students will acquire the skills to set up, configure, and troubleshoot basic network components
CO3	Analyze	Students will be able to design efficient network infrastructures by applying concepts of IP addressing, subnetting
CO4	Understand, Apply	Students will demonstrate the ability to leverage networking knowledge for informed decision-making in business management, ensuring alignment with technological advancements and organizational goals

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Basic Theory Types of Networks** Peer-Peer Networks, Client/Server Networks, Host Terminal Network, Wireless Network Wi-Fi Network, Virtual Private Network, Internet Intranet Topologies us, Star, Ring, Mesh, Hybrid and Wireless loop	6
2	**Protocols Network Protocols** - TCP/IP (IP4 & IP6) SPX/IPX, NETBEUI, Tunneling Protocols PPTP, L2TP,IP,SEC Application Protocols-FTP,	7

	TELNET, HTTP, HTTPS SPX/IPX, NETBEUI, Tunneling Protocols PPTP, L2TP,IP,SEC Mail Protocols- SMTP,POP,IMAP Frame Formats & Standards – Ethernet 802.2,802.3, Wireless 802.11a, 802.11g	
3	**Network Components Connectivity Components** Connectors RG45, Cables CAT 5, CAT 5E, CAT 6, Ethernet Cards, Switches, Routers Modems- Dial-up Modem , ISDN Modem, DSL(Cable) Modem Using Ethernet Card for Accessing Internet, Wi-Fi Access Adapter	6
4	**Microsoft Windows Server 2022** Overview of Windows Server 2022 Features: New features and improvements in Windows Server 2022, including enhanced security, container support, improved performance, and scalability for enterprise networks. Active Directory (AD) Roles: Explore the different Active Directory roles in Windows Server 2022 Concept of Domains and Directory Domain Services Manage Users and Service Accounts Manage Groups and Group Policies Manage Computer Accounts	8
5	**Installing Windows Server 2022** Windows Server 2022 Installation, Creating Windows Partitions: Installing Active Directory **Active Directory Installation:** Install and configure **Active Directory Domain Services (AD DS)** role on a Windows Server 2022 machine, including promotion to a domain controller. Installing DHCP Server **DHCP Server Installation and Configuration:** Install and configure the **DHCP (Dynamic Host Configuration Protocol)** server role to assign IP addresses dynamically to devices on the network.	8

Learning Resources

References:

- Mastering Windows Server 2022" by Mark Minasi, et al.
- Learn Windows Server Administration" by **Shivendra Kumar**
- Windows Server 2022 Networking" by Craig Zacker
- Windows Server 2022 for Beginners: A Comprehensive Guide to Install, Configure, and Manage Your Server by J. L. Chandler

Website Links:

- https://www.geeksforgeeks.org/
- https://learn.microsoft.com/en-us/windows-server/
- https://www.tutorialspoint.com/index.htm
- https://networklessons.com/
- https://www.freecodecamp.org/

NSE605MJ: Network Security		
Semester – III **Sem Code: 305** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: **50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**

Course Objectives

- To introduce the fundamental concepts of **network security** and its importance in the modern digital business environment.
- to provide an understanding of **cyber threats** and defense strategies.
- To familiarize students with security protocols, tools, and best practices for securing networks.
- To prepare students for real-world network security challenges in enterprise environments.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember, Understand	Understand core concepts in **network security** and the importance of securing organizational networks.
CO2	Remember	Identify various **network threats** and vulnerabilities, and implement preventive measures.
CO3	Analyze, Apply	Configure and manage network security solutions such as **firewalls**, **VPNs**, and **intrusion detection/prevention systems**.
CO4	Create	Develop strategies for maintaining **data integrity**, **confidentiality**, and **availability** in an organization's network
CO5	Apply	Apply knowledge of network security in securing business operations and data, preparing them for leadership roles in IT security

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Network Security** Overview of Network Security and its importance in the digital business world. Cybersecurity Trends and the role of IT professionals in business organizations. Key Security Goals: Confidentiality, Integrity, Availability (CIA Triad). Types of Attacks: External and Internal threats, Malware, Phishing, Denial-of-Service (DoS). Basic Network Security Concepts: Firewalls, VPNs, and Encryption.	7
2	**Network Security Architecture** Network Security Design principles. Defense in Depth: Multi-layered security strategy. Introduction to Perimeter Security and Network Segmentation. Security Zones: DMZ, trusted, untrusted, and semi-trusted zones. Securing network devices: Routers, switches, and firewalls.	6

3	**Cryptography and Encryption Techniques** Basic principles of Cryptography. Encryption Algorithms: Symmetric vs. Asymmetric encryption. Introduction to Public Key Infrastructure (PKI). SSL/TLS protocols for secure communication. Digital Signatures and their role in network security. Case Study: Encryption in E-commerce.	7
4	**Authentication and Access Control** Authentication methods: Password-based, biometric, multifactor authentication (MFA). Authorization and Access Control Models: Role-based access control (RBAC), Mandatory access control (MAC), Discretionary access control (DAC). Access Control Lists (ACLs). Identity and Access Management (IAM) systems. Case Study: Single Sign-On (SSO) and its business applications.	8
5	**Firewalls and Intrusion Detection Systems (IDS)** Firewalls: Types of firewalls (Packet-filtering, Stateful, Proxy, Next-gen firewalls). Configuring Firewall Rules and policies. Intrusion Detection Systems (IDS): Types (Signature-based, Anomaly-based). Intrusion Prevention Systems (IPS): Difference between IDS and IPS. Case Study: Real-world Firewall Implementation in enterprise networks.	7

Learning Resources

References:

- Network Security Essentials by William Stallings
- Principles of Information Security by Michael E. Whitman & Herbert J. Mattord
- Cryptography and Network Security by William Stallings
- Network Security: Private Communication in a Public World by Charlie Kaufman, Radia Perlman, and Mike Speciner
- Computer Security: Principles and Practice by William Stallings and Lawrie Brown
- Network Security Bible by Eric Cole

Weblinks

- https://www.geeksforgeeks.org/network-security/
- https://www.javatpoint.com/computer-network-tutorial
- https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
- https://learn.microsoft.com/en-us/training/
- https://www.khanacademy.org/computing/computer-science

SDT606MJ: Server & Desktop Technology		
Semester – III **Sem Code: 306** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: **50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**

Course Objectives

- To understand the core features and functionalities of Windows Server 2022.
- To gain hands-on experience in managing server infrastructure, active directory, DNS, DHCP, and Group Policy.
- To configure and manage Windows Server 2022 for networking, security, and server performance.
- To explore and implement desktop deployment technologies such as Windows Virtual Desktop (WVD) and remote desktop services (RDS).
- To prepare students for real-world applications and management of IT infrastructure in a business environment.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Understand, Apply	Install and configure **Windows Server 2022** and its various roles (AD DS, DNS, DHCP, etc.).
CO2	Analyze, Apply	Implement and manage **Active Directory**, **user management**, and **Group Policy**
CO3	Remember, Apply	Configure and manage **DNS**, **DHCP**, and **Remote Desktop Services**
CO4	Analyze, Apply	Use **PowerShell** and other administrative tools for system administration and automation tasks

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Windows Server 2022** Overview of Windows Server 2022: Features and benefits. Windows Server Editions: Datacenter, Standard, and Essentials. Server Installation: Methods (GUI, Server Core, Nano Server), System requirements, Licensing. Introduction to Server Manager and Windows Admin Center. Windows Update Services (WSUS) and patch management**.**	6

2	**Windows Server Installation and Configuration** Installing Windows Server 2022: Step-by-step installation. Partitioning and formatting the system disk. Initial server configuration: Network settings, computer name, and domain settings. Configuring IP addresses and network settings using Netsh and PowerShell. Basic Server Configuration: Time Zone, Language settings, Windows updates	9
3	**Active Directory Domain Services (AD DS)** Introduction to Active Directory (AD): AD concepts and components. Installing Active Directory Domain Services (AD DS). Configuring and managing domain controllers, organizational units, and domain trusts. User and Group management: Creating, modifying, and deleting users and groups. Configuring Group Policy to manage user and computer settings.	7
4	**Managing and Securing User Accounts** Active Directory Users and Computers (ADUC). Managing service accounts, user profiles, and password policies. Group Policies: Implementing security policies, user restrictions, and software restrictions. Introduction to Multi-Factor Authentication (MFA). Securing user credentials using Windows Defender.	6
5	**DNS and DHCP Configuration** Domain Name System (DNS): Role of DNS in a Windows environment, managing zones and records. Installing and configuring DNS Server. Troubleshooting DNS issues with nslookup and other tools. Dynamic Host Configuration Protocol (DHCP): DHCP Server role, scope, leases, and reservation. Configuring DHCP with DHCP Failover for high availability.	8

Learning Resources

References:

- Windows Server 2019 & 2022: Administration and Configuration, by **M. A. K. Kabeer,** Publisher: **BPB Publications**
- Networking Essentials: Windows Server 2019, by **M.S. Sreevidya,** Publisher: **Laxmi Publications**
- Windows Server 2022: The Complete Guide to Installing, Configuring, and Managing Windows Server 2022, by **Alex Blokhin,** Publisher: **Apress**
- Configuring Windows Server 2022, by Mike Halsey, Publisher: Packt Publishing

Web links

- https://learn.microsoft.com/en-us/windows-server/
- https://techcommunity.microsoft.com/t5/windows-server-2022/
- https://www.geeksforgeeks.org/
- https://www.youtube.com/results?search_query=windows+server+2022+tutorial
- https://www.linkedin.com/learning/topics/windows-server

CST607MJ: – Cloud Storage		
Semester – III **Sem Code: 307** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: **50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**

Course Objectives

- **To understand the fundamental concepts of cloud storage systems** and how they differ from traditional storage.
- **To examine various cloud storage models**, including public, private, and hybrid clouds.
- **To implement and manage cloud storage platforms**, including configuration, monitoring, and maintenance.
- **To explore the integration of cloud storage in real-world applications** such as data backup, disaster recovery, and big data management.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Define key concepts such as cloud storage, cloud providers, and storage models
CO2	Understand	Explain how cloud storage systems work and their advantages over traditional storage.
CO3	Apply	Implement a cloud storage solution on at least one major cloud platform (AWS, Google Cloud, or Azure).
CO4	Analyze	Compare different cloud storage models and their trade-offs in terms of scalability, cost, and performance.
CO5	Evaluate	Assess the security and privacy challenges associated with cloud storage systems.
CO6	Create	Integrate cloud storage with other cloud-based services such as computing and big data analytics

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud Storage** Definition of Cloud Storage Historical context and evolution of cloud storage Benefits and challenges of cloud storage systems Cloud service models (IaaS, PaaS, SaaS) Overview of major cloud providers (AWS, Google Cloud, Microsoft Azure)	7
2	**Cloud Storage Architecture** Overview of cloud storage architecture (block, object, file storage) Storage virtualization and distributed file systems Cloud storage protocols (REST, NFS, SMB, etc.) Cloud storage data consistency models	7
3	**Cloud Storage Management and Deployment**	8

	Storage provisioning and management Tools for managing cloud storage (e.g., AWS S3, Azure Blob Storage) Configuring cloud storage for high availability Implementing data backup, recovery, and redundancy Strategies	
4	**Cloud Security and Privacy in Storage** Cloud storage security risks and mitigation strategies Data encryption, authentication, and access control Regulatory compliance (e.g., GDPR, HIPAA) in cloud storage Security best practices for cloud storage providers and Users	7
5	**Performance and Scalability in Cloud Storage** Performance metrics for cloud storage systems Scaling cloud storage (horizontal vs vertical scaling) Cost optimization strategies Optimizing storage performance in multi-cloud environments	6

Learning Resources

References:

- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
- "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and
- IaaS)" by Michael J. Kavis
- "Cloud Storage Forensics" by Darren Quick
- "Cloud Storage Forensics" by Darren Quick
- "Cloud Security and Privacy" by Tim Mather, Subra Kumaraswamy, and Shahed Latif

Web links

- https://aws.amazon.com/s3/
- Google Cloud Storage Documentation
- https://learn.microsoft.com/en-us/training/
- Cloud Computing Online Course - Hands-on Labs & Projects

CCW608MJ: – Cloud computing with AWS		
Semester – III **Sem Code: 308** **LTP : 2:2:1**	**Subjective Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH): 50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**
Course Objectives • To introduce AWS and its cloud computing services, and the different deployment models within AWS • To explore the key AWS services for compute, storage, and database management • To understand the fundamental principles of AWS security and networking • To learn about AWS management and monitoring tools for effective cloud operations.		

- To implement and manage applications and workloads using AWS cloud services and platforms

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the core AWS services, deployment models, and their basic functionalities..
CO2	Understand	Explain AWS services, their applications, and usage within cloud environments.
CO3	Apply	Implement cloud-based solutions using AWS services like EC2, S3, Lambda, and RDS.
CO4	Analyze	Analyze the integration of AWS cloud services to design scalable, cost-efficient solutions.
CO5	Evaluate	Evaluate the security, cost, and performance implications of using AWS cloud computing solutions.
CO6	Create	Design and deploy cloud-based applications and infrastructure using AWS tools and techniques.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to AWS Cloud Computing** **Overview of Cloud Computing and AWS**: Introduction to cloud models (IaaS, PaaS, SaaS) and AWS fundamentals. **AWS Global Infrastructure**: Regions, availability zones, and edge locations. **AWS Deployment Models**: Public, private, hybrid clouds, and how AWS fits into these models. **AWS Console and CLI**: Introduction to AWS management console and AWS Command Line Interface	8
2	**AWS Core Services** **Compute Services**: EC2, Lambda, Auto Scaling, Elastic Load Balancing (ELB). **Storage Services**: S3, Elastic Block Store (EBS), Glacier, Elastic File System (EFS). **Database Services**: RDS, DynamoDB, Aurora, Redshift. **Networking Services**: VPC, Route 53, API Gateway, Direct Connect.	7
3	**AWS Security and Identity Management** **AWS Identity and Access Management (IAM)**: User policies, roles, and permissions. **AWS Security Best Practices**: Securing AWS resources, VPC security groups, and Network Access Control Lists (NACLs). **Encryption in AWS**: Data encryption at rest and in transit	8

	using AWS services like KMS and CloudHSM. **Multi-Factor Authentication (MFA)**: Implementing MFA for enhanced security	
4	**AWS Management and Monitoring Tools** **CloudWatch**: Monitoring AWS resources and applications. **AWS CloudTrail**: Tracking and auditing AWS service usage. **AWS Trusted Advisor**: Best practices for cost optimization, security, performance, and fault tolerance. **AWS Systems Manager**: Automated operational tasks like patch management, resource configuration.	7
5	**AWS Cost Management and Optimization** **Cost Estimation and Budgeting**: Using AWS Pricing Calculator and cost explorer to estimate expenses. **Cost Optimization**: Reserved Instances, Spot Instances, and Savings Plans. **Billing and Account Management**: AWS Billing Dashboard, consolidated billing, and cost management. **Cost Efficiency Best Practices**: Techniques for optimizing AWS costs across services	6

Learning Resources

References:

- "AWS Certified Solutions Architect Official Study Guide: Associate Exam" by Joe Baron, Hisham Baz, Tim Bixler, et al.
- "Amazon Web Services in Action" by Michael Wittig and Andreas Wittig.
- "Architecting Cloud Computing Solutions" by Kevin L. Jackson and Scott Goessling.

Web Links

- AWS Training and Certification
- AWS Documentation
- AWS Online Labs
- AWS Well-Architected Framework
- AWS Blog

CRM609MJ : – Cloud Risk Management		
Semester – III **Sem Code: 309** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To understand the concept of risk management in the context of cloud computing. • To identify and assess various risks associated with cloud adoption and operation. • To explore risk mitigation strategies and techniques for cloud environments. • To learn about compliance, legal, and regulatory issues in cloud computing. • To develop a framework for managing cloud risks effectively and efficiently.		

- To examine the role of security, privacy, and governance in cloud risk management.

.**Course Outcomes**

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the fundamental concepts of cloud risk management, including common risks and mitigation approaches.
CO2	Understand	Understand the various types of risks associated with cloud adoption, including security, compliance, and operational risks
CO3	Apply	Apply risk assessment models to evaluate risks in cloud environments.
CO4	Analyze	Analyze the effectiveness of risk mitigation strategies and security protocols used in cloud computing.
CO5	Evaluate	Evaluate the legal, regulatory, and compliance requirements for cloud environments, including GDPR, HIPAA, and others.
CO6	Create	Design and implement a risk management plan for cloud-based systems, ensuring appropriate security, compliance, and governance.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud Risk management** **Concept of Risk Management**: Overview of risk management in the cloud computing context. **Types of Cloud Risks**: Security, compliance, financial, operational, and performance risks. **Cloud Risk Lifecycle**: Identification, assessment, mitigation, monitoring, and review. **Key Challenges in Cloud Risk Management**: Managing complex, distributed systems and evolving threats.	7
2	**Risk Identification and Assessment** **Risk Identification Techniques**: Tools and methods for identifying potential risks in cloud environments. **Risk Assessment Frameworks**: Qualitative vs quantitative risk assessment methods. **Threat Modeling**: Approaches to identify and assess threats in cloud systems. **Vulnerability and Impact Analysis**: Evaluating the impact of various risks on cloud services and operations.	6
3	**Cloud Security and Privacy Risks**	8

	Security Risks in Cloud Computing: Data breaches, account hijacking, insecure APIs, and insider threats. **Privacy Risks**: Data loss, unauthorized access, compliance with privacy laws. **Cloud Security Frameworks**: Best practices for securing cloud environments (e.g., NIST, ISO 27001). **Risk Mitigation Techniques**: Encryption, access control, firewalls, and security monitoring tools	
4	**Compliance and Legal Risks** **Compliance Challenges**: Ensuring compliance with regulations like GDPR, HIPAA, SOC 2, and PCI DSS. **Legal Implications of Cloud Adoption**: Intellectual property, data sovereignty, and data localization issues. **Contractual Agreements and SLAs**: Understanding Service Level Agreements and contracts in cloud environments.**Audit and Governance**: Ensuring compliance through regular audits and monitoring.	7
5	**Cloud Risk Mitigation Strategies** **Risk Mitigation Techniques**: Approaches to reduce and manage risks in cloud deployments. **Business Continuity and Disaster Recovery**: Planning for downtime, data loss, and operational failures. **Backup Strategies**: Cloud-based backup solutions and data recovery methods. **Third-party Risk Management**: Evaluating the risks from cloud service providers and third-party integrations.	7

Learning Resources

References

- "Cloud Risk Management: A Practitioner's Guide" by Ben Halpert
- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
- "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif

Web Links

- Cloud Security Alliance (CSA) - Risk Management
- NIST Cloud Computing Risk Management
- AWS Well-Architected Framework – Security

CSP610MJ: Cloud Security and Privacy		
Semester – III **Sem Code: 310** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To understand the concepts of cloud security and privacy in the context of cloud computing. • To explore various security mechanisms and best practices in cloud environments.		

- To examine privacy concerns and regulatory compliance in cloud services.
- To develop strategies for securing cloud infrastructure, applications, and data.
- To analyze the security risks and challenges associated with cloud computing, including data breaches and insider threats.
- To design and implement security policies and privacy strategies for cloud-based systems

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the fundamental concepts of cloud security and privacy, including risks, challenges, and security controls.
CO2	Understand	Understand the importance of cloud security and privacy policies and frameworks in securing cloud-based systems.
CO3	Apply	Apply security techniques, including encryption, access control, and authentication, to secure cloud environments.
CO4	Analyze	Analyze privacy laws and regulations that affect cloud services, such as GDPR, HIPAA, and others.
CO5	Evaluate	Evaluate cloud security and privacy risks and design effective mitigation strategies
CO6	Create	Create cloud security policies and privacy frameworks tailored to organizational needs

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud Security and Privacy** **Concept of Cloud Security**: Overview of security challenges and threats in cloud computing. **Cloud Computing Model and Security**: Public, private, and hybrid cloud security considerations. **Security Goals in the Cloud**: Confidentiality, integrity, availability, and accountability. **Privacy in the Cloud**: Challenges in managing personal and sensitive data in cloud environments.	8
2	**Cloud Security Threats and Risks** **Types of Security Threats**: Data breaches, DDoS attacks, account hijacking, and insider threats. **Security Risks in Different Cloud Models**: Risks associated with IaaS, PaaS, and SaaS. **Cloud Security Vulnerabilities**: Weaknesses in cloud infrastructure, application layers,	6

	and network security. **Cloud Provider Security and Risk Management**: Responsibilities of cloud providers and customers.	
3	**Encryption in the Cloud**: Encryption techniques for data at rest, in transit, and during processing. **Access Control Models**: Role-based access control (RBAC), attribute-based access control (ABAC). **Authentication Mechanisms**: Multi-factor authentication, federated identity management. **Firewalls and Intrusion Detection Systems (IDS)**: Security tools for cloud environments.	8
4	**Cloud Privacy Regulations and Compliance** **Regulatory Compliance in Cloud Computing**: GDPR, HIPAA, PCI DSS, and other standards. **Data Sovereignty**: Understanding data localization laws and their impact on cloud deployments. **Privacy by Design**: Incorporating privacy protections into cloud architecture from the outset. **Auditing and Reporting**: Tools and practices for ensuring compliance and security in cloud systems.	7
5	**Cloud Security Best Practices** **Security Best Practices for Cloud Adoption**: Risk assessment, continuous monitoring, and incident response. **Cloud Security Policies**: Developing and implementing security policies for cloud environments. **Security Audits and Penetration Testing**: Methods for testing and improving cloud security. **Data Backup and Disaster Recovery**: Ensuring data protection and business continuity in cloud environments.	6

Learning Resources

References

- "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif
- "Cloud Security: A Comprehensive Guide to Secure Cloud Computing" by Ronald L. Krutz and Russell Dean Vines
- "Cloud Computing Security Issues and Challenges: A Survey" by Ruan Y. Zhang

Web Links

- Cloud Security Alliance (CSA)
- NIST Cloud Security Guide
- AWS Security Best Practices
- OWASP Cloud-Native Application Security Top 10
- General Data Protection Regulation (GDPR)

CCU611MJ: – Cloud Computing Using Azure		
Semester – III **Sem Code: 311** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To u**nderstand the fundamentals of cloud computing** and Azure's role in the cloud ecosystem.
- **To learn to deploy, manage, and monitor applications** and services in the Azure environment
- **To examine Azure infrastructure services**, including virtual machines, networks, and storage
- **To implement security and compliance strategies** for applications and data in Azure.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Identify different Azure services and tools.
CO2	Understand	Explain the benefits and challenges of cloud computing using Azure.
CO3	Apply	Use Azure Portal and Azure CLI to manage cloud resources.
CO4	Analyze	Compare different Azure services and solutions based on use cases.
CO5	Evaluate	Assess the scalability and performance of applications deployed on Azure
CO6	Create	Design and deploy a cloud-based application in Azure that meets real-world requirements.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Cloud Computing and Azure** Overview of cloud computing and Azure. Cloud service models: IaaS, PaaS, SaaS. Azure architecture and core components. Azure subscriptions and management tools (Azure Portal, CLI, PowerShell)	6
2	**Azure Virtual Machines (VMs) and Networking** Creating and configuring Azure Virtual Machines. Managing virtual networks in Azure. Virtual Machine sizing and optimization. Load balancing and network security groups. Azure VPN and ExpressRoute	7
3	**Azure Storage Solutions** Introduction to Azure storage services (Blob, File, Table, Queue). Configuring and managing Azure Storage Accounts. Azure Blob Storage and Azure Files for cloud storage solutions. Data redundancy and backup	8

	strategies in Azure. Introduction to Azure Content Delivery Network (CDN)	
4	**Azure Identity and Security Management** Azure Active Directory (AAD) and its components. Role-Based Access Control (RBAC). Azure Security Center and Azure Policy. Implementing identity and access management. Azure Security best practices.	7
5	**Azure App Services and Functions** Overview of Azure App Services for web app hosting. Azure Functions for serverless computing. Deploying and scaling web applications. Introduction to Azure DevOps for continuous integration and deployment (CI/CD).	7

Learning Resources

References:

- "Microsoft Azure Essentials" by Michael S. Collier and Robin E. Shahan
- "Exam Ref AZ-900 Microsoft Azure Fundamentals" by Jim Cheshire
- "Cloud Computing with Microsoft Azure" by Sachin K. Goyal and Sandeep Soni
- "Microsoft Azure Architect Technologies and Design Solutions" by Scott D. Lowe, Brian L. M. May

Web links

- https://learn.microsoft.com/en-us/azure/?product=popular
- Microsoft Azure Essentials
- https://github.com/Azure
- https://techcommunity.microsoft.com/category/Azure

SPECIALIZATION CORE COURSES (SC) -Compulsory

FULL STACK DEVELOPMENT

PPR602MJ - 01: Python Programming		
Semester – III **Sem Code: 302** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To introduce students to Python programming concepts. • To develop problem-solving skills using Python. • To equip students with skills to use Python in business-related applications (data analysis, automation, etc.). • To enable students to design and implement simple software systems and applications using Python. • To familiarize students with libraries and tools in Python used for data processing and business analytics.		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Recall the basic syntax and structure of Python programming
CO2	Understand	Understand how to read and write data from/to files.
CO3	Apply	Design and implement Python classes and objects for real-world scenarios.
CO4	Analyze	Write simple Python programs for data input and output
CO5	Evaluate	Visualize data using Python libraries
CO6	Create	Write small real world applications

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics**	**No. of sessions**
1	**Introduction to Python** Overview of Python and its applications. Setting up Python environment (installation of Python, IDEs like PyCharm, Jupyter Notebook, etc.). Basics of Python syntax and structure. Variables and Data types (Strings, Integers, Floats, Lists, Tuples, Sets, and Dictionaries). Input and Output functions. Basic operators (Arithmetic, Logical, Comparison).	6

2	**Control Flow and Functions** Conditional statements (if, elif, else). Loops (for, while). Functions in Python (defining functions, arguments, return values). Scope and lifetime of variables. Lambda functions. Error handling (try, except blocks).	6
3	**Data Structures in Python** Lists and List operations. Tuples, Sets, and their uses. Dictionaries and how to access, modify, and delete data. List comprehensions. Working with multi-dimensional data structures	7
4	**Object-Oriented Programming in Python** Introduction to Object-Oriented Programming (OOP). Classes and objects in Python. Methods, constructors, and destructors. Inheritance, Polymorphism, Encapsulation, and Abstraction. Python's special methods (e.g., __init__, __str__, etc.).	8
5	**File Handling and Working with Data** Reading and writing text files. Working with CSV and JSON files. File operations (open, close, read, write). Working with Excel files using libraries like pandas and openpyxl. Introduction to regular expressions for pattern matching in text. **Introduction to Python Libraries for Data Analysis** Overview of libraries like NumPy and Pandas. Data structures in NumPy (Arrays). Introduction to Pandas DataFrames for handling structured data. Data manipulation with Pandas (Filtering, grouping, aggregating). Plotting with Matplotlib and Seaborn.	9

Learning Resources

References:

- **"Python for Data Analysis"** by Wes McKinney (O'Reilly)
- **"Learning Python"** by Mark Lutz (O'Reilly)
- **Automate the Boring Stuff with Python"** by Al Sweigart (No Starch Press)
- **"Python Programming: An Introduction to Computer Science"** by John Zelle (Franklin, Beedle & Associates)
- **"Python for Business Analytics"** by Pradeep Gohil (Wiley India)
- "Python Programming: A Modular Approach" by R. Nageswara Rao, **Publisher:** McGraw Hill Education
- "Learn Python Programming" by Amit K. Soni, **Publisher:** BPB Publications

Weblinks

- https://docs.python.org/
- https://www.w3schools.com/python/
- https://www.geeksforgeeks.org/python-programming-language/
- https://www.python.org/about/gettingstarted/
- https://www.programiz.com/python-programming

SPECIALIZATION ELECTIVE COURSES (SE)

SEMESTER III

(Any 4 to be Opted for)

FULL STACK DEVELOPMENT

PDW604MJ: Program and Design with ASP.NET		
Semester – III **Sem Code: 304** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To provide a comprehensive understanding of ASP.NET and web application development using the latest version. • To equip students with hands-on skills to design, develop, and deploy dynamic, scalable web applications using ASP.NET Core. • To introduce modern web development practices, including RESTful APIs, MVC architecture, and data management with Entity Framework Core. • To emphasize security practices, performance optimization, and best practices for building production-ready applications.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the key components and architecture of ASP.NET, including the difference between Web Forms, MVC, and Web API.
CO2	Understand	Explain the role of the ASP.NET request-response pipeline and the lifecycle of a web page
CO3	Apply	Develop basic ASP.NET web applications using the MVC framework to demonstrate understanding of controllers, views, and models
CO4	Analyze	Analyze an existing ASP.NET application to identify performance bottlenecks and recommend improvements

CO5	Evaluate	Evaluate the security aspects of an ASP.NET application and apply best practices for user authentication, authorization, and data protection.
CO6	Create	Design and develop a fully functional ASP.NET web application integrating both front-end and back-end technologies, such as HTML, CSS, JavaScript, and a database.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Overview of ASP.NET Core** What is ASP.NET Core? Key differences between ASP.NET Core and previous versions (ASP.NET 4.x). Benefits of using ASP.NET Core: Cross-platform support, Performance improvements, and Modularity. Introduction to .NET 6/.NET 7 and their significance. **Setting Up the Development Environment** Installing .NET SDK and Visual Studio 2022/Visual Studio Code. Configuring IIS and Kestrel servers. Introduction to the ASP.NET Core CLI (Command-Line Interface). First application: Creating and running a "Hello World" app.	8
2	**Core Concepts of ASP.NET Core** **ASP.NET Core Project Structure** Overview of the directory structure (Controllers, Views, Models, wwwroot, etc.). Understanding Program.cs and Startup.cs files. Middleware pipeline and request processing in ASP.NET Core. **Routing in ASP.NET Core** Overview of routing: Conventional routing vs. Attribute routing. Configuring routes in ASP.NET Core MVC. Route constraints and custom routes.	8
3	**ASP.NET Core MVC (Model-View-Controller)** **Introduction to MVC Architecture** Understanding the MVC design pattern. Overview of Controllers, Views, and Models. MVC components in ASP.NET Core MVC. **Creating and Managing Controllers** Creating controller actions and mapping them to views. Handling HTTP GET and POST requests. Passing data from controllers to views using ViewData, ViewBag, and TempData. **Working with Views** Introduction to Razor view engine. Creating views with Razor syntax. Strongly typed views and passing models to views.	10

	Working with Partial Views and Layouts. **Model Binding and Validation** Understanding model binding in ASP.NET Core. Using data annotations for server-side validation. Implementing custom validation logic. Client-side validation with jQuery Validation.	
4	**Data Access with Entity Framework Core** **Introduction to Entity Framework Core** Overview of Object-Relational Mapping (ORM). Advantages of using Entity Framework Core over traditional ADO.NET. Setting up Entity Framework Core in an ASP.NET Core project.	6
5	**Web APIs in ASP.NET Core** **Introduction to Web APIs** RESTful services overview and HTTP methods (GET, POST, PUT, DELETE). Creating a Web API project in ASP.NET Core. Configuring and routing Web API endpoints. Returning data in JSON and XML formats. **Web API Controllers** Creating API controllers and actions. Using attribute routing in API controllers. Handling input and output in Web API methods.	6

Learning Resources

References:

- "Pro ASP.NET Core 6" **by Adam Freeman**
- "C# 9 and .NET 5 – Modern Cross-Platform Development" **by Mark J. Price**
- "ASP.NET Core in Action" **by Andrew Lock**
- "ASP.NET 4.5 in Simple Steps" ,by **Kogent Learning Solutions**
- "ASP.NET MVC 5 **– A Beginner's Guide", by** Sandeep Soni

Weblinks:

- https://learn.microsoft.com/en-us/aspnet/core
- https://www.w3schools.com/asp/
- https://www.tutorialspoint.com/asp.net/index.htm
- https://www.dotnetcurry.com/aspnet
- https://www.youtube.com/watch?v=0hWWlIHhJl0
- https://www.geeksforgeeks.org/asp-net-tutorials/

BMA605MJ: Basics of Mobile application development		
Semester – III **Sem Code: 305** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To introduce the fundamentals of mobile application development, including platforms, programming languages, and development tools
- To enable students to develop mobile applications for Android and iOS using popular technologies like Java, Kotlin, and Swift.
- To equip students with skills in designing mobile apps with a focus on user-centered design, ensuring good usability and accessibility.
- To provide hands-on experience in mobile app development by working on simple projects involving Android or iOS mobile applications.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	the basic concepts, technologies, and tools used in mobile application development
CO2	Understand,	**Describe** the fundamental architecture of mobile operating systems (Android/iOS) and how they influence app development. **Explain** the differences between native and cross-platform mobile development and when to use each approach. **Design and develop** a fully functional mobile application, integrating features such as user authentication, data synchronization, and cloud storage.
CO3	Apply	**Develop** simple mobile applications for Android and iOS using the relevant programming languages (Java/Kotlin for Android, Swift for iOS). **Design** user interfaces that meet user needs, following industry standards and best practices for usability.
CO4	Analyze	**Analyze** different mobile development frameworks (e.g., Android SDK, Xcode, React Native, Flutter) and choose the appropriate one for specific application requirements.
CO5	Evaluate	**Critique** the security features in mobile apps, such as encryption and secure storage, and evaluate their effectiveness in protecting user data.
CO6	Create	**Design and develop** a fully functional mobile application, integrating features such as user authentication, data synchronization, and cloud storage.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Mobile Application Development** **Overview of Mobile Development** History and Evolution of Mobile Apps Differences between Mobile Web and Native Apps Mobile Operating Systems: Android vs. iOS vs. Cross-Platform Mobile Development Tools and IDEs (Android Studio, Xcode)	7
2	**Mobile Application Development Basics** **Introduction to Android Development** Overview of Android OS Setting Up Android Studio Basic Android UI: Layouts, Views, and Widgets Java/Kotlin for Android Development **Introduction to iOS Development** Overview of iOS OS Setting Up Xcode Basic iOS UI: Storyboards, Views, and Auto Layout Swift for iOS Development	8
3	**User Interface and User Experience Design** **UI/UX Principles for Mobile Apps** Understanding Material Design (Android) and Human Interface Guidelines (iOS) Designing Intuitive User Interfaces Responsive Layouts and Adaptability Optimizing User Experience for Mobile Devices	6
4	**Mobile Application Architecture and Components** **MVC and MVVM in Mobile Apps** Model-View-Controller (MVC) Architecture Model-View-ViewModel (MVVM) Architecture Introduction to Android Components: Activities, Services, Broadcast Receivers, and Content Providers iOS Components: ViewControllers, Views, and Controllers **Mobile App Security and Privacy** Security Considerations in Mobile Apps Data Encryption Techniques Secure Authentication (OAuth, Firebase Authentication) Mobile App Permissions and Privacy Policies	8
5	**Data Management in Mobile Apps** **Data Storage and Management** Working with Shared Preferences (Android) and UserDefaults (iOS) SQLite for Local Data Storage Integration with Remote Databases using RESTful APIs (**JSON** Parsing**)** **Networking and Web Services** Networking in Mobile Apps	9

	HTTP Requests, Web APIs, and JSON Parsing Retrofit and Volley (Android) for Networking Alamofire for Networking in iOS Consuming RESTful APIs and Displaying Data in Apps	

Learning Resources

References:

- **"Android Programming: The Big Nerd Ranch Guide"** by Bill Phillips, Chris Stewart, and Kristin Marsicano
- **"iOS Programming: The Big Nerd Ranch Guide"** by Christian Keur, Aaron Hillegass
- Flutter for Beginners", **Author:** K. S. Kiran
- "Developing Android Applications", **Author:** Meenakshi Sundaram
- Mobile Computing and App Development" ,**Author:** P. K. Sinha
- "Mastering Android Development with Kotlin", **Author:** Naveen Kumar

Weblinks

- https://www.geeksforgeeks.org/mobile-app-development/
- https://www.w3schools.com/mobile/
- https://developer.android.com/
- https://flutter.dev/
- https://reactnative.dev/
- https://www.tutorialspoint.com/mobile_application_development/index.htm
- https://www.youtube.com/c/Freecodecamp

PHP606MJ- 03: PHP Programming		
Semester – III **Sem Code: 306** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH) : 50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To enable students to create dynamic web pages by integrating PHP with HTML and databases. • To provide skills for creating reusable functions, handling forms, and validating user input in web applications. • To teach students how to interact with MySQL databases using PHP to store and retrieve data dynamically. • To develop the ability to solve real-world problems by building small projects and applications using PHP. • To educate students on PHP security practices to prevent common vulnerabilities such as SQL injection, XSS, and CSRF.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	the various data types, variables, operators, and control structures in PHP.

CO2	Understand, Create	**Describe** the role of PHP in server-side scripting and how it integrates with HTML and databases. **Explain** the usage of PHP functions, arrays, loops, and conditionals in web development **Design and develop** a fully functional PHP web application with dynamic content, database integration, and user interaction.
CO3	Apply, Analyse	**Write** PHP scripts for form handling, data validation, and user authentication. **Develop** dynamic websites by integrating PHP with HTML, CSS, and JavaScript.
CO4	Analyze	existing PHP code for optimization, performance improvement, and security flaws. **Compare** different PHP functions and decide the most efficient method for solving specific problems.
CO5	Evaluate	**Evaluate** the use of PHP frameworks and their advantages in large-scale application development.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to PHP Programming **Overview of PHP:** Introduction to PHP, history, and its role in web development. **Setting Up the Development Environment:** Installing PHP, MySQL, and Apache (XAMPP/WAMP). **PHP Syntax and Structure:** Basic syntax, comments, variables, constants, and operators. **Data Types and Variables:** Understanding strings, integers, arrays, and Boolean data types.	4
2	Control Structures and Functions **Conditional Statements:** if, else, switch-case. **Loops in PHP:** for, while, foreach. **PHP Functions:** Built-in functions and creating user-defined functions. **Working with Arrays:** Indexed, associative arrays, and array functions. Handling Forms and User Input **HTML Forms:** Creating forms and using GET and POST methods. **PHP Superglobals:** $_GET, $_POST, $_SESSION, $_REQUEST. **Form Validation:** Validating form inputs, handling errors, sanitizing data.	6
3	Working with Files and Directories **File Handling in PHP:** Reading and writing files, file manipulation (open, read, write, delete). **File Uploads:** Handling file uploads securely. **Directories:** Creating, deleting, and manipulating directories.	4
4	PHP and MySQL Integration **Introduction to MySQL:** Overview of databases, connecting to a MySQL database using PHP. **CRUD Operations:** Performing Create, Read, Update, and Delete operations using PHP and MySQL.	7

	Prepared Statements: Using prepared statements to prevent SQL injection attacks. **Using PHP with PHPMyAdmin:** Managing databases with PHPMyAdmin.	
5	PHP and Security Best Practices **Common Security Issues:** SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF). **Data Sanitization and Validation:** Techniques for securing input and output data. **Password Handling:** Secure password storage and hashing techniques.	7

Learning Resources

References:

- **"PHP and MySQL Web Development"** by Luke Welling and Laura Thomson
- **"Learning PHP, MySQL & JavaScript"** by Robin Nixon
- **"Learning PHP, MySQL & JavaScript"** by Robin Nixon
- "PHP and MySQL for Dynamic Web Sites", **Author:** Ramesh R
- "PHP Programming", **Author:** Pradeep K. Sinha
- "Mastering PHP", **Author:** Yogesh S
- "PHP for Beginners", **Author:** R. K. Gupta

Weblinks

- https://www.geeksforgeeks.org/php-tutorial/
- https://www.w3schools.com/php/
- https://www.tutorialspoint.com/php/index.htm
- https://www.php.net/manual/en/
- https://www.codecademy.com/catalog/language/php

TCD607MJ: – Test case and design techniques		
Semester – III **Sem Code: 307** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To understand the Fundamentals of Software Testing • To learn Different Types of Test Cases • To develop Test Case Design Skills • To understand Test Case Optimization		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	**Identify** the components and structure of a well-defined test case.
CO2	Understand, Create	**Describe** the purpose of each test case design technique in the context of software testing. **Explain** how to identify functional and non-functional requirements that influence test case design.
CO3	Apply	**Develop** test cases using various test case design techniques based on different types of software applications (e.g., web, mobile, enterprise). **Implement** test case design strategies in software projects to ensure comprehensive testing coverage.
CO4	Analyze	**Analyze** a given software application's requirements and identify test scenarios for which test cases need to be designed. **Evaluate** the effectiveness of a set of test cases in terms of test coverage and defect detection
CO5	Evaluate	**Assess** the impact of poor test case design on software quality and project timelines. **Evaluate** the risk and priority levels of test cases to optimize testing efforts and resources.
CO6	Create	**Design** comprehensive and optimized test cases that cover functional and non-functional aspects of an application. **Integrate** multiple test case design techniques in a single project to ensure thorough and efficient testing.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to Software Testing **Overview of Software Testing**: Importance, types of testing (manual and automated). **Role of Test Case Design**: How designing test cases contributes to quality assurance.	6

	Test Life Cycle: Phases of testing—requirement analysis, test planning, test design, execution, and reporting.	
2	Basic Test Case Design Techniques **Boundary Value Analysis (BVA)**: Designing test cases based on boundary conditions. **Equivalence Partitioning**: Grouping inputs into equivalent partitions and designing test cases for each. **Decision Table Testing**: Using decision tables to model system behavior for complex scenarios. **State Transition Testing**: Designing test cases based on system states and transitions.	6
3	Advanced Test Case Design Techniques **Cause-Effect Graphing**: Converting requirements into a cause-effect diagram to derive test cases. **Error Guessing**: Using tester's intuition and experience to predict defect-prone areas and designing test cases. **Pairwise Testing**: Optimizing test cases by considering all combinations of pairs of inputs.	6
4	Test Case Optimization **Prioritizing Test Cases**: Based on risk, importance, and impact. **Test Case Reduction**: Reducing the number of test cases while ensuring test coverage. **Regression Testing**: Managing test cases for repeated testing during multiple iterations or releases. Test Case Management and Execution **Test Management Tools**: Introduction to tools such as JIRA, TestRail, and Quality Center. **Test Execution and Reporting**: How to execute test cases, track defects, and report results. **Test Case Documentation**: Best practices in documenting and organizing test cases.	8
5	Real-World Applications and Case Studies **Case Studies**: Practical examples of test case design in various industries (e.g., web development, mobile apps). **Team Collaboration in Test Case Design**: Working in a team to design and execute test cases for complex projects. **Test Case Design for Agile Projects**: Designing test cases in an agile software development environment.	6

Learning Resources

References:

- "Software Testing: Principles and Practices", Author: Naresh Chauhan
- "Foundations of Software Testing" , Author: Rex Black, Erik van Veenendaal, Dorothy Graham
- "Software Testing Techniques", Author: Boris Beizer

- "Software Testing Techniques", Author: K.K. Aggarwal & Yogesh Singh
- "Software Testing and Quality Assurance: Theory and Practice" ,Author: S. P. S. Yadav
- "Foundations of Software Testing", Author: Aditya P. Mathur
- "Software Testing and Test Case Design", **Author:** Dr. S. C. S. Subramanian

Weblinks

- https://www.geeksforgeeks.org/software-testing-basics/
- https://www.tutorialspoint.com/software_testing/index.htm
- https://www.softwaretestinghelp.com/
- https://stackoverflow.com/questions/tagged/software-testing
- https://www.youtube.com/results?search_query=software+testing+tutorials

MDA608MJ: – Mongo Database		
Semester – III **Sem Code: 308** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • **Understand** the core concepts of NoSQL databases and MongoDB architecture. • **Develop** the skills to create, query, and manage MongoDB databases effectively. • **Analyze** real-world business use cases to apply MongoDB for efficient data storage and retrieval. • **Design** scalable and high-performance MongoDB databases for real-time applications. • **Implement** MongoDB in a business context to solve data management challenges.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall key concepts of NoSQL databases, MongoDB architecture, and its basic commands.
CO2	Understand	Explain MongoDB's data model, document structure, and how it differs from traditional relational databases.
CO3	Apply	Use MongoDB commands for creating databases, collections, and inserting documents, and write basic queries using MongoDB.
CO4	Analyze	Analyze business problems and data requirements to determine how MongoDB's schema-less design can be leveraged to provide solutions.

CO5	Evaluate	Evaluate the advantages and challenges of MongoDB for different types of business applications, considering factors like scalability and performance.
CO6	Create	Design and implement a scalable MongoDB database, integrating it into a business solution that addresses real-time data management and analytics needs.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to NoSQL and MongoDB** Overview of NoSQL databases: Types (Key-Value, Document, Columnar, Graph) MongoDB: History, Features, and Use Cases MongoDB Architecture: Replica Sets, Sharding, and Storage Engine Setting Up MongoDB: Installation and Configuration	6
2	**MongoDB Data Model** Document-Oriented Database: Data Models (Documents, Collections) JSON-like BSON format in MongoDB CRUD Operations in MongoDB (Create, Read, Update, Delete) Inserting and Querying Data in MongoDB	6
3	**Advanced Querying and Aggregation** Advanced Query Operations: Logical Operators, Comparison Operators Sorting, Pagination, and Limiting Queries MongoDB Aggregation Framework: Group, Project, and Sort Operations	6
4	**Indexing and Optimization** Indexing in MongoDB: Single Field Indexes, Compound Indexes Indexing Best Practices Performance Optimization and Query Profiling **MongoDB Data Integrity and Security** Data Validation in MongoDB (Schema Validation) MongoDB Security: Authentication, Authorization, and Encryption Backup and Restore in MongoDB	9
5	**MongoDB in Real-World Business Applications** Real-time Data Management in Business Using MongoDB for E-commerce, Social Media, and IoT Integrating MongoDB with Analytics and Business Intelligence Tools	6

Learning Resources

References:

- **MongoDB: The Definitive Guide** by Kristina Chodorow
- **Mastering MongoDB** by Alex Giamas

- MongoDB official documentation: https://www.mongodb.com/docs/
- **"MongoDB Basics"** by **Shashank Tiwari**

Web links

- https://university.mongodb.com/
- https://www.mongodb.com/docs/
- https://www.w3schools.com/mongodb/
- https://www.tutorialspoint.com/mongodb/index.htm
- https://www.geeksforgeeks.org/mongodb/
- https://www.youtube.com/watch?v=2fNeDIBhKh4&list=PLTjRvDozrdQHDXw9tB9M_o2XXF1B38bA9

SQA609MJ: – Software Quality Assurance		
Semester – III **Sem Code: 309** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • **Understand** the importance of software quality and the role of quality assurance in the software development lifecycle. • **Learn** the key concepts, principles, and practices of Software Quality Assurance (SQA), including testing techniques, defect management, and quality standards. • **Evaluate** various quality models and frameworks to improve software quality in business contexts. • **Apply** quality assurance methodologies and tools to test and validate software products. • **Design** quality assurance plans and strategies for software development projects to ensure product reliability, performance, and compliance with business requirements.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the fundamental concepts of software quality, software testing, and software quality assurance standards and practices.
CO2	Understand	Explain different software quality models, methodologies, and their role in the software development lifecycle.
CO3	Apply	Apply SQA principles to real-world software projects, using various testing tools and techniques to ensure software quality.
CO4	Analyze	Analyze the strengths and weaknesses of different quality assurance models, testing approaches, and strategies used in the software industry.
CO5	Evaluate	Evaluate the effectiveness of quality assurance processes in ensuring software quality and meeting business requirements.

CO6	Create	Develop and implement software quality assurance plans and strategies, including test plans, defect management plans, and quality metrics for a project.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Software Quality Assurance** What is Software Quality Assurance (SQA)? Importance of SQA in Software Development The Software Development Lifecycle (SDLC) and its relation to SQA Key concepts: Quality Control vs Quality Assurance Software Quality Models and Standards (ISO, CMMI, Six Sigma)	6
2	**SQA Processes and Methodologies** The Role of SQA in the SDLC phases Types of Software Testing (Manual, Automated, Functional, Non-Functional) Common SQA Methodologies (Agile, V-Model, Waterfall) Software Testing Lifecycle: Planning, Design, Execution, and Reporting	7
3	**Test Planning and Test Case Design** Writing Test Plans: Objectives, Scope, and Strategies Test Case Design: Equivalence Partitioning, Boundary Value Analysis Types of Test Cases: Functional, Regression, Smoke, and User Acceptance Testing Traceability Matrices and Test Coverage	7
4	**Automated Testing and Tools** Introduction to Automated Testing Benefits and Challenges of Automation Common Automation Tools: Selenium, JUnit, TestNG, QTP Integrating Automated Testing into CI/CD pipelines **Defect Management and Quality Metrics** Defect Lifecycle and Defect Tracking Tools (Jira, Bugzilla) Reporting and Analyzing Defects Quality Metrics and Indicators: Test Coverage, Defect Density, Mean Time to Failure Root Cause Analysis and Continuous Improvement	8
5	**Risk-Based Testing and Quality Assurance in Agile** Risk-Based Testing: Identifying, Analyzing, and Prioritizing Risks Risk Mitigation Strategies Software Quality Assurance in Agile Environments Role of QA in Scrum, Kanban, and Agile sprints	6

Learning Resources

References:

- "Software Quality Assurance: From Theory to Implementation" by Daniel Galin
- "Foundations of Software Testing" by Rex Black, Erik van Veenendaal, and Dorothy Graham
- "Software Engineering: A Practitioner's Approach" by Roger S. Pressman

- ISO/IEC 29119 Software Testing Standards (Online Resource)

Web links

- ISTQB (International Software Testing Qualifications Board) - **www.istqb.org**
- Software Testing Help - **https://www.softwaretestinghelp.com**
- Guru99 SQA Tutorials - **https://www.guru99.com**

JSC610MJ: – Javascript		
Semester – III **Sem Code: 310** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • Understand the foundational concepts of JavaScript and its role in web development. • Comprehend the usage of JavaScript in client-side scripting and its interaction with HTML/CSS • Implement JavaScript code for basic dynamic web page functionalities such as form validation, event handling, and DOM manipulation • Develop interactive web applications using JavaScript, integrating both front-end (HTML/CSS) and back-end (APIs, databases). • Assess the security considerations and optimize JavaScript code for performance.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	List and explain basic JavaScript concepts such as variables, data types, and functions.
CO2	Understand	Interpret how JavaScript interacts with HTML/CSS and other web technologies.
CO3	Apply	Apply JavaScript to solve business-related problems such as automating tasks or creating interactive dashboards.
CO4	Analyze	Identify and correct syntax, runtime, and logical errors in JavaScript code.
CO5	Evaluate	Evaluate the usability of different JavaScript libraries and frameworks and select the appropriate one for specific business needs.
CO6	Create	Design and develop fully functional web applications incorporating dynamic features with JavaScript.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to JavaScript and its Ecosystem** Overview of JavaScript and its role in web development Introduction to the JavaScript runtime environment	6

	Setting up a development environment **Variables, Data Types, and Operators** JavaScript data types (String, Number, Boolean, Object, Array, Null, Undefined) Declaring variables using var, let, const Operators (Arithmetic, Comparison, Logical, Assignment)	
2	**Control Structures and Functions** Conditional Statements: if, else, switch Loops: for, while, do-while Functions: Function declaration, function expression, and arrow functions **Objects and Arrays** Working with objects and arrays Methods and properties of objects Array manipulation (push, pop, shift, unshift, map, filter, reduce)	6
3	**DOM Manipulation and Events** Introduction to the Document Object Model (DOM) Selecting and manipulating DOM elements Event handling (click, hover, submit, etc.) **Error Handling and Debugging** Understanding and handling errors: try, catch, finally Debugging tools and techniques **Asynchronous Programming in JavaScript** Introduction to asynchronous programming Using setTimeout, setInterval Promises and async/await	9
4	**Advanced JavaScript Concepts** Closures, scope, and the this keyword Callbacks and higher-order functions JavaScript ES6 features: Template literals, destructuring, modules	6
5	**Working with External Data: APIs and JSON** Introduction to REST APIs Fetching data using JavaScript (AJAX, Fetch API) Parsing and manipulating JSON data	6

Learning Resources

References:

- "JavaScript: The Definitive Guide" (7th Edition), **Author**: **David Flanagan**
- "Learning JavaScript", **Author**: **Nishant Shukla**
- "JavaScript for Beginners", **Author**: **Balagurusamy**
- "JavaScript in 24 Hours, Sams Teach Yourself", **Author**: **Khalid Azim**

Web links

- https://developer.mozilla.org/en-US/docs/Web/JavaScript
- https://www.w3schools.com/js/
- https://www.geeksforgeeks.org/javascript/
- https://javascript.info/
- https://www.freecodecamp.org/news/full-javascript-course-for-beginners/

AML611MJ: – AI & Machine Learning		
Semester – III **Sem Code: 311** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • Understand the basic concepts, terminologies, and techniques in Artificial Intelligence (AI) and Machine Learning (ML). • Comprehend the difference between AI, ML, and Data Science. • Implement algorithms for classification, regression, clustering, and other ML tasks using programming languages like Python. • Analyze different AI and ML models and evaluate their performance. • Critically evaluate the ethical and societal impacts of AI and ML in business and technology. • Design and develop AI/ML-based applications or solutions for business problems, incorporating models for prediction, recommendation, and decision-making.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	List the major concepts, algorithms, and frameworks used in AI and ML
CO2	Understand	Explain the key differences between AI and ML and how they are applied in business contexts.
CO3	Apply	Implement machine learning models (e.g., linear regression, decision trees) and evaluate their performance using appropriate metrics.
CO4	Analyze	Analyze the performance of machine learning models using metrics like accuracy, precision, recall, F1 score, etc.
CO5	Evaluate	Evaluate the ethical implications of AI technologies, such as bias in data and algorithm transparency.
CO6	Create	Create end-to-end AI/ML projects using Python or other relevant languages, from data collection to model deployment.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Artificial Intelligence & Machine Learning** What is AI? What is ML? Overview and differences. Applications of AI & ML in business. Key concepts and terminology: Models, features, labels, algorithms. **Problem-Solving and Search Algorithms:** Problem-solving methods in AI Search algorithms: breadth-first search, depth-first search, A* search, etc.	9

	Heuristic search techniques **Knowledge Representation and Reasoning:** Representing knowledge in AI systems Propositional and predicate logic Inference rules and reasoning techniques	
2	**Basics of Machine Learning** Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning. Overview of algorithms: Linear Regression, Classification algorithms, Clustering techniques	6
3	**Data Preprocessing and Feature Engineering** Data Cleaning, Handling missing values, Encoding categorical data. Feature scaling, normalization, and transformation. Train-test split, cross-validation.	9
4	**Unsupervised Learning - Clustering and Dimensionality Reduction** Clustering algorithms: K-Means, Hierarchical clustering. Principal Component Analysis (PCA), t-SNE for dimensionality reduction. Application of clustering in business: Customer segmentation, anomaly detection.	6
5	**Supervised Learning - Regression and Classification** Regression algorithms: Linear Regression, Polynomial Regression. Classification algorithms: Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees. Model evaluation: Accuracy, Precision, Recall, F1-score.	6

Learning Resources

References:

- Artificial Intelligence and Machine Learning: Theory and Practice- Lyla B. Das
- Artificial Intelligence for Students By Vibha Pandey
- AI and Machine Learning: From Neurons to Networks: Understanding the Mechanics of Artificial Intelligence and Deep Learning Kindle Edition by D.R. T STEPHENS
- "Artificial Intelligence: A Modern Approach", Author: D. P. Bhatnagar
- "Machine Learning", Author: R. S. Bhagat
- "Machine Learning and Artificial Intelligence", Author: P. K. Sinha

Web links

- https://www.coursera.org/courses?query=artificial%20intelligence
- https://www.edx.org/learn/artificial-intelligence
- https://www.geeksforgeeks.org/machine-learning/
- https://www.kaggle.com/
- https://www.fast.ai/
- https://www.coursera.org/collections/best-machine-learning-ai
- https://skillsbuild.org/students/course-catalog/artificial-intelligence

SPECIALIZATION CORE COURSES (SC) -Compulsory

CYBER SECURITY WITH DATA ANALYTICS

ECS602MJ: – Essentials of Cyber Security		
Semester – III **Sem Code: 302** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand fundamental concepts of cybersecurity, including threats, vulnerabilities, and risk management.
- To explore various types of cyberattacks, their methods, and mitigation strategies.
- To familiarize with cryptographic techniques and their application in securing information.
- To learn security protocols, access control mechanisms, and network security tools.
- To analyze current cybersecurity trends and best practices to safeguard digital systems.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand.	**Understand** fundamental cybersecurity principles**.** **Recall** the basic facts and functions, rather than requiring a deeper understanding of how they work.
CO2	Apply	**Recognize** different types of cyberattacks and their motivations**.** **Implement** basic cryptographic techniques to secure communications**.**
CO3	Analyze	**Analyze** different types of cyber threats and vulnerabilities**.** **Evaluate** the methods used by attackers to exploit systems and networks.
CO4	Evaluate	**Formulate** strategies to protect IT infrastructure. **Conduct** risk assessments and apply risk mitigation techniques..
CO5	Create	**Assess** the impact of emerging technologies on cybersecurity**.**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cybersecurity** Overview of Cybersecurity: Definitions, importance, and scope. Key Cybersecurity Concepts: Threats, vulnerabilities, risks, and controls. Cybersecurity Objectives: Confidentiality, Integrity, and Availability (CIA triad). Types of Attacks: Phishing, malware, ransomware, social engineering, DDoS, and more. Cybersecurity Challenges: Threat landscape, economic and legal implications.	6

	Basics of Cybersecurity Policies and Laws: Overview of major global and regional cybersecurity frameworks.	
2	**Cyber Threats and Vulnerabilities** Threats in Cyberspace: Malware, APTs (Advanced Persistent Threats), zero-day vulnerabilities. System Vulnerabilities: Software vulnerabilities, hardware vulnerabilities, insider threats. Network Vulnerabilities: Vulnerabilities in network protocols, attacks on wireless networks. Social Engineering Attacks: Types (phishing, spear phishing, baiting), psychology behind attacks. Threat Actors: Hacktivists, organized crime, state-sponsored attackers, and insider threats	6
3	**Cryptography and Network Security** Introduction to Cryptography: Symmetric and Asymmetric Encryption, Hash Functions. Public Key Infrastructure (PKI): Key management, digital signatures, certificate authorities. Network Security Fundamentals: Firewalls, VPNs, IDS/IPS. Secure Protocols: HTTPS, TLS/SSL, SSH, IPsec. Authentication and Authorization Mechanisms: Passwords, biometrics, multi-factor authentication.	6
4	Cyber Defense Mechanisms and Risk Management Cybersecurity Architecture: Defense in depth, security layers. Endpoint Security: Antivirus, Anti-malware, patch management. Risk Management Framework (RMF): Risk identification, risk assessment, risk mitigation. Incident Response: Steps in handling cyber incidents, detection, containment, eradication, recovery. Security Operations Center (SOC): Functions, monitoring, and reporting.	8
5	**Emerging Trends and Best Practices in Cybersecurity** Cloud Security: Key challenges, encryption in cloud, shared responsibility model. Mobile and IoT Security: Device management, threats, and security measures. Blockchain and Cybersecurity: Application of blockchain in enhancing cybersecurity. AI in Cybersecurity: Threat detection using machine learning, AI-driven defense. Best Practices: Security frameworks (ISO 27001, NIST), secure coding practices, and data protection guidelines.	6

Learning Resources

References:

- **"Cybersecurity Essentials"** by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short
- **"Principles of Information Security"** by Michael E. Whitman and Herbert J. Mattord
- **"Network Security Essentials: Applications and Standards"** by William Stallings
- **"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws"** by Dafydd Stuttard and Marcus Pinto
- **"Computer Security: Principles and Practice"** by William Stallings and Lawrie Brown

Websites:

- https://csrc.nist.gov
- https://owasp.org
- https://www.sans.org
- https://www.cisa.gov
- https://www.cisco.com/c/en/us/products/security.html

SPECIALIZATION ELECTIVE COURSES (SE)

SEMESTER III

(Any 4 to be Opted for)

CYBER SECURITY WITH DATA ANALYTICS

IED604MJ: – Innovation And Entrepreneurship Development		
Semester – III **Sem Code: 304** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Prerequisites		
Course Objectives • To develop an understanding of innovation and entrepreneurship in the context of emerging IT trends. • To foster entrepreneurial mindset and skills for identifying and exploiting technological opportunities. • To enable students to integrate innovation strategies into IT-driven business models. • To empower students to navigate challenges of startup ecosystems and scalability. • To cultivate ethical, sustainable, and inclusive entrepreneurship practices aligned with the NEP.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,.	Demonstrate knowledge of innovation principles and entrepreneurial frameworks
CO2	Understand	Develop innovative business models and project plans for IT-enabled ventures
CO3	Apply	Apply ethical and sustainable practices in entrepreneurship endeavors.
CO4	Analyze	Analyze and evaluate IT-driven opportunities for startups and intrapreneurship. .
CO5	Evaluate	Build strategic and operational skills to scale IT-focused businesses

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Foundations of Innovation and Entrepreneurship** Key Concepts: Innovation, invention, creativity; types of innovation (incremental, disruptive, architectural, radical); forms of entrepreneurship (social, corporate, tech-based). Role of Innovation: IT-driven entrepreneurship; digital transformation; examples of IT startups (Infosys, Freshworks). Policy Frameworks: National Innovation and Startup Policy (NISP), NEP objectives, Startup India initiatives. Emerging IT Trends: AI, Blockchain, IoT, and Cloud Computing as enablers of innovation.	6
2	**Ideation and Opportunity Recognition** Innovation Practices: Fostering team innovation; Design Thinking process (empathize, define, ideate, prototype, test). Startup Development: Lean Startup methodology (Build-Measure-Learn), identifying market gaps, technology readiness levels (TRL). Value Proposition: Tools and frameworks for IT product and service innovation. Case Studies: Insights from successful IT startups (Zoho, Infosys).	6
3	**Business Model Development and Validation** Business Models: Key components (partners, activities, value propositions, channels, revenue streams). Revenue and Pricing: Freemium, subscription, licensing models; cost-based and value-based pricing strategies. Market Research: Techniques for customer discovery (surveys, focus groups, competitor analysis). Prototyping: Building MVPs, iterating with customer feedback. IT Product Lifecycle: From ideation to scaling and updates.	6
4	**Funding, Legal, and Ethical Aspects** Funding Sources: Seed funding, Series A/B, venture capital, crowdfunding; preparing business pitches. Legal Compliance: IPR (patents, copyrights), startup legalities (LLP, Pvt Ltd), GST, Startup India benefits.	8

	Ethical Practices: Data privacy (GDPR, IT Act), avoiding plagiarism, promoting inclusivity. Financial Planning: Budgeting, forecasting, cash flow management, break-even analysis	
5	**Scaling and Sustaining Innovation** Scaling Strategies: Team expansion, leveraging technology (automation, cloud).Support Systems: Role of accelerators/incubators; examples (T-Hub, iCreate). Growth Techniques: Digital marketing (SEO, content), A/B testing, viral marketing. Sustainability: ESG principles, circular economy practices in IT. Exit Strategies: Mergers, acquisitions, IPOs; strategic exit planning.	6

Learning Resources

References:

- "The Lean Startup" by Eric Ries
- "Business Model Generation" by Alexander Osterwalder and Yves Pigneur
- "The Innovator's Dilemma" by Clayton M. Christensen
- "Creativity, Inc." by Ed Catmull
- "Venture Deals" by Brad Feld and Jason Mendelson
- "Hacking Growth" by Sean Ellis and Morgan Brown

Websites:

- https://www.startupindia.gov.in/
- https://hbr.org/
- https://theleanstartup.com/
- https://t-hub.co/
- https://blog.hubspot.com/

FDP605MJ: – Fraud detection & prevention		
Semester – III **Sem Code: 305** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To provide students with a comprehensive understanding of fraud, particularly in the context of technology and business operations, including various types of fraud, motivations behind fraudulent behavior, and its impact on organizations. • To introduce advanced fraud detection techniques such as data analytics, artificial intelligence (AI), machine learning (ML), and digital forensics, allowing students to identify fraudulent activities in a business or IT environment. • To equip students with the skills to design and implement robust fraud prevention frameworks, including internal controls, cybersecurity measures, and ethical risk management principles. • To enable students to analyze real-world fraud cases, apply critical thinking to assess risk, and develop problem-solving strategies to detect and prevent fraud in diverse business and technological contexts.		

• To familiarize students with modern technological tools and software used for fraud detection and prevention, offering hands-on experience in using data analytics, cybersecurity tools, and fraud prevention systems.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand.	Understand the Nature of Fraud in the Digital Age
CO2	Apply	Apply Data Analytics and AI for Fraud Detection
CO3	Analyze	Analyze Real-World Case Studies and IT Fraud Scenarios
CO4	Evaluate	Develop and Implement Fraud Prevention Strategies Evaluate Legal, Regulatory, and Ethical Aspects of Fraud
CO5	Create	Use Technological Tools for Fraud Detection and Prevention

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to IT Fraud:** Definition and scope of IT fraud. Types of IT fraud (cybercrime, phishing, hacking, malware attacks). IT fraud in e-commerce, banking, and enterprise systems. The role of digital identity theft and data breaches in IT fraud. The impact of IT fraud on organizations and individuals	6
2	**IT Fraud Detection Techniques:** Data analytics for detecting IT fraud. Machine learning and AI applications in fraud detection (Neural networks, decision trees, and anomaly detection). Digital forensics techniques for IT fraud detection. Blockchain technology and its role in fraud prevention. Red flags and early indicators of IT fraud	6
3	**IT Fraud Prevention Strategies:** Cybersecurity frameworks and IT fraud prevention. Role of firewalls, encryption, and access controls in preventing fraud. Corporate IT governance and compliance. Designing secure IT systems and network architecture. Ethical practices in IT fraud prevention	6
4	**IT Fraudulent Schemes and Case Studies:** Digital fraud schemes: Ransomware, phishing, social engineering, and insider attacks. Case studies of high-profile IT fraud incidents (e.g., Equifax data breach, Yahoo data breach). Analysis of fraud in online banking, e-commerce platforms, and payment systems. Lessons learned from major corporate IT fraud scandals. Emerging trends in IT fraud schemes and prevention	8
5	**Legal, Regulatory, and Ethical Issues in IT Fraud**: Overview of cybersecurity and data protection laws (e.g., GDPR, CCPA, HIPAA). IT fraud compliance and governance standards (e.g., ISO 27001, COBIT). Legal responsibilities of IT professionals and corporate leaders. Ethical issues in IT fraud detection and prevention. The role of government and international organizations in regulating IT fraud	6

6	**Technological Tools for IT Fraud Detection:** Intrusion detection and prevention systems (IDS/IPS). Data mining software for fraud detection. Machine learning algorithms and their applications in IT fraud prevention. Blockchain and its role in securing digital transactions. Cloud computing, cybersecurity, and fraud prevention. Digital forensics tools and techniques for IT fraud detection	6

Learning Resources

References:

- "Computer Forensics and Cyber Crime: An Introduction" by Marjie T. Britz
- "IT Auditing Using Controls to Protect Information Assets" by Chris Davis, Mike Schiller, and Kevin Wheeler
- "Fraud Examination for Managers and Auditors" by Jack Bologna, Robert Lindquist
- "Cybersecurity and Cyberwar: What Everyone Needs to Know" by P.W. Singer and Allan Friedman
- "Data Mining for Intelligence, Fraud & Criminal Detection" by Christopher Westphal

Websites:

- https://www.theiia.org/
- https://www.nist.gov/
- https://owasp.org/
- https://www.sans.org/apac/
- https://www.isaca.org/

EHA606MJ: – Ethical Hacking		
Semester – III **Sem Code: 306** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To introduce students to the foundational concepts of ethical hacking and its role in cybersecurity. • To equip students with practical skills in vulnerability assessment and penetration testing. • To foster a strong ethical understanding of hacking practices in alignment with legal frameworks. • To develop critical thinking for securing IT systems and responding to cyber threats. • To enable students to analyze and implement security measures in organizations.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember, Understand.	Understand and articulate the principles and ethical considerations of hacking.
CO2	Apply	Identify system vulnerabilities and apply penetration-testing techniques
CO3	Analyze	Analyze the legal and regulatory frameworks related to cybersecurity.
CO4	Evaluate	Provide strategic solutions to mitigate risks in IT environments
CO5	Create	Design and implement basic security measures to prevent cyberattacks

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Ethical Hacking** Overview of ethical hacking: definition, scope, and importance. Differences between ethical hacking, penetration testing, and cybercrime. Ethical hacker roles and responsibilities. Cybersecurity fundamentals: threats, vulnerabilities, and risks. NEP-aligned focus: Ethics, digital safety, and inclusivity in IT.	6
2	**Networking and Security Essentials** Networking basics: TCP/IP, DNS, HTTP, HTTPS. Common network vulnerabilities and attack vectors. Network defense tools: firewalls, IDS/IPS, and VPNs. Wireless network security and encryption methods. NEP-aligned focus: Interdisciplinary learning with real-world IT challenges.	6
3	**Penetration Testing and Tools** Phases of penetration testing: reconnaissance, scanning, gaining access, maintaining access, and reporting. Tools: Kali Linux, Nmap, Metasploit, Burp Suite. Social engineering techniques and mitigation strategies. Case studies of ethical hacking in organizational contexts. NEP-aligned focus: Experiential learning through hands-on practice.	6
4	**Application Security and Exploitation Techniques** Web application vulnerabilities: SQL injection, cross-site scripting (XSS), and cross-site request forgery (CSRF). Secure coding practices and software security frameworks. Mobile application security challenges. Exploiting misconfigurations and privilege escalation. NEP-aligned focus: Application of skills in diverse technological contexts.	8
5	**Cyber Laws and Ethical Frameworks** Overview of Indian IT Act, 2000, and amendments. Global cybersecurity laws and regulations (e.g., GDPR, CCPA). Ethical frameworks: professional responsibilities, privacy concerns, and user rights. Incident	6

	response and reporting mechanisms. NEP-aligned focus: Societal responsibility and sustainable technology use.	

Learning Resources

References:

- "The Basics of Hacking and Penetration Testing" by Patrick Engebretson
- "Ethical Hacking and Penetration Testing Guide" by Rafay Baloch
- "Network Security Essentials: Applications and Standards" by William Stallings
- "The Web Application Hacker's Handbook" by Dafydd Stuttard and Marcus Pinto
- "Cyber Law in India" by Talwant Singh and Pavan Duggal

Websites:

- https://www.netacad.com/
- https://nmap.org/
- https://www.hackthebox.com/
- https://www.cyberlawconsulting.com/
- https://iapp.org/

BTE607MJ: – Blockchain Technologies		
Semester – III **Sem Code: 307** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • **Introduction to Blockchain**: Understand the foundational concepts of blockchain technology, including its architecture, consensus mechanisms, and cryptographic principles. • **Blockchain Applications**: Explore how blockchain is applied across various industries, including finance, supply chain, healthcare, and IoT. • **Smart Contracts**: Learn the development and deployment of smart contracts using platforms like Ethereum. • **Cryptocurrencies**: Gain knowledge about the working of cryptocurrencies, including Bitcoin, Ethereum, and their underlying protocols. • **Security and Privacy**: Study the security aspects of blockchain technology, focusing on cryptography, privacy-preserving techniques, and vulnerabilities. • **Blockchain Development**: Hands-on experience with blockchain development tools, such as Hyperledger, Solidity, and Ethereum, for building decentralized applications (DApps)..		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,.	Demonstrate knowledge of innovation principles and entrepreneurial frameworks

CO2	Understand	Understand the core concepts of blockchain, its decentralized architecture, and key technologies like cryptographic hashing and digital signatures.
CO3	Apply	Explain the functioning of popular cryptocurrencies such as Bitcoin and Ethereum, including mining, consensus algorithms, and transaction processes.
CO4	Analyze	Analyze the potential of blockchain in various industries and assess the suitability of blockchain solutions for specific business problems. Write, deploy, and interact with smart contracts on Ethereum or similar blockchain platforms using programming languages like Solidity.
CO5	Evaluate	Design and develop blockchain-based applications, from simple cryptocurrency wallets to complex decentralized applications (DApps) using tools like Truffle and Ganache.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Blockchain** Evolution of Blockchain technology Centralized vs Decentralized systems Key Concepts: Distributed ledger, peer-to-peer network, cryptography Blockchain architecture and components: blocks, nodes, transactions Public vs Private blockchain	6
2	**Cryptographic Fundamentals** Cryptography essentials: Public-key cryptography, Hash functions (SHA-256)Digital signatures, Merkle Trees, Proof of Work (PoW), Proof of Stake (PoS) Consensus algorithms: PoW, PoS, Delegated PoS, Byzantine Fault Tolerance	6
3	**Smart Contracts and Decentralized Applications (DApps)** Introduction to Smart Contracts: Concepts, characteristics, and benefits Ethereum blockchain: Overview, architecture, Ether, Gas Solidity programming: Syntax, data types, functions, modifiers Developing and deploying smart contracts using Ethereum Case studies of successful DApps	6
4	**Cryptocurrencies** Overview of Bitcoin and Ethereum Mechanism of cryptocurrency transactions and mining Wallets, public and private keys Security concerns in cryptocurrencies: 51% attacks, double-spending, wallet security Regulatory and legal issues	8
5	**Blockchain in Industry and Applications** Blockchain use cases in Finance, Supply Chain, Healthcare, IoT Introduction to Hyperledger, Corda, Quorum Building blockchain solutions for supply chain management, identity management, etc. Case studies of industry applications of blockchain	6

Learning Resources

References:

- **"Mastering Blockchain"** by Imran Bashir
- **"Blockchain Basics"** by Daniel Drescher
- **"Ethereum and Solidity: The Complete Developer's Guide"** by Chris Dannen

Websites:

- https://ethereum.org/en/
- https://www.hyperledger.org/
- https://archive.trufflesuite.com/
- https://cointelegraph.com/

CLA608MJ: – Cyber Laws		
Semester – III **Sem Code: 308** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To familiarize students with the **Information Technology Act, 2000**, including its evolution, necessity, salient features, and the powers of various authorities under the Act. • To provide knowledge about the legal provisions of **e-commerce** in India, including **digital signatures, e-governance**, and the validity of **e-contracts**.. • To understand the legal implications of **intellectual property rights (IPR)** in cyberspace, focusing on **domain names, trademark disputes, cyber squatting**, and **copyrights in digital mediums**.. • To examine the legal definitions of **Sensitive Personal Data or Information (SPDI)** and the **reasonable security practices** required for data protection in India. • To analyze **international cyber law frameworks**, including the **UNCITRAL Model Law** and the **EU Convention on Cyber Crime**.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember,	DEFINE the key terms and concepts pertaining to cyber laws.
CO2	Understand.	DESCRIBE the relevant legal provisions in detail.
CO3	Apply	DETERMINE the applicability of the legal provisions in a specific scenario.
CO4	Analyze	OUTLINE the course of action in case of violation of the legal provisions.
CO5	Evaluate	EXPLAIN the various legal, social and international issues and the various remedies available under the Information Technology Act for the breach and commission of offence in cyber space

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Information Technology Act:** Evolution of the IT Act, Genesis and Necessity, Salient features of the IT Act, 2000; various authorities under IT Act and their powers; Penalties & Offences, amendments, Cyber Space Jurisdiction, Jurisdiction issues under IT Act, 2000.	6
2	**E-commerce and Laws in India**: Digital/ Electronic Signature in Indian Laws, E-Commerce; Issues and provisions in Indian Law, E-Governance; concept and practicality in India, E-Taxation issues in Cyberspace, E-Contracts and its validity in India, Cyber Tribunal & Appellate Tribunal, Cyber Regulations	6
3	**Intellectual Property Rights**: Domain Names and Trademark Disputes, Concept of Trademark/ in Internet Era, Cyber squatting, Reverse Hijacking, Jurisdiction in Trademark Disputes, Copyright in the Digital Medium, Copyright in Computer Programmes, Copyright and WIPO Treaties, Concept of Patent Right, Relevant Provisions of Patent Act 1970.	6
4	**Personal Data Security**: Sensitive Personal Data or Information (SPDI) in Cyber Law, SPDI Definition and Reasonable Security Practices in India, Reasonable Security Practices – International perspective, Cloud Computing & Law.	8
5	**Cyber Law**: International Perspective, EDI : Concept and legal Issues, UNCITRAL Model Law, Electronic Signature Law's of Major Countries, Cryptography Laws, Cyber Law's of Major Countries, EU Convention on Cyber Crime.	6

Learning Resources

References:

- Cyber Law & Cyber Crimes by Advocate Prashant Mali, Snow White Publications, Mumbai
- Cyber Law in India by Farooq Ahmad, Pioneer Books
- Information Technology Law and Practice by Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd
- The Indian Cyber Law by Suresh T. Vishwanathan, Bharat Law House New Delhi
- Guide to Cyber and E- Commerce Laws by P.M. Bukshi and R.K. Suri, Bharat Law House, New Delhi
- Guide to Cyber Laws by Rodney D. Ryder, Wadhwa and Company, Nagpur
- The Information technology Act, 2000, Bare Act- Professional Book Publishers, New Delhi
- Computer Forensics: Principles and Practices by Linda Volonino, Reynaldo Anzaldua and Jana Godwin; Pearson Prentice-Hall

Websites:

- https://www.meity.gov.in/
- https://legislative.gov.in/
- https://www.dsci.in/
- https://www.nist.gov/
- https://www.wipo.int/portal/en/index.html
- https://copyright.gov.in/
- https://uncitral.un.org/

ETC609MJ: – Emerging Technology in Cyber Security		
Semester – III **Sem Code: 309** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To introduce the latest trends and advancements in cybersecurity technologies. • To analyze how emerging technologies address current cybersecurity challenges. • To equip students with practical knowledge of implementing cutting-edge security solutions. • To develop a critical understanding of risks and benefits associated with advanced cybersecurity tools. • To foster innovation and strategic thinking in adopting emerging technologies for cybersecurity		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Understand and evaluate emerging technologies in the cybersecurity domain
CO2	Understand.	Assess the implications of emerging technologies on data privacy and ethical considerations.
CO3	Apply	Apply advanced tools and techniques to enhance IT security.
CO4	Analyze	Develop strategic solutions for leveraging technology in securing business operations.
CO5	Evaluate	Contribute to the innovation and design of next-generation cybersecurity frameworks

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Emerging Cybersecurity Technologies** Overview of emerging trends in cybersecurity. Challenges in traditional cybersecurity approaches. Importance of adopting new technologies. Role of innovation and interdisciplinary approaches (aligned with NEP's focus on holistic and multidisciplinary education).	6
2	**Artificial Intelligence (AI) and Machine Learning (ML) in Cybersecurity** AI and ML in threat detection and response. Predictive analytics for identifying vulnerabilities. AI-based anomaly detection in network traffic. Challenges of adversarial AI and ethical considerations. NEP-aligned focus: Fostering creativity and ethical application of AI in cybersecurity.	6
3	**Cloud Security and Zero Trust Architecture**	6

	Security challenges in cloud computing. Introduction to Zero Trust Architecture: principles and implementation. Multi-cloud security and hybrid cloud solutions. Role of automation and orchestration in cloud security. NEP-aligned focus: Industry-relevant skills and sustainability in IT practices	
4	**Blockchain and Distributed Ledger Technologies** Blockchain principles: decentralization, transparency, and immutability. Blockchain applications in cybersecurity: secure authentication, identity management, and data integrity. Use cases in securing IoT and supply chains. NEP-aligned focus: Practical and innovative use of blockchain in diverse sectors.	8
5	**Quantum Computing and Post-Quantum Cryptography** Fundamentals of quantum computing and its impact on cybersecurity. Cryptographic challenges posed by quantum computing. Introduction to post-quantum cryptography and its algorithms. Strategic implications and global readiness for quantum threats. NEP-aligned focus: Global competencies and future-ready skills.	6

Learning Resources

References:

- "Artificial Intelligence in Cybersecurity" by Reza Montasari and Hamid Jahankhani.
- "Blockchain Basics: A Non-Technical Introduction" by Daniel Drescher.
- "Cloud Security Handbook" by Eyal Estrin.
- Research articles on post-quantum cryptography and emerging cybersecurity frameworks.

Websites:

- https://www.nist.gov/topics/cybersecurity/emerging-technologies
- https://www.darkreading.com/
- https://aws.amazon.com/security/blog/
- https://www.cisa.gov/
- https://csrc.nist.gov/Projects/post-quantum-cryptography
- https://www.ibm.com/quantum

BDA610MJ: – Big Data Analytics		
Semester – III **Sem Code: 310** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives		

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hodoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R..

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Identify Big Data and its Business Implications.
CO2	Understand.	List the components of Hadoop and Hadoop Eco-System Access and Process Data on Distributed File System
CO3	Apply	Apply Machine Learning Techniques using R Develop Big Data Solutions using Hadoop Eco System
CO4	Analyze	Analyze Infosphere BigInsights Big Data Recommendations.
CO5	Evaluate	Manage Job Execution in Hadoop Environment

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**INTRODUCTION TO BIG DATA AND HADOOP** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	6
2	**HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures	6
3	**Map Reduce** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	6
4	**Hadoop Eco System** **Pig :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators**.** **Hive :** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Hbase** : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS**.** **Big SQL :** Introduction	8
5	**Data Analytics with R Machine Learning :** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	6

Learning Resources

References:

- Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
- Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
- Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
- Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
- Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012
- Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
- Pete Warden, "Big Data Glossary", O'Reily, 2011.
- Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

MAN611MJ: – Marketing Analytics		
Semester – III **Sem Code: 311** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- **Understand the fundamentals of marketing analytics and its significance in making data-driven marketing decisions.**
- **Learn key marketing metrics and KPIs** for assessing marketing performance across various channels, including digital and traditional media.
- **Develop expertise in analyzing customer data** to derive insights that influence marketing strategy, segmentation, targeting, and positioning.
- **Master the use of marketing analytics tools** for measuring campaign effectiveness, ROI, and optimizing marketing efforts.
- **Understand the role of advanced analytics techniques** such as predictive modeling, customer lifetime value (CLV) analysis, and churn prediction in marketing decisions.
- **Explore the integration of marketing analytics with big data and cloud computing** to leverage large datasets and gain comprehensive marketing insights.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Use analytical techniques to segment markets, understand customer behavior, and personalize marketing efforts.
CO2	Understand.	Understand the importance of marketing analytics in strategic decision-making and how data can drive more effective marketing strategies.
CO3	Apply	Apply marketing metrics and key performance indicators (KPIs) to evaluate the performance of marketing campaigns across digital and traditional channels.
CO4	Analyze	Develop skills in advanced analytics methods, such as regression analysis, A/B testing, and predictive modeling, to forecast marketing trends and customer responses..

CO5	Evaluate	Evaluate customer lifetime value (CLV), and retention metrics and predict customer churn to optimize customer relationship management (CRM).

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Marketing Analytics** **Overview of Marketing Analytics:** Definition, Importance, and Role in Marketing Decision-Making. The Rise of Data-Driven Marketing, Key Concepts: Data, Metrics, and Models in Marketing Analytics. Challenges and Opportunities in Marketing Analytics **The Marketing Funnel and Analytics:** Customer Acquisition, Conversion, Retention, and Loyalty. Key Metrics for Each Stage of the Funnel (Impressions, Clicks, Conversion Rate, etc.)	6
2	**Data Collection and Management for Marketing Analytics** **Sources of Marketing Data:** Customer Data, Transaction Data, Social Media Data, Web Traffic Data. Structured vs. Unstructured Data in Marketing **Data Collection Tools:** CRM Systems, Web Analytics Platforms (Google Analytics), Social Listening Tools. Surveys, Focus Groups, A/B Testing for Marketing Experiments **Data Management:** Data Cleaning, Preprocessing, and Handling Missing Data. Introduction to Databases for Marketing Analytics (SQL, Data Warehouses, Cloud Databases)	6
3	**Marketing Metrics and Key Performance Indicators (KPIs)** **Overview of Marketing Metrics:** Customer Acquisition Cost (CAC) Customer Lifetime Value (CLV) Return on Marketing Investment (ROMI) Cost per Lead (CPL), Cost per Click (CPC), Click-Through Rate (CTR) Conversion Rate, Bounce Rate, Engagement Metrics (Likes, Shares, Comments) **Measuring Campaign Performance:** Digital Marketing Metrics (SEO, SEM, PPC, Email Marketing) Social Media Metrics and Analytics Traditional Marketing Metrics (TV, Print, Radio) **Marketing Dashboards:** Visualizing Marketing Data and KPIs for Decision-Making. Creating Effective Dashboards for Real-Time Monitoring	6
4	**Customer Segmentation and Targeting** **Customer Segmentation Techniques:** Demographic, Behavioral, Psychographic, and Geographic Segmentation. RFM (Recency, Frequency, Monetary) Analysis for Customer Segmentation. Cluster Analysis and Market Basket Analysis for Behavioral Insights **Targeting and Positioning:** Identifying High-Value Customer Segments Developing Targeting Strategies Based on Analytics Personalization and Tailored Marketing Strategies Based on Segmentation	8
5	**Predictive Analytics and Forecasting in Marketing** **Predictive Modeling in Marketing:** Regression Analysis for Predicting Customer Behavior Logistic Regression for Binary Outcomes (e.g.,	6

	Customer Churn) Time Series Analysis for Sales Forecasting and Demand Prediction **Customer Lifetime Value (CLV) Calculation:** Importance of CLV in Marketing Strategy Methods for Calculating CLV Using Historical Data **Churn Prediction and Retention Strategies:** Analyzing Customer Behavior to Predict Churn Designing Marketing Strategies for Customer Retention **Digital Marketing Analytics Tools:** Google Analytics, Facebook Ads Manager, Google Ads **Web Analytics:** Tracking User Behavior, Conversion, and Attribution Modeling	

Learning Resources

References:

- **Marketing Analytics: Data-Driven Techniques with Microsoft Excel"** by Wayne L. Winston
- "Marketing Analytics: Strategic Models and Metrics" by Stephan Sorger
- **"Data-Driven Marketing: The 15 Metrics Everyone in Marketing Should Know"** by Mark Jeffery
- **"Cutting-Edge Marketing Analytics: Real World Cases and Data Sets for Hands-On Learning"** by Rajkumar Venkatesan, Paul Farris, and Ronald T. Wilcox
- **"Python for Marketing Research and Analytics"** by Jason S. Schwarz, Chris Chapman, and Elea McDonnell Feit

Websites:

- **https://academy.hubspot.com/**
- **https://www.marketingprofs.com/**
- **https://www.datacamp.com/**

IT603OJT: – On The Job Training (OJT)		
Semester – III **Sem Code: 303** **LTP : 0:0:2**	**Mandatory** **Credit: 08**	**Examination Scheme:** **Internal (TH) :100 Marks** **External (TH)** : 100 Marks **Total :200 Marks**
Course Objectives • Enable students or trainees to acquire hands-on experience and develop specific job-related skills directly in the workplace. • Help trainees apply theoretical knowledge gained in the classroom to real-world tasks and challenges in their field of work. • Encourage trainees to think critically and find practical solutions to workplace challenges in real-time scenarios. • Promote personal and professional development by building confidence, work ethic, and a sense of responsibility in a structured work environment. • Equip trainees with the skills, experience, and knowledge that are directly relevant to their future job roles, making them more competitive in the job market.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	REMEMBERING	IDENTIFY and DESCRIBE the fundamental aspects of the organization and industry where the OJT is conducted, including the company's profile, core business activities, and organizational structure
CO2	UNDERSTANDING.	EXPLAIN the relevance and application of theoretical concepts learned in the classroom to real-world business practices observed during the OJT
CO3	APPLYING	UTILIZE relevant theoretical knowledge and technical skills in real-world tasks and projects during the OJT in a professional setting
CO4	ANALYSING	EXAMINE and break down the problems or tasks undertaken during the OJT, identifying the key issues, underlying causes, and possible solutions
CO5	EVALUATING	ASSESS the effectiveness of the strategies and solutions implemented during the OJT, from the standpoint of utility to the host organization, the feedback from the industry mentor.
CO6	CREATING	DEVELOP a comprehensive OJT report and presentation that integrates the learning experiences, data collected, analysis, and outcomes of the project, demonstrating a clear connection between academic knowledge and practical application.

A] Preamble:

On Job Training (OJT) is an integral component of the MBA-IT program that provides students with a unique opportunity to bridge the gap between theoretical knowledge gained in the classroom and practical application in a real-world environment. This training aims to equip students with both technical and non-technical skills that are essential for success in the industry.

Each student shall undertake an On-the-Job Training (OJT) at the end of Second Semester and complete the same before the commencement of the Third Semester.

B] Guidelines for the On-Job Training (OJT)

B - 1] Nature of the OJT:

1. The On-the-Job Training (OJT) program shall be of 12 weeks (3 months).
2. 8 weeks of training in the organization (industry / bank etc.) with 30 hours of work per week.
3. 4 Weeks of pre and post training work including proposal making, analysis, report preparation and etc.
4. OJT must be conducted outside the academic institution to expose students to real-world work environments.
5. OJT must be related to the intended specialization of the student.
6. OJT must be done individually. Group projects are not permitted.
7. OJT may involve actual tasks relevant to the area of specialization of the student and as per the demands of the industry / organization where the student is carrying out the OJT.
8. OJT should involve fieldwork / desk work in the organisation; online OJT is not permitted.
9. Primary data collection is mandatory for Research based OJT.
10. Research based OJT can be quantitative / qualitative in nature or even use mixed approaches.
11. Research based OJT can involve surveys, interviews, case studies or observation studies.
12. It is mandatory for the student to seek advance written approval from the faculty mentor and the Director of the Institute about the type of work and organization before commencing the OJT.

B-2] Permissible Partner Organizations:

Students have the flexibility to conduct the OJT with any of the following organizations:

1. Companies listed on either NSE or BSE in India /abroad
2. Unlisted subsidiaries of Listed Companies.
3. Government / Semi-Government Undertaking / PSU
4. Government Offices
5. Start Ups with an existence of 5 years or more and manpower more than 50.
6. Family managed businesses with an existence of 10 years or more and manpower more than 100.
7. Large Cooperative Societies / NGOs with an existence of 5 years or more operating in areas such as agriculture, food processing, health care, retail, banking, etc.

B-3] OJT mentors:

a) Each student shall be assigned two mentors

i. A faculty mentor from the institution

ii. An industry mentor from the host organization where the student understakes the OJT.

b) Industry Mentor Role: The industry mentor plays a crucial role in guiding the student during the internship. They ensure that the internee fulfils the requirements of the organization and successfully meets the demands of the assigned project. Through their expertise and experience, industry mentors provide valuable insights into real-world practices and industry expectations.

c) Faculty Mentor Role: The faculty mentor serves as the overall coordinator of the OJT program of the assigned / allotted students. They oversee the entire internship process and evaluate the quality of the OJT in a consistent manner across all the assigned students. The faculty mentor ensures that the OJT aligns with the MBA program's objectives and provides valuable learning opportunities. They also facilitate communication between the institution, industry mentor, and student to ensure a fruitful OJT experience.

B-4] Submission of documentation for OJT:

a) OJT Progress diary: Each student shall maintain an OJT Progress Diary detailing the work carried out and the progress achieved on a daily basis. Daily entry can be of 3- 4 sentences giving a very brief account of the learning/activities/ tasks / interaction taken place. The faculty mentor will be monitoring the entries in the diary regularly. The student shall submit the duly signed and stamped OJT Progress Diary along with the OJT Report. Soft copy diaries (with time stamp) are also permitted.

b) Formal Evaluation from the industry mentor: The students shall also seek a formal evaluation cum feedback of their OJT from the industry mentor. The formal evaluation cum feedback by the industry mentor shall comment on the nature and quantum of work undertaken by the student, the effectiveness and overall professionalism. The learning outcomes of the OJT and utility of the OJT to the host organization must be specifically highlighted in the formal evaluation cum feedback by the industry mentor. The OJT evaluation sheet duly signed and stamped by the industry mentor shall be included in the final OJT report.

c) OJT report: A student is expected to make a report based on the OJT he or she has done in an organization. The student shall submit TWO hard copies & soft copy of the OJT report to the institute. One hard copy of the OJT report is to be returned to the student by the Institute after the

External Viva-Voce. In the interest of environmental considerations, students are encouraged to print their OJT reports on both faces of the paper. Spiral bound copies may be accepted.

B-5] OJT report should contain the following:
The OJT report should be well documented and supported by –

1. Institute's Certificate
2. Certificate by the Company
3. Formal feedback from the company guide
4. Executive Summary
5. Organization profile
6. Outline of the problem/task undertaken
7. Research methodology & data analysis (in case of research projects only)
8. Relevant activity charts, tables, graphs, diagrams, pictures, screenshots, AV material, etc.
9. Learning of the student through the OJT
10. Consideration to factors such as environment, safety, ethics, cost, professional (national & international) standards
11. Contribution to the host organization
12. References in appropriate referencing styles. (APA, MLA, Harvard, Chicago Style etc.)

B-6] Interaction between mentors:

It is suggested that a meet-up involving the intern, industry mentor, and the faculty mentor should be done as a midterm review to ensure the smooth conduct of the OJT. The meeting can preferably be online to save time and resources. The meeting ensures the synergy between all stakeholders of the OJT. A typical meeting can be of around 15 minutes where at the initial stage the intern briefs about the work and interaction goes for about 10 minutes. This can be followed by the interaction of the mentors in the absence of the intern. This ensures that issues between the intern and the organization, if any, are resolved amicably.

B-7] OJT workload for the faculty:

Every student is provided with a faculty member as a mentor. So, a faculty mentor will have a few students under him/her. A faculty mentor is the overall in-charge of the OJT of the allocated students. He/she constantly monitors the progress of the OJT by regularly overseeing the diary, interacting with the industry mentor, and guiding on the report writing etc.

B-8] Evaluation Pattern:

Total Marks: 200
Formative Assessment: 100 Marks
Summative Assessment: 100 Marks

1] Formative Assessment Weightage (100 marks):

1. Executive Summary	- 05 marks
2. Organization profile	- 05 marks
3. Outline of the problem/task undertaken	- 10 marks
4. Research methodology & data analysis (in case of research projects only) OR Relevant activity charts, tables, graphs, diagrams, pictures, screenshots, AV material, etc.	- 10 marks
5. Learning of the student through the OJT	- 10 marks

6. Consideration to factors such as environment, safety, ethics, cost, professional (national & international) standards - 10 marks
7. Contribution to the host organization - 10 marks
8. References in appropriate referencing styles. (APA, MLA, Harvard, Chicago Style etc.) - 10 marks
9. Formal feedback from the company guide - 05 marks
10. Regularity of interaction with the faculty mentor - 05 marks
11. Overall quality of the OJT report - 05 marks
12. Internal Viva-Voce - 15 marks

2] Summative Assessment Weightage (100 marks):

1. There shall be a panel of 2 examiners for the Final Viva-Voce
2. University shall nominate External Examiners
3. Director shall nominate Internal Examiners
4. Presentation by each student along with a spiral bound report is mandatory
5. Students will deliver a presentation of 15 minutes about their OJT project.
6. Weightages for summative assessment shall be as follows
    a) Presentation – 20 marks
    b) Viva-Voce – 30 marks
    c) Report – 30 marks
    d) Ability to connect with the theoretical & conceptual frame work – 20 marks

The Internal & the External viva-voce shall evaluate the candidate based on:

1. Adequacy of work undertaken by the student
2. Application of concepts learned in Sem I and II
3. Understanding of the organization and business environment
4. Analytical capabilities
5. Technical Writing & Documentation Skills
6. Outcome of the project – sense of purpose
7. Utility of the project to the organization
8. Variety and relevance of learning experience

Presentation could be through any of the enlisted formats (this is an indicative list and innovative formats if any beyond this list may be adopted) –

1. Traditional Slide Deck Presentation
2. Infographics
3. Video presentation
4. Paper presentation
5. Poster presentation
6. Webinar or online presentation
7. TED-style presentation
8. Storytelling Presentation etc.

SEMESTER IV

Generic Core (GC) - Compulsory

MIS615MJ : – Management Information System		
Semester – IV **Sem Code:401** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Prerequisites		

Course Objectives

- **To understand the fundamental concepts of Management Information Systems (MIS)** and their role in business operations.
- **To identify and describe the different types of MIS**, such as Transaction Processing Systems, Management Information Systems, Decision Support Systems, and Expert Systems.
- **To explore the capabilities and complements of MIS**, including the integration of technology with business processes and decision-making.
- To u**nderstand the foundations of Business Intelligence (BI)**, including data mining, text mining, and their role in decision support and business analytics.
- To i**dentify and discuss the social, ethical, and security issues** related to the use of information systems, including privacy concerns, cybersecurity, and regulatory compliance

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Recall MIS concepts, types, and frameworks. Identify key systems and their components.
CO2	Understand	Explain the role of MIS in business. Describe the components of database management systems and BI tools.
CO3	Apply	Apply database and system design principles. Implement ERP, SCM, CRM systems. Utilize decision support tools.
CO4	Analyze	Analyze IT alignment with business goals. Compare enterprise systems in terms of functionality. Examine the potential of emerging technologies.
CO5	Evaluate	Evaluate IT strategies and their impact. Assess the ethical, social, and security implications of MIS.
CO6	Create	Propose innovative solutions for implementing emerging technologies

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of**

		Sessions
1	**Introduction to Management Information Systems** Definition and Importance of MIS Types of MIS: Transaction Processing Systems, Management Information Systems, Decision Support Systems, and Expert Systems Capabilities and Complements of MIS CCR (Content, Context, and Relationship) Framework Role of Managers with Respect to IT in an Organization: Strategic and Operational Decision Making **Database Management Systems (DBMS) and Data Warehousing** Overview of Database Management Systems (DBMS): Structure and Components Relational Databases and Data Modeling Data Warehousing: Concepts and Architecture Introduction to Data and Text Mining	8
2	**Foundations of Business Intelligence** Business Intelligence: Definition and Purpose BI Tools and Techniques Data Warehousing and Business Intelligence Integration Data Mining vs. Text Mining: Applications and Benefits	6
3	**Strategic Enterprise Systems** Overview of Strategic Enterprise Systems Enterprise Resource Planning (ERP): Components, Modules, and Benefits Supply Chain Management (SCM): Integrating Business Processes Customer Relationship Management (CRM): Enhancing Customer Experience Supplier Relationship Management (SRM): Building Strong Supplier Networks **Operational Support Systems** Manufacturing Systems: Process Control, Automation, and ERP Integration Sales and Marketing Systems: Tools for Managing Sales, Campaigns, and Customer Data Human Resource Information Systems (HRIS): Managing Employee Data and HR Functions Finance and Accounting Systems: Systems for Managing Financial Transactions, Payroll, and Reporting	8
4	**IT Strategy and Balanced Scorecard** Defining IT Strategy in Business Contexts IT-Business Alignment: Ensuring IT Supports Organizational Goals Introduction to the Balanced Scorecard Framework Cloud and Vendor Strategies: Key Considerations for IT Strategy Development **Social, Ethical, and Security Issues in MIS** Social Issues in MIS: Digital Divide, Privacy Concerns, and Cybersecurity Ethical Issues: Data Misuse, Surveillance, and Intellectual Property Security Challenges: Protecting Data, Systems, and Networks Legal and Regulatory Compliance: GDPR, HIPAA, and Other Standards	7

5	**Future Trends in MIS** Impact of Emerging Technologies on MIS The Future of Work: Remote Collaboration Tools and Artificial Intelligence Evolution of MIS with Smart Devices and IoT The Role of Blockchain and Big Data in Shaping Future Business Models Preparing for Future Trends in Technology and Innovation	6

Learning Resources

References:

- "Management Information Systems" by Kenneth C. Laudon and Jane P. Laudon
- "Essentials of Business Information Systems" by Kenneth C. Laudon
- Management Information Systems by Dr. D. B. Bharati & Rohan Dahivale Himalaya Publications
- Management Information Systems by Jawadekar, TMGH, 4 th Edition
- Management Information System- Jame O Brien- Tata Mcgraw Hill

Web links

- https://www.rhsmith.umd.edu/programs/business-masters/academics/information-systems
- https://www.coursera.org/learn/management-information-systems
- https://www.linkedin.com/learning/learning-business-intelligence
- https://www.gartner.com/en/chief-information-officer/topics/it-strategic-plan
- https://www.techtarget.com/blog/

DWA652MJ : – Data Warehousing		
Semester – IV **Sem Code: 402** **LTP : 2:2:0**	**Mandatory** **Credit: 02**	**Examination Scheme:** **External (TH)** : 50 Marks **Total :50 Marks**
Prerequisites		
Course Objectives • To introduce the concept of Data warehousing as an important tool for enterprise data management. • To make students well versed in methods of evaluation and the tools used for data warehousing.. • To provide knowledge on how to gather and analyze information for business understanding. • To impart skills that can enable students to approach business problems analytical methods		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes

CO1	Remember	Describe the key components and architecture of Data Warehousing
CO2	Understand	Explain the Data Warehouse architecture and ETL processes
CO3	Apply	Apply data modeling techniques (e.g., star schema)
CO4	Analyze	Analyze data using OLAP and data mining tools
CO5	Evaluate	Evaluate the performance of Data Warehouse systems
CO6	Create	Design and implement Data Warehouse systems

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Data Warehousing** Definition, history, and importance Components of a Data Warehouse OLTP vs OLAP **Data Warehouse Architecture** Three-tier architecture (Staging, Data Warehouse, Data Marts) Data Warehouse design concepts Data Warehouse models	8
2	**Data Modeling in Data Warehousing** Star Schema Snowflake Schema Fact tables and dimension tables **ETL (Extract, Transform, Load) Process** ETL overview Data extraction methods Data transformation techniques Loading into Data Warehouse	6
3	**Data Warehouse Indexing and Partitioning** Indexing techniques in Data Warehouses Partitioning strategies for large datasets **OLAP (Online Analytical Processing)** OLAP concepts and operations OLAP cube design OLAP tools and technologies	8
4	**Data Mining Introduction** What is Data Mining? Data mining techniques and applications Association, classification, clustering, regression **Data Warehouse Querying and Reporting** Query languages for Data Warehousing Reporting tools	7

	Data Warehousing with SQL **Performance Tuning and Optimization** Query optimization in Data Warehouses Performance bottlenecks and solutions Database partitioning and indexing	
5	**Big Data and Data Warehousing** Challenges and solutions in Big Data integration Data Warehousing in the context of Big Data Tools for Big Data in Data Warehousing (Hadoop, Spark, etc.) **Data Warehouse Security** Security issues in Data Warehouses Encryption and access controls Data privacy concerns **Emerging Trends in Data Warehousing** Cloud Data Warehousing Real-time Data Warehousing Self-service BI tools	6

Learning Resources

References:

- *"The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling"* by Ralph Kimball and Margy Ross
- *"Data Warehousing: Concepts, Techniques, Products and Applications"* by J. D. N. Rao
- *"Data Mining: Concepts and Techniques"* by Jiawei Han and Micheline Kamber
- Data Warehousing, Data Mining, and OLAP Alex Berson, Stephen J. Smith
- Data Warehousing and Mining: Concepts, Methodologies, Tools, and Applications John Wang Montclair State University, USA
- Complete Reference Data Warehouse Design: Modern Principles and Methodologies by Golfarelli & Rizz
- Data Mining and Business Analytics with R, Johannes Ledolter, Wiley, 2013, ISBN: 978-1118447147 .
- Practical Data Science with R, Nina Zumel and John Mount, Manning Publications 2014, ISBN: 9781617291562 .
- Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005, ISBN: 0-12-088407-0.

Web links

- Coursera Data Warehousing Specialization
- https://www.kimballgroup.com/
- https://docs.oracle.com/cd/B28359_01/server.111/b28318/dwh.htm
- https://cloud.google.com/bigquery
- TechTarget Data Warehousing Guide

SPECIALIZATION CORE COURSES (SC) -Compulsory

Cloud Computing

CCT653MJ : – Cloud Computing Tools And Techniques		
Semester – IV **Sem Code: 405** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand the different types of cloud computing tools used in deployment and management of cloud services.
- To explore the techniques and frameworks used for building and managing cloud infrastructure.
- To examine cloud platforms and tools, such as AWS, Microsoft Azure, GoogleCloud, and their role in cloud service delivery.
- To learn about containerization, virtualization, and orchestration techniques in cloud environments.
- To evaluate cloud security tools and techniques for ensuring the safety of cloud-based applications and data.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Recall the essential cloud tools and techniques used for cloud computing and their key functionalities
CO2	Understand	Explain the various cloud computing tools, their purpose, and how they are applied in real-world scenarios.
CO3	Apply	Apply cloud computing tools for effective management of infrastructure, virtualized environments, and applications.
CO4	Analyze	Analyze the performance and capabilities of cloud tools in optimizing cloud infrastructure and services
CO5	Evaluate	Evaluate different cloud computing techniques and their impact on efficiency, scalability, and security.
CO6	Create	Design solutions using cloud tools and techniques for deploying and managing scalable and secure cloud applications

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Cloud Computing Tools** Overview of Cloud Computing Tools: Key tools for managing cloud infrastructure, services, and applications. Cloud Platforms: AWS, Microsoft Azure, Google Cloud – Introduction, key features, and advantages. Deployment and Management Tools: Infrastructure automation, configuration management, and monitoring tools.	8
2	**Virtualization and Containerization Tools** Virtualization Technologies: VMware, Hyper-V, KVM – Virtual machines and hypervisor concepts. Containers: Docker, Kubernetes – Benefits of containerization in cloud computing. Orchestration: Kubernetes, Docker Swarm – Managing containerized applications at scale. Serverless Architectures: Introduction to serverless computing with AWS Lambda and Azure Functions.	6
3	Cloud Security Tools and Techniques Cloud Security Frameworks: Key concepts of security in multi-tenant cloud environments. Encryption and Identity Management: AWS Identity and Access Management (IAM), Azure Active Directory, Google Cloud IAM. Security as a Service (SECaaS): Tools for intrusion detection, monitoring, and threat management. Data Privacy and Compliance Tools: GDPR compliance tools, data loss prevention (DLP) in the cloud.	8
4	**Cloud Networking and Monitoring Tools** Cloud Networking Tools: Virtual private networks (VPN), SD-WAN, and network management in the cloud. Monitoring and Logging Tools: AWS CloudWatch, Azure Monitor, Google Cloud Operations Suite. Cloud Cost Management: Tools for cost estimation, budgeting, and cost optimization in cloud services. Performance Monitoring: Tools for assessing performance, scalability, and load balancing in cloud systems.	7
5	**Cloud Automation and DevOps Tools** DevOps Tools in Cloud: Jenkins, Git, Docker, Terraform – Continuous integration and deployment in the cloud. Cloud Automation Frameworks: CloudFormation, Azure Resource Manager, Google Cloud Deployment Manager. Automation for Scalability: Auto-scaling and resource allocation techniques in the cloud. CI/CD Pipelines: Building and deploying applications with automated pipelines in cloud environments.	6

Learning Resources

Books

- "Cloud Computing: Tools and Techniques" by J. K. Batra, A. K. Bansal, and Rajeev Kumar.
- "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael Kavis.
- "Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski.

Web Links

- Amazon Web Services (AWS)
- Google Cloud Platform (GCP)
- Microsoft Azure
- Docker
- Kubernetes
- Cloud Security Alliance

SPECIALIZATION ELECTIVE COURSES (SE)

SEMESTER IV

(Any 4 to be Opted for)

Cloud Computing

CCM655MJ: –Cloud Computing Management		
Semester – IV **Sem Code: 405** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To understand the key concepts and principles of cloud computing and its management. • To explore different cloud deployment models (public, private, hybrid) and service models (IaaS, PaaS, SaaS). • To examine the management practices required for efficient use and operation of cloud infrastructure and services. • To develop strategies for cloud resource management, optimization, and scaling. • To analyze the challenges and opportunities associated with cloud adoption and its integration into business operations. • To understand the role of cloud computing in business transformation and competitive advantage.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the basic concepts, models, and architecture of cloud computing
CO2	Understand	Understand the different cloud service and deployment models, and their applications in real-world scenarios
CO3	Apply	Apply best practices for managing cloud resources, including monitoring, scaling, and optimization.
CO4	Analyze	Analyze the organizational and business benefits of cloud computing in terms of efficiency, cost reduction, and innovation
CO5	Evaluate	Evaluate the challenges, risks, and governance issues associated with cloud adoption and management.
CO6	Create	Create strategies for the effective management and transformation of business processes using cloud technologies

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud computing** Cloud Computing Overview: Definition, benefits, and challenges. Cloud Computing Models: Public, private, and hybrid clouds. Cloud Service Models: IaaS, PaaS, SaaS. Key Cloud Concepts: Virtualization, scalability, elasticity, multi-tenancy.	8
2	**Cloud Deployment Models and Service Models** Cloud Deployment Models: Private, public, hybrid, and community cloud. Service Models Overview: IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service). Choosing the Right Cloud Model for Business: Factors influencing cloud model choice. Comparing Service Models: Advantages and limitations of IaaS, PaaS, and SaaS.	6
3	**Cloud Resource Management and Optimization** Managing Cloud Resources: Virtualization, provisioning, and scaling. Resource Optimization Techniques: Auto-scaling, load balancing, and resource pooling. Cost Management in Cloud: Cloud pricing models, budgeting, and cost optimization strategies. Performance Monitoring and Management: Tools and techniques for monitoring cloud performance and health.	8
4	**Cloud Adoption and Integration** Business Drivers for Cloud Adoption: Cost reduction, scalability, and agility.	7

	Cloud Integration Challenges: Integration with legacy systems, data migration, and vendor lock-in. Governance and Compliance in Cloud: Cloud governance models, data privacy, and regulatory compliance. Cloud Adoption Strategy: Frameworks for adopting and transitioning to cloud computing.	
5	**Cloud Computing in Business Transformation** Cloud as an Enabler of Business Transformation: Case studies and real-world applications. Business Models for Cloud Computing: How cloud computing supports new business models and innovation. Cloud Computing for Competitive Advantage: How businesses use cloud computing to gain a competitive edge. Cloud in Digital Transformation: The role of cloud in driving digital business transformation	6

Learning Resources

Books

- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
- "Cloud Computing: Principles, Systems and Applications" by Nikos Antonopoulos, Lee Gillam
- "Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti

Web Links

- IBM Cloud Computing
- Microsoft Azure
- AWS Cloud Computing
- Cloud Computing Architecture

CIE656MJ: – Cloud Innovations and Emerging Technologies

Semester – IV **Sem Code: 406** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- **To introduce the concepts of cloud computing** and its role in modern technology
- **To explore various cloud models** (IaaS, PaaS, SaaS) and their real-world applications
- **To evaluate emerging technologies** in the cloud space such as AI, machine learning, IoT, and blockchain.
- **To develop an understanding of cloud security issues** and their impact on cloud-based services.
- **To provide hands-on exposure** to cloud platforms and tools for practical learning.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes

CO1	Remember	Recall the fundamental concepts and terminologies of cloud computing and emerging technologies.
CO2	Understand	Explain the architecture of cloud computing and its role in enabling digital transformation
CO3	Apply	Apply cloud models to design scalable and flexible cloud-based solutions for real-world scenarios.
CO4	Analyze	Analyze cloud-based systems to identify potential risks, performance issues, and scalability concerns.
CO5	Evaluate	Evaluate the security risks associated with cloud computing and propose solutions for data privacy and protection.
CO6	Create	Develop and deploy a cloud-based application with a focus on security, scalability, and performance

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	Introduction to Cloud Computing Overview of Cloud Computing Cloud Computing Service Models (IaaS, PaaS, SaaS) Cloud Computing Deployment Models (Private, Public, Hybrid) Key cloud providers (AWS, Microsoft Azure, Google Cloud) Cloud Computing Architecture	8
2	**Cloud Innovations and Emerging Technologies** Introduction to Emerging Technologies: AI, Machine Learning, Blockchain, IoT Cloud AI and ML Integration Cloud and IoT: Applications in Smart Devices and Cities Blockchain in Cloud: Use Cases and Benefits Edge Computing and Serverless Architectures	6
3	Cloud Security and Privacy Cloud Security Challenges Data Encryption, Authentication, and Authorization in Cloud Identity and Access Management (IAM) Security Tools and Solutions for Cloud Compliance and Regulatory Issues in Cloud	8
4	Advanced Cloud Models and Architectures Hybrid Clouds: Advantages and Challenges Multi-cloud and Cross-cloud Solutions Serverless Computing: Concepts and Benefits Containerization and Kubernetes in Cloud	7
5	Future Trends and Cloud Innovations Cloud-based Big Data and Analytics Cloud 5.0 and Quantum Computing Predictive Analytics and Automation in Cloud Environments	6

	Future of Cloud Integration with Emerging Technologies The Role of Cloud in Digital Transformation	

Learning Resources

Books

- **"Cloud Computing: Concepts, Technology & Architecture",** Authors: Thomas Erl, Zaigham Mahmood, Ricardo Puttini
- **"Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)"**
  Author: Michael Kavis
- **"Cloud Security and Privacy",** Author: Tim Mather, Subra Kumaraswamy, Shahed Latif
- **"Emerging Technologies in Cloud Computing: The Cloud Era",** Author: S. K. Garg, Rajkumar Buyya, S. M. A. Kazmi
- **"Cloud Native Patterns: Designing change-tolerant software",** Author: Cornelia Davis

Web Links

- https://www.ibm.com/think/topics/cloud-computing
- https://aws.amazon.com/training/
- Google Cloud Learning
- https://cloudsecurityalliance.org/
- https://cloudsecurityalliance.org/

IWE657MJ: – Interfacing with Virtualization		
Semester – IV **Sem Code: 407** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- To understand the basic concepts and principles of virtualization.
- To explore different virtualization technologies and their application in various computing environments.
- To understand the architecture of virtualization and how it interfaces with physical resources.
- To examine different virtualization tools and platforms such as VMware, VirtualBox, and Hyper-V.
- To analyze the role of virtualization in resource management, scalability, and cloud computing.
- To develop hands-on skills in configuring and managing virtual machines and virtual networks.
- To explore the benefits and challenges of integrating virtualization into business IT infrastructures.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall the fundamental concepts and types of virtualization.
CO2	Understand	Understand the architecture of virtualization and how it interfaces with hardware resources
CO3	Apply	Apply virtualization tools and platforms for creating and managing virtual machines.
CO4	Analyze	Analyze the role of virtualization in improving scalability, resource utilization, and business efficiency.
CO5	Evaluate	Evaluate the challenges and limitations of virtualization technologies
CO6	Create	Create a virtualized infrastructure that meets business needs and integrates with cloud computing environments.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Virtualization** Definition and Importance of Virtualization: What virtualization is and why it is important in modern IT. Types of Virtualization: Hardware, software, network, and storage virtualization. Virtualization Benefits: Resource optimization, cost reduction, isolation, and scalability. Hypervisors: Type 1 (bare-metal) and Type 2 (hosted) hypervisors.	8
2	**Virtualization Architecture and Components** Virtualization Architecture Overview: Layers, components, and working of virtualization systems. Virtual Machine (VM) Components: VM configuration, virtual CPU, memory, storage, and networking. Virtualization Hosts: Hosts and guest OS, role of the hypervisor. Resource Management in Virtualized Environments: CPU, memory, and storage allocation.	6
3	VMware: Overview, features, and configuration of VMware Workstation and vSphere. VirtualBox: Setup and management of virtual machines using VirtualBox. Hyper-V: Features of Microsoft Hyper-V and its role in enterprise virtualization. Cloud-based Virtualization: Integration with cloud environments like AWS and Microsoft Azure	8
4	**Virtual Networking and Storage**	7

	Virtual Networks: Concepts of virtual LANs, virtual switches, and network adapters. Virtual Storage: Virtual disks, storage pooling, and storage area networks (SANs). Network Configuration in Virtualization: Configuring network interfaces for virtual machines. Storage Virtualization Tools: Managing virtual storage using VMware and other platforms.	
5	**Virtualization in Cloud Computing** Virtualization and Cloud Computing: Role of virtualization in enabling cloud services. Resource Allocation and Management in Clouds: Auto-scaling, load balancing, and virtualized resources. Virtual Private Cloud (VPC): Concept and use in cloud environments. Benefits of Virtualization in Cloud: Cost savings, flexibility, and scalability in cloud computing.	6

Learning Resources

Books

- "Virtualization Essentials" by Matthew Portnoy
- "Mastering VMware vSphere 6.7" by Andrea Mauro and Luca Dell'Oca
- "Virtualization and Cloud Computing with VMware: A Handbook for IT Professionals" by K. K. Shubham

Web Links

- VMware Official Site
- Oracle VirtualBox Documentation
- Microsoft Hyper-V
- Cloud Computing with Virtualization

CMM658MJ: – Cloud Migration and Management		
Semester – IV **Sem Code: 408** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- Gain a clear understanding of cloud computing models (IaaS, PaaS, SaaS), deployment types (public, private, hybrid, multi-cloud), and key cloud providers (AWS, Azure, Google Cloud).
- Learn how to assess an organization's readiness for cloud migration, create migration plans, and choose appropriate migration approaches (Lift-and-Shift, Re-platforming, Refactoring).
- Design, manage, and optimize cloud infrastructure, including workload distribution, auto-scaling, and disaster recovery
- Identify security risks in cloud environments, implement best practices for identity management, data protection, and ensure compliance with regulatory standards like GDPR, HIPAA.
- Stay updated on trends like serverless architecture, edge computing, multi-cloud strategies, and green cloud computing to enhance cloud management efficiency.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	**Develop cloud migration strategies** for enterprises, including evaluating migration readiness, planning, and execution.
CO2	Understand.	**Understand cloud computing concepts** and models, including IaaS, PaaS, and SaaS.
CO3	Apply	**Apply cloud management best practices**, including monitoring, scaling, resource optimization, and governance
CO4	Analyze	**Identify and mitigate cloud security risks** and ensure compliance with industry regulations.
CO5	Evaluate	**Evaluate different cloud service providers** and understand the technical, financial, and security implications of cloud adoption..

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to Cloud Computing and Migration: **Cloud Computing Models:** IaaS, PaaS, SaaS. **Types of Cloud Deployment:** Public, Private, Hybrid, and Multi-cloud. **Cloud Migration Overview:** Need for migration, migration drivers, challenges, and benefits. **Key Cloud Providers:** Overview on AWS, Microsoft Azure, Google Cloud. **Assessing Cloud Readiness and Migration Strategy:** Considerations and evaluation frameworks	6
2	Cloud Migration Phases and Approaches: **Phases of Cloud Migration:** Planning, Discovery, Assessment, Design, Migration, Validation, Optimization. **Cloud Migration Approaches:** Lift-and-Shift, Re-platforming, Re-architecting, Refactoring, Hybrid Migration. **Data Migration to Cloud:** Tools, techniques, and best practices. **Testing & Validation Post Migration. Case Study Analysis of Cloud Migrations**	6
3	Cloud Architecture and Application Management: **Cloud Infrastructure Design and Management. Workload Distribution and Load Balancing. Auto-scaling, High Availability, and Disaster Recovery. Containerization and Microservices Architecture (e.g., Kubernetes, Docker). Continuous Integration and Continuous Deployment (CI/CD) in the Cloud**	6
4	Cloud Governance, Security, and Compliance: **Cloud Governance:** Policies, automation, and governance tools. **Cloud Security Management:** Identity and Access Management (IAM), Encryption, Data Loss Prevention, Network Security, Threat Detection. **Compliance and Regulatory Standards in Cloud:** GDPR, HIPAA, SOC 2, etc. **Managing SLAs, Contracts, and Vendor Lock-in**	8

5	Advanced Cloud Management and Automation: **Cloud Monitoring and Performance Management. Cloud Orchestration and Automation Tools. DevOps Practices in Cloud Management. Artificial Intelligence and Machine Learning in Cloud Management. Hybrid Cloud Management Platforms** **Cloud Cost Management Strategies. Cloud Cost Optimization Tools:** Right-sizing, Reserved Instances, Spot Instances	6

Learning Resources

References:

- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
- "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
- "Cloud Migration: Innovative Tools for Successful Cloud Migration" by Daniel Cook
- "Cloud Management and Security" by Imad M. Abbadi
- "AWS Certified Solutions Architect – Official Study Guide" by Joe Baron, Hisham Baz, and Tim Bixler
-

Websites:

- https://aws.amazon.com/migration-hub/
- https://azure.microsoft.com/en-us/migration/
- https://cloud.google.com/migration-center
- https://cloudacademy.com/
- https://www.cncf.io/
- https://www.coursera.org/specializations/cloud-computing

CCS659MJ: – Cloud Computing Security Architecture		
Semester – IV **Sem Code: 409** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • Learn the foundational concepts of cloud security and how they differ from traditional IT security. • Develop the ability to design cloud architectures that incorporate robust security measures and align with business goals. • Explore and apply different cloud security models, including preventive, detective, and corrective controls. • Learn to identify and mitigate security risks unique to cloud environments, such as data breaches, insecure interfaces, and insider threats. • Implement secure authentication and authorization mechanisms, including multi-factor authentication and role-based access control.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	**Understand incident response and disaster recovery strategies** in the context of cloud environments.
CO2	Understand.	**Understand the fundamentals of cloud security** and how it differs from traditional IT security.
CO3	Apply	**Apply Identity and Access Management (IAM)** strategies and secure authentication mechanisms in cloud environments. **Design secure cloud architectures** that align with business objectives and regulatory requirements.
CO4	Analyze	**Implement cloud security controls** and frameworks to protect cloud infrastructures and data. **Identify and mitigate cloud-specific security risks** including data breaches, insider threats, and vulnerabilities.
CO5	Evaluate	**Evaluate and apply encryption techniques** for data protection in transit and at rest in cloud environments.
CO6	Create	**Develop a cloud security governance framework** to ensure continuous monitoring and auditing of cloud resources.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to Cloud Security Architecture: **Cloud Computing Overview**: Cloud models (IaaS, PaaS, SaaS), cloud deployment types (public, private, hybrid, multi-cloud). **Cloud Security Architecture**: Key principles, shared responsibility model, cloud security reference models. **Differences between Traditional and Cloud Security**: Key challenges and considerations in cloud environments. **Cloud Security Providers**: AWS, Azure, Google Cloud security tools and service	6
2	Identity and Access Management (IAM) in the Cloud: **Identity and Access Management (IAM)**: Concepts, best practices in cloud environments. **Authentication & Authorization**: Role-based access control (RBAC), least privilege, multi-factor authentication (MFA). **Cloud IAM Services**: AWS IAM, Azure Active Directory, Google Cloud IAM. **Federated Identity Management and Single Sign-On (SSO)**	6
3	Cloud Security Controls and Frameworks: **Security Controls in the Cloud**: Preventive, detective, and corrective controls. **Cloud Security Frameworks**: Cloud Security Alliance (CSA), ISO/IEC 27017, NIST Cloud Computing Security Framework. **Data Protection and Encryption**: Data-at-rest, data-in-transit encryption, key management. **Cloud Security Posture Management (CSPM)**: Monitoring and management tools for compliance	6
4	Risk Management and Threats in Cloud Computing: **Cloud-Specific Threats**: Data breaches, account hijacking, insecure interfaces, Denial-of-Service (DoS), insider threats **Risk Assessment and Management in the Cloud**: Risk mitigation strategies, tools, and techniques. **Incident Response in Cloud Security**: Detection, response, and recovery plans for cloud-based incidents. **Vulnerability Management**: Patching, monitoring, and vulnerability scanning	8

5	Cloud Encryption and Data Security Techniques: **Encryption Techniques for Cloud Data**: Symmetric vs. asymmetric encryption, key management systems. **Cloud Provider Encryption Services**: AWS KMS, Azure Key Vault, Google Cloud Key Management. **Encryption in Use**: Homomorphic encryption and other emerging encryption technologies. **Data Masking, Tokenization, and Anonymization**: Protecting sensitive data in the cloud	6

Learning Resources

References:

- "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif
- "Cloud Security: A Comprehensive Guide to Secure Cloud Computing" by Ronald L. Krutz and Russell Dean Vines
- "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
- "Security and Privacy in Cloud Computing" by Siani Pearson and George Yee
- "AWS Certified Security Specialty Study Guide" by Marcello Zillo

Websites:

- https://cloudsecurityalliance.org/
- https://aws.amazon.com/security/
- https://azure.microsoft.com/en-us/services/security-center/
- https://www.nist.gov/programs-projects/cloud-computing
- https://cloud.google.com/security/

FSD660MJ: – Fundamentals of Storage and Data Centers		
Semester – IV **Sem Code: 410** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Prerequisites		
Course Objectives • To provide students with a deep understanding of data storage systems and modern data center infrastructures. • It focuses on storage technologies, data management, virtualization, cloud storage, data center design, and operational management. • To emphasize on strategic decision-making for the deployment, management, and optimization of storage and data center resources in alignment with business goals. • To provide insight into how these systems support enterprise operations, improve efficiency, and ensure business continuity		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	**Explain how the storage technologies** such as SAN, NAS, and DAS, and how they are applied in enterprise environments.
CO2	Understand.	**Understand data protection techniques**, including backups, disaster recovery, and high availability in data centers.
CO3	Apply	**Apply virtualization and cloud storage concepts** in modern IT infrastructure, including hybrid cloud environments.
CO4	Analyze	**Analyze and optimize data center efficiency**, focusing on energy consumption, scalability, and cost management.
CO5	Evaluate	**Implement storage security measures** to ensure the confidentiality, integrity, and availability of data.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to Data Storage: **Data Storage Concepts**: Basic storage models (block, file, and object storage). **Types of Storage Technologies**: Direct Attached Storage (DAS), Network Attached Storage (NAS), Storage Area Network (SAN). **Cloud Storage Models**: Private, public, hybrid cloud storage. **Key Storage Metrics**: Capacity, performance, IOPS, latency, throughput. **Storage Tiers**: Cold, warm, hot storage	6
2	Data Center Infrastructure Overview: **Introduction to Data Centers**: Definition, purpose, and evolution. **Key Components of Data Centers**: Power, cooling, networking, servers, and storage. **Types of Data Centers**: Enterprise, cloud-based, colocation, and edge data centers. **Tier Classification of Data Centers**: Uptime Institute's data center tiers (Tier I to Tier IV). **Data Center Physical Security and Environmental Controls**	6
3	Storage Systems and Architectures: **Block Storage vs. File Storage**: Concepts, use cases, and architectures. **RAID (Redundant Array of Independent Disks)**: RAID levels, benefits, and trade-offs. **Storage Virtualization**: Concepts, benefits, and technologies. **Networked Storage Solutions**: SAN and NAS architecture, Fiber Channel, iSCSI. **Hyper-Converged Infrastructure (HCI)**: Converging compute, storage, and networking	6
4	Data Center Design and Management: **Data Center Design Considerations**: Space planning, power distribution, and airflow management. **Energy Efficiency in Data Centers**: PUE (Power Usage Effectiveness) and DCiE (Data Center Infrastructure Efficiency). **Green Data Centers**: Energy-efficient designs, renewable energy usage. **Data Center Monitoring and Management**: Tools and platforms (DCIM). **Cost Optimization Strategies in Data Centers**	8

5	Data Center Networking and Security: **Networking in Data Centers**: Ethernet, Fiber Channel, InfiniBand. **Storage Network Protocols**: iSCSI, Fiber Channel over Ethernet (FCoE), NVMe over Fabrics. **Data Center Security**: Physical security, access control, network security, firewalls. **Data Encryption**: In-transit and at-rest encryption methods. **Compliance and Regulatory Requirements**: GDPR, HIPAA, PCI DSS	6

Learning Resources

References:

- "Data Center Handbook" by Hwaiyu Geng
- "Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and Filing Systems" by Marc Farley
- "Enterprise Data Center Design and Methodology" by Rob Snevely
- "Mastering Cloud Computing: Foundations and Applications Programming" by Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi
- "Cloud Data Management and Storage" by Geoff Bacon

Websites:

- https://blogs.vmware.com/storage/
- https://aws.amazon.com/products/storage/
- https://azure.microsoft.com/en-us/services/storage/
- https://cloud.google.com/storage

CCD661MJ: – Cloud computing & Devops		
Semester – IV **Sem Code: 411** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- Understand the fundamentals of DevOps, its principles, and its role in the modern software development life cycle.
- Gain insights into the skills required for a DevOps engineer in the current market and how to implement a DevOps culture in organizations.
- Learn about the DevOps delivery pipeline and its stages, from coding to testing to deployment.
- Explore the tools used in DevOps such as Git, Jenkins, Docker, and Kubernetes, and their significance in automating and streamlining development and deployment processes.
- Understand the importance of cloud computing in the context of DevOps, including cloud and virtualization architecture, cloud deployment models, and the role of cloud providers.
- Learn how to implement DevOps on the cloud, specifically using Amazon Web Services (AWS), and understand its integration with DevOps practices.
- Become proficient in version control with Git, including setup, commands, workflows, and best practices.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Comprehend the core principles of DevOps and its market trends, and recognize the technical challenges DevOps practitioners face.
CO2	Understand.	Navigate through the DevOps delivery pipeline and understand the tools involved in each stage, including version control, integration, deployment, and monitoring..
CO3	Apply	Apply to Understand cloud computing fundamentals and why DevOps is essential for cloud environments, with a focus on Amazon Web Services (AWS).
CO4	Analyze	Demonstrate hands-on experience with Git, including version control, branching, and merging, and apply these skills to real-world software development scenarios.
CO5	Evaluate	Set up and manage Jenkins for Continuous Integration (CI), automating build processes and deployments.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to DevOps** • DevOps Principles in detail • DevOps Engineer Skills in the market • Knowing DevOps Delivery Pipeline • Market trend of DevOps • DevOps Technical Challenges • Tools we use in DevOps	7
2	**DevOps on Cloud** • Essentials of Cloud computing? • Cloud and virtualization architecture • Cloud deployment architecture • Cloud providers – An overview • Why we need DevOps on Cloud? • Introducing to Amazon web services	6
3	**GIT** – A Version controlling tool • Knowing about Version control • Git – A CLI • Essentials of GIT in industry • How to setup GIT • Working with various commands in GIT • Recording Changes to the Repository• Viewing the Commit History• Undoing Things• Working with Remotes• Branching and Merging in Git	6
4	**Jenkins** • Essentials of Continuous Integration • An example scenario where CI is used • Know about Jenkins and its architecture in detail • Jenkins tool Management in detail • Know about User management in Jenkins • Authentication• Authorization • Overview of Maven • Creating jobs and automatic build settings	8
5	**Docker** • Introduction• Working with container• Introduction to Docker Networking. Docker Swarm – An introduction. Kubernetes • Introduction to Kubernetes • Kubernetes Cluster Architecture — An overview • Understanding concepts of Pods, Replica sets, deployments and namespaces • Understanding the concepts of services and networking • Persistent volumes and persistent volume claims —an overview • Design of Pods • Understanding labels, selectors, jobs, and schedulers	7

Learning Resources

References:

- "The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win" by Gene Kim, Kevin Behr, and George Spafford
- "The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations" by Gene Kim, Patrick Debois, John Willis, and Jez Humble
- "Pro Git" by Scott Chacon and Ben Straub
- "Jenkins: The Definitive Guide" by John Ferguson Smart
- "Docker Deep Dive" by Nigel Poulton
- "Kubernetes Patterns: Reusable Elements for Designing Cloud-Native Applications" by Bilgin Ibryam and Roland Huß

Websites:

- **https://git-scm.com/doc**
- **https://www.jenkins.io/doc/**
- **https://aws.amazon.com/training/**

CAM662MJ: – Cloud Analytics		
Semester – IV **Sem Code: 412** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: **50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**

Course Objectives

- **Understand the fundamentals** of marketing analytics and its significance in making data-driven marketing decisions**.**
- **Learn key marketing metrics and KPIs** for assessing marketing performance across various channels, including digital and traditional media.
- **Develop expertise in analyzing customer data** to derive insights that influence marketing strategy, segmentation, targeting, and positioning.
- **Master the use of marketing analytics tools** for measuring campaign effectiveness, ROI, and optimizing marketing efforts.
- **Understand the role of advanced analytics techniques** such as predictive modeling, customer lifetime value (CLV) analysis, and churn prediction in marketing decisions.
- **Explore the integration of marketing analytics with big data and cloud computing** to leverage large datasets and gain comprehensive marketing insights.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Use analytical techniques to segment markets, understand customer behavior, and personalize marketing efforts.
CO2	Understand.	Understand the importance of marketing analytics in strategic decision-making and how data can drive more effective marketing strategies.
CO3	Apply	Apply marketing metrics and key performance indicators (KPIs) to evaluate the performance of marketing campaigns across digital and traditional channels.

CO4	Analyze	Develop skills in advanced analytics methods, such as regression analysis, A/B testing, and predictive modeling, to forecast marketing trends and customer responses..
CO5	Evaluate	Evaluate customer lifetime value (CLV), and retention metrics and predict customer churn to optimize customer relationship management (CRM).

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud Computing and Analytics** **Overview of Cloud Computing:** Definition, History, and Evolution of Cloud Computing. Cloud Service Models: IaaS, PaaS, SaaS. Cloud Deployment Models: Public, Private, Hybrid, Community **Introduction to Cloud Analytics:** Definition and Role of Analytics in the Cloud. Advantages and Challenges of Cloud Analytics. Traditional Analytics vs. Cloud-Based Analytics. Key Use Cases and Trends in Cloud Analytics	6
2	**Cloud Computing for Big Data and Analytics** **Big Data and Cloud Computing:** Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value). The Role of Cloud in Big Data Storage and Processing. Cloud-Based Storage Solutions (Amazon S3, Google Cloud Storage, Azure Blob Storage). Data Lakes and Data Warehouses on the Cloud (Snowflake, BigQuery, Redshift) **Cloud Analytics Platforms:** Introduction to AWS Analytics (EMR, Redshift, Kinesis). Google Cloud Analytics (BigQuery, Dataflow, Dataproc). Microsoft Azure Analytics (Synapse, Databricks, Data Lake)	6
3	**Data Management and Analytics in the Cloud** **Cloud-Based Data Pipelines:** Data Ingestion, Transformation, and Storage on the Cloud. ETL (Extract, Transform, Load) in the Cloud. Data Integration from Multiple Sources in Cloud Environments. Real-Time vs. Batch Data Processing **Analytics Frameworks:** Apache Hadoop, Apache Spark in the Cloud. Serverless Computing for Analytics (AWS Lambda, Google Cloud Functions). Running Machine Learning and AI Models on the Cloud	6
4	**Business Intelligence (BI) and Cloud Analytics** **BI on the Cloud:** Using Cloud-Based BI Tools (Power BI, Tableau, Looker) Data Visualization and Dashboards in Cloud Analytics Self-Service Analytics and Collaboration on the Cloud Integrating BI with Cloud Data Warehouses **Predictive and Prescriptive Analytics:** Running Predictive Analytics Models in the Cloud. Cloud Platforms for AI and Machine Learning (AWS SageMaker, Google AI, Azure Machine Learning) Prescriptive Analytics for Business Decision-Making	8
5	**Cloud Analytics Security and Compliance** **Security Challenges in Cloud Analytics:** Data Privacy and Data Governance in the Cloud Encryption, Access Control, and Identity	6

	Management in Cloud Environments Best Practices for Securing Data in the Cloud **Compliance in Cloud Analytics:** Compliance Regulations (GDPR, CCPA, HIPAA). Cloud Security Standards and Certifications (ISO/IEC 27001, SOC 2). Risk Management and Incident Response on the Cloud	

Learning Resources

References:

- "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
- "Big Data Analytics with Hadoop 3" by Sridhar Alla
- "Cloud Computing for Dummies" by Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper
- "Cloud Computing and Big Data: Technologies and Applications" by Md. Zia Ur Rahman
- "Cloud Analytics with Google Cloud Platform" by Sanket Thodge

Websites:

- https://aws.amazon.com/big-data/datalakes-and-analytics/
- https://azure.microsoft.com/en-in/services/analytics/
- https://www.qa.com/self-paced-learning/

SPECIALIZATION CORE COURSES (SC) – Compulsory

Full Stack Development

AJP653MJ: – Advance Java Programing		
Semester – IV **Sem Code: 403** **LTP : 2:2:1**	**Mandatory** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To remember concepts such as Java Beans, Servlets, JSP, and JDBC • To understand how object-oriented programming (OOP) principles can be applied in Java in building scalable enterprise applications. • To develop Java-based web applications using Servlets, JSP, and other Java EE technologies. • To understand and analyze different application servers and web containers like Apache Tomcat.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall advanced Java programming concepts including Java Beans, Servlets, JSP, and JDBC.
CO2	Understand	Understand how to use design patterns like MVC in Java-based applications.

CO3	Apply	Develop a dynamic web application using Servlets and JSP.
CO4	Analyze	Analyze the structure and design of Java-based enterprise applications and suggest improvements.
CO5	Evaluate	Assess the performance and scalability of Java EE applications.
CO6	Create	Build and deploy a web application using Java EE, with a focus on secure, scalable, and maintainable code.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Advanced Java Fundamentals** Overview of Java EE (Enterprise Edition). Advanced Object-Oriented Programming (OOP) concepts in Java. Introduction to Java Beans, Servlets, and JSP. Exception handling in Java.	6
2	**Java Servlet Programming** Introduction to Servlets: life cycle, architecture, and structure. HTTP and session management in Java web applications. Writing and deploying Servlets. Handling forms and request-response cycle.	6
3	**JavaServer Pages (JSP)** Introduction to JSP: JSP architecture and components. JSP scripting elements, directives, and tags. Using JSP with Servlets for dynamic web applications. Implicit objects in JSP	6
4	**Java Database Connectivity (JDBC)** Introduction to JDBC: connection establishment, Statement, PreparedStatement, and ResultSet. Handling exceptions and transactions in JDBC. Working with relational databases in Java. Database connection pooling.	6
5	**Java Security & Performance Optimization** Securing Java web applications: SSL/TLS, authentication, authorization. Common security vulnerabilities and their mitigation (SQL injection, XSS, etc.). Performance tuning techniques for Java applications.	6

Learning Resources

References:

- "Java EE 7: The Big Picture", Author: N. K. Goundar
- "Core Java Volume I - Fundamentals", Author: Cay S. Horstmann (Indian Edition)
- Java Programming", Author: Balagurusamy
- HEAD FIRST SERVLETS & JSP, Bryan Basham , Kathy Sierra , Bert Bates
- Web Application using JSP (Java Server Page) By P. Karthik

Web links

- https://www.tutorialspoint.com/java/index.htm
- https://www.geeksforgeeks.org/java/
- https://www.geeksforgeeks.org/java/
- https://www.javatpoint.com/servlet-tutorial

SPECIALIZATION ELECTIVE COURSES (SE)

SEMESTER IV

(ANY 4 TO BE OPTED FOR)

FULL STACK DEVELOPMENT

MDE655MJ: – MERN Development		
Semester – IV **Sem Code: 405** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To Understand the core concepts of the MERN stack (MongoDB, Express.js, React.js, Node.js) • Comprehend how the components of the MERN stack interact and integrate to create full-stack web applications. • Develop simple web applications using React.js for front-end and Node.js for back-end • Evaluate different solutions for database queries and user authentication within the MERN stack.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Identify and describe the key components of the MERN stack: MongoDB, Express.js, React.js, and Node.js.
CO2	Understand	Explain how the MERN stack works and how different components interact with each other
CO3	Apply	Build a front-end using React.js, integrating components, state, and props
CO4	Analyze	Compare different methods of handling server-side routing and client-side state management in React
CO5	Evaluate	Evaluate different techniques for improving the performance and scalability of MERN applications.
CO6	Create	Design and develop a full-fledged MERN stack web application

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Full-Stack Development and MERN Stack** Overview of full-stack development. Introduction to the MERN stack: MongoDB, Express.js, React.js, and Node.js. Basic setup and environment configuration.	6
2	**Node.js Basics** Introduction to Node.js: architecture and features. Setting up a Node.js environment and creating a simple server. Event-driven architecture and asynchronous programming in Node.js. **Express.js for Building APIs** Introduction to Express.js and setting up routes. Middleware and request handling. Creating a simple API for the back-end.	8
3	MongoDB Basics and Integration with Node.js Introduction to MongoDB: data modeling and CRUD operations. MongoDB syntax and querying. Integrating MongoDB with Node.js using Mongoose.	6
4	**Introduction to React.js** Introduction to React.js: components, JSX, and state. Setting up React application using Create React App. React component life cycle and event handling. **Building Interactive User Interfaces with React** Handling user input and events in React. Working with forms and validation. Using React Router for navigation	8
5	**RESTful API Development with Express.js and MongoDB** Designing RESTful APIs with Express.js. CRUD operations using MongoDB and Express.js. Authentication using JWT (JSON Web Tokens). **Integrating React.js with Express.js and MongoDB** Connecting React front-end with Node.js back-end. Using Axios or Fetch for API requests from React. Displaying data dynamically from MongoDB.	8

Learning Resources

References:

- "MERN Stack Development", Author: Sandeep Soni
- "React: The Complete Guide", Author: Chandra Sekhar
- **MERN Quick Start Guide, Eddy Wilson**
- **Beginning MERN Stack - Greg Lim**

Web links

- https://www.freecodecamp.org/news/mern-stack-roadmap-what-you-need-to-know-to-build-full-stack-apps/
- https://www.geeksforgeeks.org/mern-stack/

- https://www.youtube.com/playlist?list=PL4cUxeGkcC9iJ_KkrkBZWZRHVwnzLIoUE
- https://github.com/SarangaSiriwardhana9/Student-Management-System-Using-MERN-STACK
- https://ijsrem.com/download/student-faculty-hub-using-mern-stack/

AJS656MJ: – Angular JS		
Semester – IV **Sem Code: 406** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To understand the key concepts of AngularJS and its architecture • To comprehend the role of directives, data binding, and dependency injection in AngularJS development • To create dynamic, interactive, and responsive web applications using AngularJS • To analyze the interaction between AngularJS components and understand the application flow.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	To remember the architecture and features of AngularJS, including modules, components, directives, and services.
CO2	Understand	To understand the concepts of two-way data binding, dependency injection, and directives in AngularJS
CO3	Apply	To build interactive and dynamic web applications using AngularJS, integrating components and services
CO4	Analyze	To analyze the structure of AngularJS applications and troubleshoot common issues.
CO5	Evaluate	To evaluate the performance of AngularJS applications and implement optimization techniques.
CO6	Create	To design and develop a full-featured single-page web application using AngularJS

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to AngularJS** Overview of AngularJS and its ecosystem. Setup and installation of AngularJS. Architecture of AngularJS applications: Modules, Controllers, and Views.	6
2	**AngularJS Modules and Components** What is an AngularJS module and how to create one. Introduction to components in AngularJS. Understanding the component life cycle.	8

	AngularJS Directives Understanding directives in AngularJS. Built-in directives (ng-model, ng-repeat, ng-if, ng-show, etc.). Creating custom directives	
3	**Data Binding and Dependency Injection** Two-way data binding in AngularJS. One-way data binding and how to use it. Introduction to dependency injection in AngularJS. **Controllers in AngularJS** Understanding AngularJS Controllers. Working with scope and data binding in controllers. Defining and using controller functions.	6
4	AngularJS Services **Introduction to AngularJS services.** **Creating and using custom services.** **Built-in services: $http, $location, $timeout, etc.** **AngularJS Routing and Navigation** **Introduction to routing in AngularJS.** **Setting up routes using the ngRoute module.** **Navigating between different views using AngularJS router.**	8
5	**AngularJS Forms and Validation** Working with forms in AngularJS. Validation of forms using AngularJS. Custom form validations and error handling. **AJAX and HTTP Requests in AngularJS** Making AJAX requests using AngularJS $http service. Handling asynchronous requests in AngularJS. Working with RESTful APIs.	8

Learning Resources

References:

- "AngularJS: Up and Running", Author: Shivprasad Koirala
- "Mastering AngularJS", Author: Arun S. R.
- "AngularJS for .NET Developers", Author: Bharat Suneja

Web links

- **https://www.freecodecamp.org/news/tag/angularjs/**
- **https://www.geeksforgeeks.org/angularjs/**
- **https://docs.angularjs.org/guide**
- **https://www.w3schools.com/angular/**

RJS657MJ: – React JS		
Semester – IV **Sem Code: 407** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 marks**

Course Objectives

- To u**nderstand the fundamentals of React JS** and its role in developing modern web applications.
- **To learn to build interactive user interfaces** using React components, state, and props.
- **To explore the concept of React lifecycle methods** and how they help manage component states and interactions.
- **To understand how to manage application state** with tools like Context API and Redux.
- **To apply React hooks** such as useState, useEffect, and useContext to optimize functional components.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall key React concepts such as components, state, props, and React hooks. Identify different lifecycle methods.
CO2	Understand	Explain the role of React in building web applications. Describe how to manage state in React and how React Router works.
CO3	Apply	Implement React components and manage their states using useState and useEffect. Demonstrate routing in React apps.
CO4	Analyze	Analyze the performance implications of different state management techniques. Compare functional components and class components
CO5	Evaluate	Evaluate React applications for performance, usability, and scalability.
CO6	Create	Build a React app with routing and state management. Develop complex applications using Redux

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	Introduction to React What is React? History and evolution. React's role in modern web development. Setting up the development environment (Node.js, npm, Create React App). Introduction to React components and JSX. Rendering React elements to the DOM.	6
2	React Components Functional components vs. Class components. Component properties (props) and component state. Handling events in React. Building and reusing components.	6

3	React Component Lifecycle Introduction to React lifecycle methods (componentDidMount, componentWillUnmount, etc.). Using lifecycle methods in class components. Handling side-effects with useEffect hook in functional components.	6
4	React Hooks Introduction to React hooks: useState, useEffect, and useContext. Building functional components with hooks. Managing local component state with useState. Handling side effects with useEffect Managing State in React Lifting state up between components. Context API for managing global state. Introduction to Redux for complex state management. Setting up Redux in a React application.	8
5	Routing with React Router Introduction to React Router. Setting up routes and navigation in a React app. Dynamic routing and nested routes. Programmatic navigation with useHistory and Link components. Styling in React CSS-in-JS using styled-components. Using external CSS and CSS modules. Managing themes and global styles in React apps. Responsive design with React.	8

Learning Resources

References:

- "React JS by Example" by Krishna Rungta
- "React: Up and Running" by Stoyan Stefanov (Indian Edition)
- "React Native for Mobile Development" by Ravindra K. Gohil
- "Mastering React" by Adam Freeman (Indian Edition)

Web links

- **https://www.w3schools.com/REACT/DEFAULT.ASP**
- **https://legacy.reactjs.org/docs/getting-started.html**
- **https://www.freecodecamp.org/news/free-react-course-2022/**
- **https://www.codecademy.com/learn/react-101**
- **https://scrimba.com/learn-react-c0e**

RPR658MJ: –R Programming		
Semester – IV **Sem Code: 408** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal(TH)**: 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives		

- To i**ntroduce students to the fundamentals of R programming**
- To e**quip students with skills** to import, clean, manipulate, and analyze data using R.
- To e**nable students to visualize data** and communicate results effectively using R's plotting capabilities (ggplot2).
- To t**each students the principles of statistical analysis** using R, including hypothesis testing, regression, and probability distributions.
- To d**evelop students' ability to write R functions** and apply them in solving real-world problems efficiently.

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Recall fundamental concepts of R, including data structures, functions, and packages. Identify key R functions and libraries
CO2	Understand	Explain R syntax, data types, and structures. Describe how to use R for statistical analysis and data visualization.
CO3	Apply	Apply R functions for data cleaning, manipulation, and analysis. Demonstrate basic and advanced data visualizations
CO4	Analyze	Analyze data trends and relationships using statistical methods. Compare R libraries for different types of analysis.
CO5	Evaluate	Evaluate the performance of different statistical models.
CO6	Create	Design data analysis workflows using R. Develop functions and scripts for automating analysis.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to R Programming** Introduction to R and RStudio. Basic R syntax, data types (vectors, lists, data frames). Arithmetic and logical operations in R. Introduction to R packages and functions. Data structures in R: vectors, matrices, arrays, lists, data frames	6
2	**Data Manipulation in R** Importing and exporting data (CSV, Excel, JSON). Data cleaning: handling missing values, duplicates, and data transformations. Data manipulation using dplyr, tidyr for filtering, sorting, summarizing, and reshaping data. Working with dates and factors.	6
3	**Data Visualization in R** Introduction to basic plotting in R (base R plots). Advanced data visualization with ggplot2. Customizing plots: titles, axes, legends, and themes. Visualizing different types of data: histograms, scatter plots, box plots, bar plots.	6

	Creating multi-panel plots.	
4	**Statistical Analysis in R** Descriptive statistics: mean, median, standard deviation, variance, correlation. Inferential statistics: hypothesis testing, t-tests, chi-square tests, ANOVA. Probability distributions: normal, binomial, Poisson, and others. Random number generation in R.	8
5	**Linear and Logistic Regression in R** Simple and multiple linear regression in R. Model diagnostics: residuals, multicollinearity, and heteroscedasticity. Logistic regression for classification tasks. Model evaluation: ROC curves, confusion matrix, accuracy, precision, recall.	8

Learning Resources

References:

- "Hands-On Programming with R" by Garrett Grolemund (Indian Edition)
- "R Programming for Data Science" by Raj (Indian Author)
- "Statistics with R" by Ashish Ranjan Jha (Indian Author)
- "R for Data Science" by Hadley Wickham and Garrett Grolemund (Indian Edition)

Web links

- https://www.r-project.org/
- DataCamp - R Programming
- https://www.khanacademy.org/math/statistics-probability
- https://education.rstudio.com/
- **ggplot2 Documentation**
- **https://www.learn-r.org/**

AWD659MJ: – Advance Web Development		
Semester – IV **Sem Code: 409** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** Internal (TH) : 50 Marks **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • **To understand** advanced front-end technologies and tools used in modern web development • **To analyze** the architecture and components of complex web applications, including single-page applications (SPAs) and RESTful APIs (Comprehension • **To design** and implement dynamic, responsive, and high-performance web applications using modern front-end frameworks • **To apply** security principles and best practices for developing secure web applications		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Describe the key concepts of advanced web technologies
CO2	Understand	Explain front-end and back-end web architecture
CO3	Apply	Develop dynamic and responsive web applications
CO4	Analyze	Build and deploy Progressive Web Apps
CO5	Evaluate	Assess the security and performance of web apps
CO6	Create	Design and implement a full-stack web application

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Advanced Web Development** Overview of Modern Web Development Front-end vs Back-end Development Tools and IDEs for Advanced Web Development **Advanced HTML5 and CSS3** New HTML5 Features (Forms, APIs) Advanced CSS3 (Grid, Flexbox, Animations) Responsive Web Design using Media Queries	6
2	**JavaScript ES6+ and Advanced JavaScript Concepts** JavaScript ES6+ Features (Arrow functions, async/await, destructuring, etc.) Closures, Promises, and Event Loop JavaScript Modules and Webpack	6
3	**Introduction to Front-End Frameworks (React, Angular, Vue.js)** React Basics: Components, State, and Props Component Lifecycle in React Introduction to Angular and Vue.js	6
4	**State Management in React (Redux and Context API)** Introduction to Redux Managing State with Redux React Context API for Global State Management	6
5	**Database Integration and Advanced Queries** SQL vs NoSQL Databases Advanced Queries with MongoDB and MySQL Database Optimization Techniques	6

Learning Resources

References:

- *"Learning React: Functional Web Development with React and Redux"* by Alex Banks and

Eve Porcello
- *"Node.js Design Patterns"* by Mario Casciaro
- *"Pro Angular"* by Adam Freeman
- *"Web Performance in Action"* by Jeremy Wagner
- *"Progressive Web Apps: Building Lightning Fast Web Apps with Service Workers"* by Jason Grigsby

Web links

- https://developer.mozilla.org/en-US/docs/Web
- https://www.freecodecamp.org/
- https://www.w3schools.com/
- https://dev.to/
- **https://css-tricks.com/**

FAD660MJ: – Fundamentals of Agile Development		
Semester – IV **Sem Code: 410** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH):50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**
Prerequisites		
Course Objectives • To u**nderstand** the core principles and values of Agile Development • **To explain** the key Agile frameworks, including Scrum, Kanban, and Lean • **To analyze** the role of collaboration, communication, and feedback in an Agile team environment • **To create** a basic Agile project plan, including sprint goals, tasks, and timelines		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember	Define Agile principles and core values
CO2	Understand	Describe the differences between Agile frameworks
CO3	Apply	Apply Agile practices such as Scrum and Kanban
CO4	Analyze	Analyze the collaboration and communication in Agile teams
CO5	Evaluate	Evaluate Agile methods and their effectiveness
CO6	Create	Design an Agile project plan

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Agile Development** History and evolution of Agile Development The Agile Manifesto and its principles Benefits and challenges of Agile methodologies	6
2	**Core Concepts of Agile** Iterative vs. waterfall development	6

	The Agile lifecycle Agile roles (Product Owner, Scrum Master, Development Team)	
3	**Kanban and Lean Frameworks** Introduction to Kanban and Lean principles Differences between Scrum and Kanban Visualizing work and managing flow	6
4	**User Stories and Backlog Management** Writing effective user stories (INVEST criteria) Product Backlog vs. Sprint Backlog Prioritizing and refining user stories **Agile Estimation and Planning** Estimation techniques: Story points, T-shirt sizing, Planning Poker Velocity and burn-down charts Sprint planning and forecasting	7
5	**Agile Testing Practices** Test-driven development (TDD) and behavior-driven development (BDD) Continuous integration and continuous delivery (CI/CD) Automated testing and Agile testing strategies **Agile Retrospectives and Continuous Improvement** The importance of retrospectives Conducting effective retrospectives Creating action plans for continuous improvement	8

Learning Resources

References:

- *Agile Estimating and Planning"* by Mike Cohn
- *"Scrum: The Art of Doing Twice the Work in Half the Time"* by Jeff Sutherland
- *"Kanban: Successful Evolutionary Change for Your Technology Business"* by David J. Anderson
- *"The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses"* by Eric Ries
- *"User Stories Applied: For Agile Software Development"* by Mike Cohn
- *"Agile Project Management with Scrum"* by Ken Schwaber

Web links

- https://agilemanifesto.org/
- https://www.scrumalliance.org/
- https://www.scrum.org/
- https://www.coursera.org/specializations/agile-development
- https://www.mountaingoatsoftware.com/

STP661MJ: – Software Test Planning and Documentation		
Semester – IV **Sem Code: 410** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH):50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**
Prerequisites		
Course Objectives To understand various test plan formats, risk management in testing, To study defect management and test report generation tools, using various case studies..		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	**Identify and classify** different levels and types of testing (unit, integration, system, acceptance) and their relevance in various software development models.
CO2	Understand	**Explain** the fundamental principles, terminologies, and life cycle of software testing
CO3	Apply	**Develop** well-structured test cases, test scripts, and test data based on software requirements and design specifications.
CO4	Analyze	**Analyze** test results and defect reports to evaluate software quality and identify improvements in the testing process.
CO5	Evaluate	Evaluate the suitability of different techniques for various tasks
CO6	Create	**Design** effective software test plans, including test strategies, scope, resources, schedules, and risk analysis

Sr. No	Topics Details	No of Sessions
1	**Pre requisites of Test Planning**Risk associated with software development ,Risk associated with software testing Risk Analysis, Risk Management	6
2	**Preparation of Test Plan**Test Objectives, acceptance criteria Assumptions , Constraints, Characteristics of software being developed, Develop test Matrix, Define Test Administration, Test Plan standards	6
3	**Test Case Design**Functional test cases , Structural test cases, Erroneous test cases Stress test cases, Test Script, Use Cases	6
4	**Perform tests and recording**Use of tools in testing, perform Unit test, Perform Integration test Perform System Test **Defect Management.** **Test Result Reporting Current status**test reports , Final Test reports **User Acceptance Testing**User's Role and tester's role , Acceptance test plan and execution	6

5	**Tools used to prepare test report**Pareto Charts and voting ,Cause and Effect Diagrams, Check sheet Histogram, Run charts, control charts ,Scatter Plot diagram Regression analysis and Multivariate analysis, benchmarking and QFD	6

Learning Resources

References:

- CSTE Common Body of Knowledge (www.softwarecertifications.org).
- Software Engineering with UML, Mohammad Ali Shaikh, ISBN 9781643243566.
- Introducing Software Testing Louise Tamres.
- Effective Methods for software Testing William Perry.
- Software Testing in Real World Edward Kit.
- Software Testing Techniques Boris Beizer

DMI662MJ: – Data Mining		
Semester – IV **Sem Code: 412** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) :50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • To **understand** the fundamental concepts and techniques used in data mining • **To explain** various types of data mining tasks and algorithms • **To apply** data mining techniques like classification, clustering, and association rule mining to real datasets • **To analyze** the effectiveness of data mining algorithms for different datasets and problem		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Define key data mining techniques and concepts
CO2	Understand	Explain data mining tasks and algorithms
CO3	Apply	Apply data mining algorithms to real datasets
CO4	Analyze	Analyze data mining results
CO5	Evaluate	Evaluate the suitability of different techniques for various tasks
CO6	Create	Build and document a data mining solution

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Data Mining and Data Preprocessing** Overview of Data Mining: Definition and Importance of Data Mining Applications of Data Mining: Finance, Healthcare, Retail, etc. Data Mining Process: CRISP-DM, KDD, SEMMA Data Preprocessing: Data Cleaning: Handling Missing Data, Noise, Outliers Data Transformation: Normalization, Standardization, Feature Engineering Data Reduction: Dimensionality Reduction (PCA, LDA), Feature Selection Discretization Techniques Handling Imbalanced Data	6
2	**Classification Algorithms** **Introduction to Classification**: Basic Concepts: Classes, Labels, Training, Testing Data Performance Metrics: Accuracy, Precision, Recall, F1 Score, ROC Curve **Classification Algorithms**: Decision Trees (ID3, C4.5, CART) k-Nearest Neighbors (k-NN) Naive Bayes Classifier Support Vector Machines (SVM) Neural Networks (Introduction to Deep Learning) **Model Evaluation**: Cross-validation Techniques **Confusion Matrix, Performance Metrics (Precision, Recall, F1 Score)**	6
3	**Clustering Algorithms** **Introduction to Clustering**: Types of Clustering: Partitional, Hierarchical, Density-based Applications of Clustering in Data Mining **Clustering Algorithms**: k-Means Clustering DBSCAN (Density-Based Spatial Clustering of Applications with Noise) Agglomerative Hierarchical Clustering Expectation-Maximization (EM) Algorithm **Clustering Evaluation**: Internal vs. External Evaluation Metrics Silhouette Score, Davies-Bouldin Index Cluster Validation Techniques	6
4	**Association Rule Mining** Introduction to Association Rules**:** **Basic Concepts: Items, Itemsets, Support, Confidence, Lift** **Applications of Association Rule Mining (Market Basket Analysis)** Association Rule Mining Algorithms**:** **Apriori Algorithm**	6

	FP-Growth (Frequent Pattern Growth) **Eclat Algorithm** Advanced Topics in Association Rules**:** **Constraint-based Association Mining** **Mining Sequential Patterns**	
5	**Advanced Topics and Applications of Data Mining** Anomaly Detection**:** **Definition and Types of Anomalies: Point, Contextual, Collective** **Statistical Approaches to Anomaly Detection** **Proximity-based and Clustering-based Anomaly Detection** Text Mining and Web Mining**:** **Text Preprocessing: Tokenization, Lemmatization, Stopword Removal** **Text Classification, Sentiment Analysis** **Web Mining: Web Crawling, Clickstream Analysis,** **Recommender Systems**	6

Learning Resources

References:

- *"Data Mining: Concepts and Techniques"* by Jiawei Han, Micheline Kamber, Jian Pei
- *"Introduction to Data Mining"* by Pang-Ning Tan, Michael Steinbach, Vipin Kumar
- *"Pattern Recognition and Machine Learning"* by Christopher M. Bishop
- *"Data Science for Business"* by Foster Provost and Tom Fawcett
- *"Mining of Massive Datasets"* by Anand Rajaraman and Jeffrey David Ullman
- *"Data Mining: Practical Machine Learning Tools and Techniques"* by Ian H. Witten, Eibe Frank, Mark A. Hall

Web links

- https://www.kaggle.com/
- https://archive.ics.uci.edu/
- **https://colab.research.google.com/weka**

SPECIALIZATION CORE COURSES

Cyber Security with Data Analytics

DAN653MJ: – Data Analytics		
Semester – IV **Sem Code: 403** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**
Course Objectives • Introduce fundamental concepts of data analytics, including data types, collection, and processing. • Provide hands-on experience with tools and techniques used for data analysis. • Develop skills in statistical and machine learning methods for analyzing large datasets. • Equip students with the ability to derive meaningful insights from data and present findings effectively.		

.

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember, Understand.	Recall basic data analytics concepts, data types, and data preprocessing techniques Explain different data analysis techniques, statistical models, and their applications in solving business problems.
CO2	Apply	Apply data analysis techniques using tools like Python, R, or Excel to clean, visualize, and analyze datasets.
CO3	Analyze	Analyze real-world datasets using statistical and machine learning methods to extract insights and identify trends.
CO4	Evaluate	Evaluate the effectiveness of different models and techniques in solving data-driven problems, assessing their performance using appropriate metrics.
CO5	Create	Design and implement end-to-end data analysis projects, integrating data collection, preprocessing, analysis, and visualization to solve a business problem.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Data Analytics**: **Overview of Data Analytics**: Importance, scope, and applications of data analytics. **Data Types**: Structured, unstructured, and semi-structured data. **Data Collection Methods**: Surveys, web scraping, sensors, and databases. **Data Quality**: Common issues (e.g., missing data, duplicates) and their solutions. **Data Cleaning**: Techniques like handling missing values, outliers, and normalization.	7

2	Data Preprocessing and Exploration: **Data Preprocessing**: Handling missing data, encoding categorical data, data transformation, and scaling. **Exploratory Data Analysis (EDA)**: Summary statistics, correlation analysis, and data visualization. **Tools**: Overview of Python (Pandas, NumPy), R, and Excel for data preprocessing and exploration.	6
3	Statistical Analysis: **Descriptive Statistics**: Mean, median, mode, variance, standard deviation. **Probability Distributions**: Normal, binomial, and Poisson distributions. **Hypothesis Testing**: T-tests, chi-square tests, p-values, and confidence intervals. **Correlation and Regression Analysis**: Simple linear regression, multiple regression, and correlation coefficients.	7
4	Machine Learning for Data Analytics: **Introduction to Machine Learning**: Supervised vs. unsupervised learning. **Supervised Learning**: Regression models, decision trees, support vector machines (SVM), k-nearest neighbors (k-NN). **Unsupervised Learning**: Clustering (K-means, hierarchical clustering), dimensionality reduction (PCA). **Model Evaluation**: Metrics like accuracy, precision, recall, F1-score, and ROC-AUC curves.	8
5	Data Visualization and Communication: **Data Visualization Principles**: Importance of visualizing data, best practices. **Visualization Tools**: Matplotlib, Seaborn, Tableau, Power BI. **Creating Dashboards**: Interactive dashboards and visualizations for reporting insights. **Communicating Results**: Storytelling with data, presenting data analysis outcomes to stakeholders.	7

Learning Resources

References:

- *Data Science for Business by Foster Provost & Tom Fawcett*
- *Practical Statistics for Data Scientists by Peter Bruce and Andrew Bruce*
- *Python for Data Analysis by Wes McKinney*
- *Data Wrangling with Python by Jacqueline Kazil and Katharine Jarmul*
- *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron*

Websites:

- https://www.datacamp.com/
- https://www.khanacademy.org/math/statistics-probability
- https://www.fast.ai/
- https://hadoop.apache.org/docs/r1.2.1/

SPECIALIZATION ELECTIVE COURSES (SE)
SEMESTER IV
(Any 4 to be OPTED For)

Cyber Security with Data Analytics

TFC655MJ: – Trends & Future in Cloud Computing		
Semester – IV **Sem Code: 405** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : **50 Marks** **Total :100 Marks**
Course Objectives • To understand the latest trends and emerging technologies in cloud computing, focusing on their implications for cybersecurity. • To explore the evolution of cloud computing, new security challenges posed by cloud environments, and strategies to secure cloud-based infrastructures. • To evaluate the future direction of cloud technologies and their intersection with cybersecurity, enabling them to make strategic decisions for enterprises.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember	Discuss emerging trends such as serverless computing, edge computing, hybrid clouds, and AI-driven cloud services, along with their impact on security.
CO2	Understand.	Demonstrate knowledge of security controls, encryption, access management, and other cybersecurity strategies tailored for cloud platforms.
CO3	Apply	Identify potential security risks associated with cloud computing and recommend appropriate risk mitigation strategies.
CO4	Analyze	Analyze the architecture, deployment models, and service models of cloud computing, including IaaS, PaaS, and SaaS.
CO5	Evaluate	Design and implement strategic cloud security policies that align with enterprise goals and regulatory requirements

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cloud Computing:** Evolution of Cloud Computing. Cloud Service Models (IaaS, PaaS, SaaS). Cloud Deployment Models (Private, Public, Hybrid, Multi-cloud). Introduction to Cloud Security Challenges. Cloud Architecture Overview. Security Design Principles in the Cloud	5
2	**Data Privacy and Security in the Cloud:** Data Encryption Techniques. Data Loss Prevention (DLP) in Cloud. Securing Cloud Storage and Backups. GDPR, HIPAA, and other Data Privacy Regulations.	7

	Application Security in the Cloud. Cloud Network Security (Firewalls, VPN, Virtual Private Clouds). Secure APIs for Cloud Services. Intrusion Detection and Prevention Systems (IDPS) for Cloud	
3	**Securing Cloud Applications and Networks:** Application Security in the Cloud. Cloud Network Security (Firewalls, VPN, Virtual Private Clouds). Secure APIs for Cloud Services. Intrusion Detection and Prevention Systems (IDPS) for Cloud. Hybrid Cloud Architectures. Security in Hybrid and Multi-cloud Environments. Managing Security Across Multiple Cloud Providers. Cloud Interoperability and Security Challenges	8
4	**Emerging Trends in Cloud Computing and Security:** Serverless Computing and Security. Edge Computing and Security Implications. AI and Machine Learning in Cloud Security. Blockchain and Cloud Security	8
5	**Future Directions in Cloud Computing and Cybersecurity:** Predictions for Cloud Computing Growth. Future Cybersecurity Challenges in the Cloud. Innovations in Cloud Security Solutions. Strategic Planning for Cloud Security in Enterprises.	6

Learning Resources

References:

- **"Cloud Computing: Concepts, Technology & Architecture"** by Thomas Erl
- **"Cloud Security: A Comprehensive Guide to Secure Cloud Computing"** by Ronald L. Krutz, Russell Dean Vines
- **"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"** by Tim Mather, Subra Kumaraswamy, and Shahed Latif
- **"Mastering Cloud Security"** by Kris Hermans

Websites:

- https://www.nist.gov
- https://cloudsecurityalliance.org
- https://owasp.org
- https://docs.microsoft.com/en-us/azure/security/

CSG656MJ: – Cryptography & Network security		
Semester – IV **Sem Code: 406** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- Introduce the fundamental concepts and history of **cryptography**, including key principles like **confidentiality, integrity**, and **authentication**.
- Provide in-depth knowledge of **symmetric encryption algorithms** such as **AES, DES**, and their **modes of operation**, emphasizing their applications in data protection.
- Teach students **asymmetric encryption algorithms** like **RSA** and **Elliptic Curve Cryptography (ECC)**, and explore their roles in secure communication and digital signatures.
- Familiarize students with **network security protocols**, such as **SSL, IPSec**, and **VPNs**, and demonstrate their importance in safeguarding data during transmission.
- Equip students with knowledge of **network security applications**, including **firewalls,**

	intrusion detection systems, and advanced topics like **quantum cryptography** and **blockchain security**

.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Understand the fundamental principles of **cryptography**, including classical and modern techniques, and assess the security of cryptographic systems.
CO2	Understand.	Implement and evaluate **symmetric encryption algorithms** like **AES** and **DES**, and apply them to real-world scenarios for data protection and secure communication.
CO3	Apply	Apply **network security protocols** such as **SSL/TLS, IPSec**, and **VPNs** to protect communication channels and prevent unauthorized access in network environments
CO4	Analyze	Demonstrate proficiency in **asymmetric encryption techniques**, including the use of **RSA, ECC**, and **digital signatures** for secure key exchange and message authentication.
CO5	Evaluate	Design and implement **security mechanisms** like **firewalls, IDS, and IPS** to safeguard networks from threats and attacks, while exploring emerging technologies such as **quantum cryptography** and **blockchain security**

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cryptography** Basic Concepts: Confidentiality, Integrity, and Authentication History of Cryptography: Classical Techniques (Substitution and Transposition Ciphers) Types of Cryptography: Symmetric and Asymmetric Cryptanalysis: Attacks on Cryptosystems	6
2	**Symmetric Key Cryptography** Symmetric Encryption: DES, AES, and Triple DES Block Cipher Modes: ECB, CBC, CFB, OFB Stream Ciphers: RC4 Key Distribution and Management	6
3	**Asymmetric Key Cryptography** Public Key Cryptography: RSA Algorithm, Diffie-Hellman Key Exchange Elliptic Curve Cryptography (ECC) Digital Signatures and Public Key Infrastructure (PKI) Cryptographic Hash Functions: MD5, SHA-1, SHA-2	6
4	**Network Security Protocols** Authentication Protocols: Kerberos, Needham-Schroeder Transport Layer Security (TLS) / Secure Sockets Layer (SSL) Internet Protocol Security (IPSec)	8

	Wireless Security: WPA, WPA2 Virtual Private Networks (VPNs)	
5	**Network Security Applications** Firewalls: Types and Operation Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) Email Security: Pretty Good Privacy (PGP), S/MIME Web Security: HTTPS and E-commerce Security Advanced Topics: Quantum Cryptography, Blockchain, Cloud Security	6

Learning Resources

References:

- "Cryptography and Network Security: Principles and Practice" by William StallingsCyber Law in India by Farooq Ahmad, Pioneer Books
- "Applied Cryptography: Protocols, Algorithms, and Source Code in C" by Bruce Schneier
- "Network Security Essentials: Applications and Standards" by William Stallings
- "Introduction to Modern Cryptography" by Jonathan Katz and Yehuda Lindell

Websites:

- https://www.tutorialspoint.com/cryptography/index.htm
- https://csrc.nist.gov/Projects/cryptographic-standards-and-guidelines
- https://crypto.stackexchange.com/
- https://www.cisa.gov/
-

CNS657MJ: – Cyberspace & Governance		
Semester – IV **Sem Code: 407** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : 50 Marks **Total :100 Marks**

Course Objectives

- Provide an in-depth understanding of **cyberspace** and its governance, exploring key stakeholders, governance models, and international organizations shaping the regulatory frameworks.
- Equip students with comprehensive knowledge of **cyber laws** and the **legal frameworks** governing cyberspace, including national and international regulations on data protection, privacy, and cybercrimes.
- Develop the ability to critically assess **cybersecurity policies and strategies** at national and international levels, emphasizing the protection of critical infrastructure and effective incident response.
- Enable students to understand **data governance and privacy** issues in the digital age, focusing on personal data protection frameworks, emerging trends like cloud computing, and the ethical challenges of managing big data.
- Introduce students to **emerging trends** in cyber governance, such as the impact of blockchain, AI, and cyber diplomacy, and prepare them for the evolving global landscape of cybersecurity governance.

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Demonstrate a clear understanding of the **concept of cyberspace** and the key actors and frameworks governing it, both nationally and internationally.
CO2	Understand.	Assess and formulate effective **cybersecurity policies and strategies** for both government and private organizations, focusing on risk management and cross-border cooperation.
CO3	Apply	Apply knowledge of **cyber laws** to analyze legal challenges in cyberspace, including issues related to **data protection**, **cybercrime**, and **digital evidence**.
CO4	Analyze	Demonstrate proficiency in **asymmetric encryption techniques**, including the use of **RSA, ECC**, and **digital signatures** for secure key exchange and message authentication. Analyze **emerging cyber governance trends**, such as the integration of **AI, blockchain**, and **cyber diplomacy**, and propose solutions for the global challenges and opportunities posed by these technologies.
CO5	Evaluate	Critically evaluate **data governance frameworks** and **privacy policies**, understanding the role of legislation and ethical considerations in the management and protection of digital data.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Introduction to Cyberspace and Cyber Governance**: Concept of Cyberspace: Definition, Characteristics, and Importance. Evolution of the Internet and Cyberspace. Governance of Cyberspace: Key Stakeholders and Global Frameworks. Internet Governance Models: Multi-Stakeholder vs. Multilateral Approaches. Role of International Organizations in Cyberspace Governance (e.g., ICANN, ITU, UN)	6
2	**Cyber Laws and Legal Frameworks:** Overview of Cyber Laws: History, Development, and Need. National and International Cyber Laws: IT Act, 2000 (India), GDPR (Europe), and Other Key Legislations. Data Protection and Privacy Laws: Frameworks for Protecting User Data. Cybercrime Laws: Types of Cybercrimes and Legal Provisions. Digital Evidence and Cyber Forensics: Legal Aspects	6
3	**Cybersecurity Policies and Strategies**: National Cybersecurity Strategies: Key Elements and Best Practices. Cybersecurity in Critical Infrastructure: Role of Government and Private Sector. Cyber Threats and Vulnerabilities: Understanding Cybersecurity Risks. Incident Response and Disaster Recovery: Policies and Implementation. International Cybersecurity Cooperation: Sharing Best Practices and Cross-Border Collaboration	6

4	**Data Governance and Privacy in the Digital Age:** Data Governance Frameworks: Principles, Standards, and Best Practices. Data Privacy and Sovereignty: Issues in Cross-Border Data Flows. Personal Data Protection: Policies and Compliance Measures (e.g., GDPR, CCPA). Emerging Issues in Data Governance: Big Data, Cloud Computing, and IoT. Ethical Considerations in Data Governance: Balancing Innovation and Privacy	8
5	**Emerging Trends in Cyber Governance:** Role of Blockchain and Distributed Ledger Technologies in Governance. Artificial Intelligence and Cyber Governance: Challenges and Opportunities. Cyber Diplomacy: Role of Governments and International Organizations. Cyber Warfare and International Conflict: Legal and Strategic Implications. Future of Cyber Governance: Global Trends, Policies, and Challenges	6

Learning Resources

References:

- **Cyber Law: Text and Cases by** Suresh T. Viswanathan
- **Cybersecurity and Cyberlaw** by S. K. Agarwal
- **Internet Governance: The New Global Frontier by E. K. Choi, R. T. Lamb**
- Cybersecurity: Law and Governance by E. M. L. J. Finkelstein

Websites:

- https://thegfce.org/
- https://cyber.harvard.edu/
- https://epic.org/
- https://fpf.org/

WAN658MJ: – Web Analytics		
Semester – IV **Sem Code: 408** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : **50 Marks** **Total :100 Marks**
Course Objectives • Learn the history of web analytics, challenges in traditional methods, and the future of advanced customer-focused analytics. • Gain expertise in collecting and analyzing clickstream, outcomes, research, and competitive data to drive business insights. • Create customer-centric strategies aligned with business objectives, leveraging best practices in data analysis and organizational structure. • Perform search analytics, optimize SEO, and measure PPC effectiveness to improve website traffic and conversion rates. • Learn to design and conduct website experiments and testing programs to optimize user experience and website performance.		

Course Outcomes

On completion of the course, learners should be able to

CO#	Cognitive Domain	Course Outcomes
CO1	Remember,	Recognize the types of web data: clickstream, outcomes data, research data, and competitive data.
CO2	Understand.	Describe the importance of data quality, SEO, and PPC in web performance optimization.
CO3	Apply	Implement SEO strategies and perform search analytics for internal site search and PPC campaigns.
CO4	Analyze	Analyze different website types (e-commerce, support, blogs) using foundational reports to generate actionable insights.
CO5	Evaluate	Evaluate testing and experimentation outcomes to optimize website performance and user experience.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Web Analytics**—Present and Future: A Brief History of Web Analytics, Current Landscape and Challenges, Traditional Web Analytics Is Dead, What Web Analytics Should Be **Data Collection**—Importance and Options: Understanding the Data Landscape, Click stream Data, Outcomes Data, Research Data, and Competitive Data.	7
2	**Overview of Qualitative Analysis**: Overview of Qualitative Analysis, Lab Usability Testing, Heuristic Evaluations **Critical Components of a Successful Web Analytics Strategy?** : Focus on Customer Centricity, Solve for Business Questions, Follow the 10/90 Rule, Hire Great Web Analysts, Identify Optimal Organizational Structure and Responsibilities.	6
3	**Web Analytics Fundamentals**: Capturing Data: Web Logs or JavaScript tags? Selecting Your Optimal Web Analytics Tool, Understanding Clickstream Data Quality, Implementing Best Practices, Apply the "Three Layers of So What" Test.	6
4	**Diving Deep into Core Web Analytics Concepts**: Preparing to Understand the Basics, Revisiting Foundational Metrics, Understanding Standard Reports, Using Website Content Quality and Navigation Reports. **Jump-Start Your Web Data Analysis**: Creating Foundational Reports, E-commerce Website, Support Website, Blog Measurement	8
5	**Search Analytics**—Internal Search, SEO, and PPC Performing Internal Site Search Analytics, Beginning Search Engine Optimization, Measuring SEO Efforts, Analyzing Pay per Click Effectiveness. **Website Experimentation and Testing**—Shifting the Power: Why Test and What Are Your Options? What to Test, Build a Great Experimentation and Testing Program	6

Learning Resources

References:

- Web Analytics: An Hour a Day by Avinash Kaushik ,2007,

- Actionable Web Analytics: Using Data To Make Smart Business Decisions by Jason Burby and Shane Atchison,2007,

Websites:

- https://www.oreilly.com/library/view/web-analytics-an/9780470130650/

DFO659MJ: – Digital forensic		
Semester – IV **Sem Code: 409** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH) : 50 Marks** **Total :100 Marks**
Course Objectives • Learn the core concepts of cyber forensics, focusing on investigating data breaches, analyzing malware, and applying scientific forensic methods. • Study various forensic technologies, including military, law enforcement, and business applications, as well as encryption vulnerabilities and wireless security. • Gain knowledge of different forensic systems, such as intrusion detection and biometric security, and apply ethical hacking techniques through case studies. • Develop skills in collecting and analyzing digital evidence, reconstructing cyberattacks, and investigating network traffic and web-based crimes. • Explore the legal aspects of cyberspace, including cybercrime classifications, digital signatures, e-contracts, and the IT Act 2000 and its amendments.		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember,	Recognize the scope of cyber forensics, types of cybercrimes, and the IT Act of 2000 and its amendments.
CO2	Understand.	Explain the forensic methods used to investigate data breaches, malware, and web attacks
CO3	Apply	Apply evidence collection techniques to gather volatile and non-volatile data while maintaining the chain of custody during cybercrime investigations.
CO4	Analyze	Investigate cybercrime cases by reconstructing attacks and analyzing technical surveillance devices.
CO5	Evaluate	Evaluate the effectiveness of digital signatures, public and private key infrastructures, and e-governance models in securing online transactions and communication.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Introduction to Cyber forensics**: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Analyzing malicious software. Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer	6

	Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls Biometric Security Systems	
2	**Types of Computer Forensics Systems**: Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems, Identity Theft, Biometric Security Systems ,Router Forensics. Cyber forensics tools and case studies. Ethical Hacking: Essential Terminology, Windows Hacking, Malware, Scanning, Cracking.	7
3	**Evidence Collection and Data Seizure**: Why Collect Evidence, Collection Options Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Controlling Contamination: The Chain of Custody, Reconstructing the Attack, The digital crime scene, Investigating Cybercrime, Investigating Web attacks, Investigating network Traffic ,Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events.	6
4	**Basics of law**, Understanding cyber space, Defining cyber law, Scope and jurisprudence, Concept of jurisprudence, Overview of Indian legal system, Introduction to IT Act 2000, Amendment in IT Act.	6
5	**Cyber Crimes** – Types of cyber crimes –against individuals institution, and states-various offenses and punishments, digital signature-concepts of public key and private key, certification authorities and their role, creation and authentication of digital signature. E-contracting –salient features of Econtracts, formation of E-contracts and types, E-governance, E-governance models, E-commerce salient features and advantages	8

Learning Resources

References:

- Computer Forensics: Computer Crime Scene Investigation, 2nd Edition,John R. Vacca, Charles River Media,2005
- Cyber Forensics - Concepts and Approaches, Ravi Kumar &B Jain,2006, icfaiuniversitypress
- Understanding Cryptography: A Textbook for Students and Practitioners, ChristofPaar, JanPelzl, 2010, Second Edition,Springer's.
- Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri,First edition, 2009
- Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics),2010
- "Internet Complete Reference, Harley Hahn, second Edition, 1996, Osborne/McGraw-Hill
- Internet and Web design, , Ramesh Bangia Firewall Media, (An imprint of Lakshmi

Publications Pvt. Ltd.). Second Edition 2006.
- Cyber Law Crimes, Barkhs and U. Rama Mohan, Third Edition ,2017,Asia LawHouse
- Cyber Laws Simplified,ViveekSood, Fourth reprint 2008,McGrawHill.

Websites:

- https://evestigate.com/computer-forensics-links/
- https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-0?active-tab=description-tab
- https://www.coursera.org/learn/digital-forensics-concepts
- https://networksimulationtools.com/computer-forensics-projects-for-students/

CET660MJ: – Cyber Ethics		
Semester – IV **Sem Code: 410** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : **50 Marks** **Total :100 Marks**
Course Objectives • Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services • Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes • Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response. • Understand Criminal Liability, Cyber Crime implications and challenges. • Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember,	List and discuss various forms of Cyber Crimes
CO2	Understand.	Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services
CO3	Apply	Explain Computer and Cyber Crimes
CO4	Analyze	Analyse & Understand Cyber Crime at Global and Indian Perspective..
CO5	Evaluate	Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**
1	**Information Technology & Cyber Crimes**: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information	7

	Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.	
2	**Technology & Forms of Cyber Crimes**: Influence of Technology on Criminality, Forms of Cyber Crimes. Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects(~f Criminological Research.	6
3	**Cyber Crimes 'and Global Response**: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000, Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs	6
4	**Mens Rea & Criminal Liability**: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.	8
5	**Cyber Crimes:** Discovery and Appreciation of Evidences: Introduction, Lawof Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence. Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, FundamentalRights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, No Nearer Solution in Sight, Self-regulation in Cyber Space.	8

Learning Resources

References:

- Craig B, “Cyber Law: The Law of the Internet and Information Technology”. PearsonEducation.
- Pawan Duggal, “Cyber Laws” Universal Law Publishing.
- K.Kumar,” Cyber Laws:Intellectual property&E Commerce, Security”, First Edition, Dominant Publisher, 2011.
- Rodney D. Ryder, “Guide to Cyber Laws”, Second Edition, Wadhwa And Company, New Delhi, 2007.
- Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
- JusticeYatindraSingh, "Cyber Laws", Universal LawPublishing, First Edition,NewDelhi, 2003.
- Sharma, S.R., “Dimensions of Cyber Crime”, Annual Publications Pvt. Ltd., First Edition,

2004. Augastine, Paul T., "Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007 **Websites:**

Weblinks :

- https://pnccs.edu.in/cyber-safety-principles-for-students/
- https://staysafeonline.in/concept/student/internet-ethics/protection-personal-information
- https://niccs.cisa.gov/education-training/cybersecurity-students
- https://pressbooks.pub/odugencyber/chapter/cyber-ethics/

CRM661MJ: – Cyber Risk Management		
Semester – IV **Sem Code: 411** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : **50 Marks** **Total :100 Marks**
Course Objectives • **Understand the fundamentals of cyber risk management** and its relevance to modern businesses. • **Identify and assess cyber risks** in different business environments, including IT infrastructure, digital systems, and networks. • **Analyze various cyber threats** like hacking, data breaches, ransomware, and phishing attacks, and understand how they impact organizations. • **Learn and implement strategies** to mitigate and manage cyber risks effectively, ensuring business continuity and compliance with regulatory requirements. • **Develop and execute cyber risk management plans** for corporate environments and understand the economic, legal, and reputational impacts of cyber incidents.		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember,	Understand the fundamental principles of cyber risk management and its critical role in business sustainability.
CO2	Understand.	Identify various cyber threats and vulnerabilities affecting organizations and assess their potential impacts.
CO3	Apply	Apply regulatory frameworks and international cybersecurity standards to manage and mitigate cyber risks.
CO4	Analyze	Perform cyber risk assessments and develop strategies to minimize or transfer risks.
CO5	Evaluate	Formulate incident response plans and business continuity plans for managing cyber incidents

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	**Topics Details**	**No of Sessions**

1	**Introduction to Cyber Risk Management: What is Cyber Risk? Understanding Risk vs. Threats and Vulnerabilities. Importance of Cyber Risk Management** in Business Operations **Types of Cyber Risks:** Financial, Reputational, Operational, and Legal Risks **The Cyber Risk Management Lifecycle**: Risk Identification, Assessment, Mitigation, and Monitoring	6
2	**Cyber Threats and Vulnerabilities: Cyber Threat Landscape:** Malware, Phishing, Denial of Service (DoS), Ransomware. **Vulnerability Assessment**: Identifying weaknesses in IT systems, Networks, Software, and Hardware. **Impact of Data Breaches** and Information Leaks on Organizations. **Emerging Threats**: IoT, Cloud Security Risks, Insider Threats, AI-based Attacks. **Cyber Espionage and Advanced Persistent Threats (APT)**	6
3	**Cybersecurity Frameworks and Regulations: International Cybersecurity Standards**: ISO/IEC 27001, NIST Cybersecurity Framework. **General Data Protection Regulation (GDPR)** and its Cyber Risk Implications. **Other Key Regulatory Frameworks**: CCPA, HIPAA, PCI-DSS. **The Role of Corporate Governance** in Cyber Risk Management. **Risk Compliance and Regulatory Audits**	6
4	**Risk Assessment and Analysis: Understanding Risk Assessment Models**: Qualitative vs. Quantitative Risk Analysis. **Risk Evaluation Techniques**: Threat Modeling, Attack Surface Analysis. **Business Impact Analysis (BIA)**: Financial, Reputational, and Operational Impacts of Cyber Incidents. **Cyber Risk Scoring and Prioritization**: Methods to Evaluate the Severity of Risks. **Scenario Planning**: Risk Simulations and Incident Impact Analysis	8
5	**Cyber Risk Mitigation Strategies: Cyber Risk Management Strategies**: Avoidance, Acceptance, Mitigation, Transfer (Cyber Insurance) . **Cybersecurity Best Practices**: Network Security, Encryption, Multi-factor Authentication **Incident Response Planning**: Preparing for Cyber Incidents, Incident Response Teams, Playbooks. **Business Continuity Planning (BCP)** and Disaster Recovery (DR) Plans.**Cyber Insurance**: Types of Coverage, Risk Transfer Mechanisms	6

Learning Resources

References:

- "Cyber Risk Management: Prioritize Threats, Identify Vulnerabilities, and Apply Sound Risk Management Principles" by Christopher Hodson
- "Managing Cybersecurity Risk: How Directors and Corporate Officers Can Protect Their Businesses" by Jonathan Reuvid
- "The Cyber Risk Handbook: Creating and Measuring Effective Cybersecurity Capabilities" by Domenic Antonucci
- "Risk Management Framework: A Lab-Based Approach to Securing Information Systems" by James Broad
- "Cybersecurity and Cyber Risk **Management"** by Kevin King

Websites:

- https://www.sans.org/apac/
- https://owasp.org/
- https://appinventiv.com/blog/it-risk-management/

CCC662MJ: – Cyber Crimes & Case Study		
Semester – IV **Sem Code: 412** **LTP : 2:2:1**	**Subject Elective** **Credit: 03**	**Examination Scheme:** **Internal (TH) : 50 Marks** **External (TH)** : **50 Marks** **Total :100 Marks**
Course Objectives • **Understand the fundamentals of cybercrime:** definition, origin, evolution, and its relevance in today's information age. • **Identify different types of cybercrimes** and the methods used by cybercriminals, including an understanding of the roles played by various actors in cybercrime. • **Learn the technical and legal aspects** of combating cybercrime, including phishing, identity theft, hacking, and data breaches, with a focus on various countermeasures and safeguards • **Develop a comprehensive understanding of cybercrime's social, economic, and legal impact** on organizations, individuals, and governments. • **Analyze real-world case studies** of cybercrime incidents and the legal precedents set by judicial rulings.		

Course Outcomes

On completion of the course, learners should be able to

CO#	**Cognitive Domain**	**Course Outcomes**
CO1	Remember,	Define and explain the concept of cybercrime and information security, and understand the origin and evolution of cybercrime as it relates to the digital age.
CO2	Understand.	Classify various types of cybercrimes, such as email spoofing, spamming, hacking, identity theft, and online fraud, and understand how these crimes are carried out.
CO3	Apply	Identify different social engineering methods and understand how cybercrimes like cyberstalking and identity theft are conducted and how they can be prevented.
CO4	Analyze	Analyze the methods and tools used by cybercriminals, such as phishing, keyloggers, viruses, worms, and DoS attacks, and evaluate how these techniques are used to exploit weaknesses in systems.
CO5	Evaluate	Evaluate the effectiveness of global and Indian legal frameworks governing cybercrime, including the Information Technology Act 2000 and its amendments, and understand the limitations of current laws

Cognitive Domain**: Remembering/Understanding/Applying/Analysing/Evaluating/Creating**

Sr. No	Topics Details	No of Sessions
1	**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Web Jacking, Newsgroup Spam, Industrial Spying, Hacking, Online Frauds, Pornographic Offenders, Software Piracy, Computer Sabotage Email Bombing, Computer Network Intrusion, Password Sniffing, Credit Card Frauds, Identity Theft	7
2	**Cyber Offenses:** How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing	6
3	**Tools and Methods used in Cybercrime:** Proxy server and Anonymizers, phishing: How Phishing works? How password cracking works? Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Dos and DDOS Attacks, SQL Injection, Buffer Overflow, An Attacks on Wireless Networks	6
4	**Phishing and Identity Theft:** Phishing: Methods of Phishing, Phishing Techniques, Types of Phishing Scams, Phishing countermeasures, Identity theft, Types and Techniques of identity thefts and its counter measures	7
5	**IT ACT, Offenses and Penalties** Offences under the Information and Technology Act 2000 - Penalty and adjudication - Punishments for contraventions under the Information Technology Act 2000 (Case Laws, Rules and recent judicial pronouncements to be discussed) - Limitations of Cyber Law	7

Learning Resources

References:

- Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives By Nina Godbole, Sunit Belapur, Wiley
- Understanding Cybercrime: Phenomena, and Legal Challenges Response, ITU

Websites:

- https://www.sans.org/apac/
- https://owasp.org/
- https://appinventiv.com/blog/it-risk-management/

MPR681MJP – Major Project		
Semester – IV **LTP : 0:0:2**	**Credit: 06**	**Examination Scheme:** **Internal: 100 Marks** **External** : **50 Marks** **Total :150 Marks**

A] Preamble:

The Major Project for MBA-IT students is an essential component of the program, offering students the opportunity to apply theoretical knowledge gained throughout the coursework to real-world IT environments. The project aims to prepare students for the industry by developing both technical and managerial skills, enhancing their understanding of IT systems, processes, and management in a professional setting. This project is typically undertaken at the end of the Third semester and completed before the Fourth semester, providing a practical approach to IT solutions, digital transformation, and innovation in line with the student's specialization.

B] Guidelines for the Major Project:

B-1] Nature of the Major Project:

1. The Major Project will span **8 weeks (2 months).**
2. **8 weeks** of project work within an organization (industry, IT company, bank, etc.) with **30 hours of work per week**.
3. **4 weeks** for pre-project planning, data collection, analysis, report writing, and presentation preparation.
4. The Major Project must take place outside the academic institution, offering students a hands-on, real-world experience.
5. The project must **align with the specialization** of the student, whether in **Cloud Computing**, **Full Stack Development** & **Cybersecurity with Data Analytics** or other IT management areas.
6. Each student must work **individually** on their project. **Group projects are not allowed**.
7. The project should involve tasks and responsibilities aligned with the **organization's IT needs**, such as solving a problem, developing an IT solution, or conducting IT-based research.
8. The project must involve **in-person fieldwork or desk work** within the organization. **Remote or online work is not permitted**.
9. **Primary data collection** is mandatory for research-based projects.
10. Research-based projects may use **quantitative, qualitative, or mixed-method approaches**.
11. Research methodologies may include **surveys, interviews, case studies**, or **system simulations**.
12. Students must seek **advance written approval** from their faculty mentor and the Director before commencing the project.

Syllabus Setting Committee:-

1. **Hon. Dr. Parag Kalkar**, Pro-Vice Chancellor, Savitribai Phule Pune University, Pune
2. **Dr. Shailesh Prabhakar Kasande**, CEO & Group Director, Suryadatta Education Foundation Pune.
3. **Dr. Santosh Deshpande,** Chairman, Board of Studies - Computer Management**.**
4. **Dr. Porinita Banerjee, Director (Incharge),** Poona Institute of Management Sciences & Entrepreneurship.
5. **Dr. Zarina Shaikh,** Associate Professor, Poona Institute of Management Sciences & Entrepreneurship.
6. **Mrs**. **Lubna Shaikh,** Assistant Professor, Poona Institute of Management Sciences & Entrepreneurship.