



**KIBABII UNIVERSITY**

**SCHOOL OF COMPUTING AND INFORMATICS**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**MASTER OF SCIENCE (INFORMATION TECHNOLOGY)**

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## **2.0 THE CURRICULUM**

### **2.1 Title of the Programme**

The Programme is referred to as Master of Science in Information Technology, abbreviated as MSc. (IT).

### **2.2 Philosophy of the Programme**

The MSc. (IT) programme embodies the view that well trained manpower and Innovation in Information Technology is critical for sustainable utilization of ICT and human resources for the development and posterity of the universe.

### **2.3 Rationale of the Programme**

The economic development of a nation is deeply influenced by its Information and Communication Technology (ICT) skills, with modern businesses relying on technological advancements for global competitiveness. Information Technology (IT) plays a pivotal role in organizations, driving competitiveness and collaborations. Adapting curricula is crucial to empower students with research capabilities that keep pace with IT advancements. In Kenya, constitutional changes and the Kenya National ICT Masterplan (2022-2032) published in April 2022 prompted curriculum realignment to meet emerging demands. The growth of ICT in Kenya requires a skilled workforce, making the Master of Science in Information Technology programme essential for equipping students with relevant knowledge to shape the country's technological future.

#### **2.3.1 Needs Assessment/Market Survey/Situation Analysis**

In collaboration with industry stakeholders such as the ICT Authority, Communications Authority of Kenya, Safaricom, and Huawei, the Department of Information Technology at Kibabii University conducted a needs assessment. A significant discovery highlighted that over half of the surveyed individuals lack sufficient competence in critical areas like software engineering, Networking and Security, and Web design. This underscores the urgency of bridging these gaps and elevating proficiency levels in the field of Information Technology to keep abreast with the pace of technology in this field. (See Appendix XII)

### **2.3.2 Stakeholders' Involvement**

A stakeholders meeting was held on 3<sup>rd</sup> July 2023 and the views of participants incorporated in this programme. A hundred percent (100%) of the stakeholders indicated that the programme will be integral in equipping students in underpinning areas of Software engineering, Web development, Networking, Database administration and IT management. The stakeholders involved included Huawei network experts, Professors and lecturers from public and private Universities in Kenya, past and present IT postgraduate students of Kibabii University (See Appendix IX).

### **2.3.3 Justification of the Need of the Programme**

The growing demand for individuals holding a Master of Science in Information Technology (MSc. IT) degree reflects the profound impact of the rapidly changing technological landscape across various sectors. Demonstrating the importance of MSc. IT graduates involves acknowledging their diverse contributions. These encompass filling skill gaps in the ever-evolving Information Technology field, propelling digital transformation, addressing cybersecurity issues, pioneering software solutions, and upholding resilient network infrastructure. Equipped with exposure to cutting-edge technologies, MSc. IT graduates amplify economic advancement, create job prospects, and enhance global competitiveness. Their adeptness in analytical problem-solving and adaptability to emerging obstacles further solidify their pivotal role. In essence, MSc. IT graduates are essential assets propelling innovation, securing digital domains, and nurturing growth in an increasingly technology-centric world.

## **2.4 Goal of the Programme**

The goal of the programme is to equip professionals with the capacity to generate, communicate, and advance novel knowledge in the field of Information Technology, thereby contributing to the pursuit of sustainable development.

## **2.5 Expected Learning Outcomes of the Programme**

By the end of the programme, the graduate will be able to:

- i. Demonstrate understanding of principles and methods underpinning computing and Information Technology

- ii. Communicate technical and business Information Technology concepts to a range of audiences
- iii. Conduct research in Information Technology and related areas
- iv. Analyse emerging Information Technology challenges and opportunities within the dynamically changing business environment

## **2.6 Mode of delivery of the Programme**

The mode of delivery shall be blended.

## **2.7 Academic Regulations for the Programme**

### **2.7.1 Admission Requirements**

The common university regulations for Master's Degree shall apply.

In addition, the applicants should be in possession of one of the provisions below:

- a) Bachelor's degree in a computing discipline, of at least Upper Division Second Class Honours of Kibabii University, or an equivalent qualification from another institution recognized by Senate. In addition, prospective students must demonstrate proficiency in at least one of the object-oriented Programming languages.

**OR**

- b) Bachelor's degree in a computing discipline or related discipline of at least Lower Division Second Class Honours (lower division) of Kibabii University plus at least two years relevant experience, or an equivalent qualification from another institution recognized by Senate. In addition, prospective students must demonstrate proficiency in at least one of the object-oriented programming languages

### **2.7.2 Regulations for Credit Transfer**

There shall be no credit transfer for this graduate Programme in line with the best practise internationally.

### 2.7.3 Course Requirements

The students shall be required to attend the seminars, lectures, research projects and lecturing tasks of the Programme. The students shall also be required to write and publish in peer reviewed journals papers as required in the different courses. The lecturers shall be required to deliver and facilitate seminars, lectures, research projects and lecturing tasks of the Programme. The lecturers shall be expected to supervise all work done by the students and provide guidance to them with regard to publishing of their work and ensuring that the student's names appear as first authors of the articles.

### 2.7.4 Student Assessment Policy/Criteria

Assessment shall take various forms which will be inclusive of participation in class and seminar presentations, scientific review paper writing, research thesis examination, and sit in examinations.

The assessment shall be as follows:

- i. Continuous assessment Test that will be undertaken during the semester (40%)
- ii. Final sit-in end of semester examination (60%)
- iii. The pass mark for each course shall be 50%.

### 2.7.5 Grading System

The marks obtained by the students in the respective courses including research and thesis shall be graded as indicated in the table below:

MARKS	GRADE	REMARK
75% - 100%	A	PASS
65 -< 75	B	PASS
50 -< 65	C	PASS
0-< 50%	E	FAIL

### 2.7.6 Examination Regulations

#### 2.7.6.1 Examination and Assessment of Candidates

- a) Candidates shall be required to pass in all the prescribed courses in a given Programme. The pass mark shall be 50%.

- b) Assessment at the end of the coursework shall consist of:
  - (i) A written examination which shall normally constitute 60% of the total marks in each course,
  - (ii) Continuous assessment based on essays, laboratory assignments and such other tests as may be prescribed by the department. This will normally constitute 40% of the total marks.
- c) A candidate who fails in Three (3) or more of the prescribed courses shall be discontinued; otherwise, the candidate shall be eligible to take Supplementary Examinations. Candidates who are required to sit supplementary examinations shall pay an examination fee of 25% or such other amount as may be determined by the University Senate.
- d) The supplementary exams shall be done immediately the results are released; the final mark for a pass in a supplementary examination shall be 50%. Continuous Assessment marks shall not count towards Supplementary Examinations.
- e) A candidate who fails in a Supplementary Examination shall be discontinued.

#### **2.7.6.2 Appeals for Reassessment of Examination Scripts**

- a) All appeals for reassessment of examination scripts to Registrar AA and copied to DVC (ASA).
- b) A candidate may appeal, giving reasons for such an appeal, for reassessment of examination scripts, within one (1) month of University Senate confirming the results.
- c) If such an appeal is approved, University Senate shall appoint an independent examiner to mark the script(s) and report to the Senate.
- d) The score obtained on remarking a script, shall be the official and final mark.

#### **2.7.6.3 Submission and Examination of Thesis**

- a) At least twelve weeks before the actual submission of the thesis, a candidate shall give a written notice of intent to submit a thesis to the Dean, SGS through the supervisor(s) and Head of department. The notice should be copied to the Dean of the Faculty/School and to the chairmen of the Departmental and Faculty/School Graduate Studies Committees. The notice should include a signed Abstract not exceeding 400 words and which has been countersigned and dated by the Supervisor(s).

- b) The DGSC shall organize for at least 1 seminar for Masters students before filling the Intent to submit form.
- c) Within four weeks after the notice of intent to submit a thesis has been issued, the respective Chairman for the Departmental Graduate Studies Committee shall recommend to the Dean, school of Graduate Studies through the respective FGSC/SGSC, one External Examiner, two Internal Examiners and two Faculty/School Representatives for the candidate's panel of Examiners. The CV of Examiners who are not staff of Kibabii University shall also be submitted for consideration by the Board, SGS, if the Examiners are being appointed for the first time.
- d) The Senate shall, on the recommendation of the SGS Board, appoint in respect of each candidate presenting a thesis, a panel of Examiners for oral examination, Consisting of:
  - i) The Dean, SGS
  - ii) The Dean of the Faculty/school
  - iii) Chairperson of the relevant department
  - iv) External Examiner(s) shall normally be expected to attend
  - v) Two Internal Examiner(s), at least one of whom should be from the relevant department
  - vi) Candidate's supervisor(s)
  - vii) Chairperson of FGSC/SGSC
  - viii) Chairperson of the DGSC
- e) Each candidate shall submit six spiral bound copies of his/her thesis to the Dean, SGS. The thesis must be prepared according to the format approved by University Senate and must be signed by the student and the supervisor(s) and bear the date of submission.
- f) Copies of the thesis shall be distributed to the Internal and External Examiners. The Internal Examiner(s) and the External Examiner(s) shall be required to assess the thesis and submit detailed reports to the Dean, SGS within four weeks of receipt of the thesis. An honorarium shall be done as per the graduate payments' procedure No. 2.1.
- g) Each examiner shall indicate within his/her detailed report:
  - i) Whether or not the thesis is adequate in form and content
  - ii) Whether or not the thesis reflects an adequate understanding of the subject, and in consequences;



- iii) Whether or not the thesis needs a major or minor revision or corrections;
  - iv) The mark assigned to the thesis
  - h) The Dean, SGS, in consultation with the Chairman of the respective DGSC shall appoint a new Examiner when an Examiner's report is delayed beyond stipulated time.
  - i) After the receipt of all the Examiner's reports, the Dean, SGS shall set a date for the Oral Défense. Such a date shall normally be within one week of the date of receipt of the last report. The External Examiner may not be required to attend the Oral defence for Masters Candidate. The External Examiner's report and grade shall be given due attention during oral examination.
  - j) All internal Examiners and Supervisors shall be required to attend the Oral examination unless a valid reason is given to the Dean SGS.
  - k) In special circumstances, the Chair of Department shall be required to appoint a member of the Graduate Faculty to stand in for the Internal Examiner during the Oral defence. This shall be done in writing to the Dean SGS prior to the Oral Examination. For external Examiner the Dean SGS will designate one of the panellists to stand in.
  - l) If a candidate is failed by Two (2) Examiners, the candidate shall not be allowed to defend his/her work; otherwise, the candidate shall be required to make correction as per the Examiners reports and re-submit fresh copies (6) for re-examination at the student's cost. It shall be treated as a supplementary.
  - m) Plagiarism shall be treated as an Examination Irregularity.
  - n) The oral examination shall be open to the public who shall be notified in advance. The public will be allowed to ask questions but these will not contribute to the assessment of the candidate's performance. The duration of the Oral Defence shall be a maximum of 2 hours. A candidate will be given 20 minutes to present his/her work after which there will be questions and answers session. Assessment shall be conducted as follows:
    - i) Each member of the board, with the exception of the supervisors, shall be required to assign a mark not exceeding 20% to the Oral Defence. The mean of all the scores shall be the final grade for that defence, and shall be designed mark Y.
- N/B- The Viva voce marks shall not be tampered with once Submitted for tallying to the secretariat, but the examination panel may agree by simple majority to round off the mark to the nearest whole number.

- ii The Chairman of the Board of Examiners shall calculate the mean score from the three examiner's scripts designate it as mark X. The overall Grade for the thesis shall then be calculated from the following formula: Thesis Mark =  $(0.8X + Y) \%$
  - iii A candidate must pass both the Oral Exam and the Written Thesis to be declared 'pass overall'. The pass mark is 50%. Passing of oral defence, the score must be 10 out of 20 and above.
  - iv If a candidate is failed by the External Examiner, the External Examiner may be invited to the defence.
- o) After the completion of the Oral Defence, the Board of Examiners shall decide:
- i Whether the candidate defended the thesis adequately and the whether the candidate should be declared pass outright, thus assigning the grade to the thesis, and recommending the award of the degree subject to the candidate fulfilling other requirements in respect of course work.
  - ii Whether the thesis needs minor revision and/or corrections over the above the recommendations contained in the Examiners' Reports, thus assigning the grade to the thesis, and recommending submission of the final revised thesis within one month, duly certified by the supervisors.
  - iii Whether the thesis needs major revision and corrections, and recommending re-submission of the thesis within three months for fresh assessment by two of the Internal Examiners. Should the candidate still fail at this stage, the candidate must submit a revised thesis within six (6) months for fresh assessment by all the three Examiners and appear for a second defence thereafter.
  - iv Whether the thesis needs a complete overhaul, including collection of more data and/or change of methodology, and recommending re-submission within nine months for fresh assessment by all the three Examiners and a second defence thereafter.
  - v Whether the thesis is unacceptable for the award of degree of Kibabii University, and thereby declaring the candidate to have failed outright.
- p) A thesis cannot be defended more than two times.
- q) A candidate who fails Oral defence that is less than 10 out 20 shall not be awarded the degree and shall re-submit even if the overall score is 50% and above.

### **2.7.7 Moderation of Examinations**

- a) The chairperson of respective departments shall give notices to course lecturers to set and organise for moderation of the examinations within three (3) weeks after commencement of the semester.
- b) The chairperson of respective departments shall forward internally moderated examination question papers to the University appointed external examiner who is normally at the rank of senior lecturer and above for further moderation after internal moderation.
- c) The chairperson of respective departments shall submit the externally moderated examination question papers to Registrar Academic Affairs (RAA) within one (1) week after receiving them from the external examiners after taking into consideration the external examiners comments.
- d) After students have sat for the end semester examinations and internal examiners have marked the scripts, they shall be further moderated by the external examiner before results are processed.

### **2.7.8 Graduation Requirements**

- a) The Programme requires a minimum of seventeen (17) units of appropriate MSc. IT graduate work. A pass shall be obtained if the average marks in all examined work is 50% and above.
- b) The Programme shall constitute of one and half years of course work and the last half a year of research.
- c) A candidate may take undergraduate level courses in the area of specialization to close knowledge gaps. However, this should be done as directed by the supervisor and will not contribute towards meeting the graduation requirements.
- d) A candidate may take undergraduate level courses from other departments / faculties subject to approval by the department. However, this should be done as directed by the supervisor and will not contribute towards meeting the graduation requirements.

### **2.7.9 Thesis Description and Regulations**

- (a) A thesis in this programme shall be an original report in support of a candidate's independent research activities undertaken under the supervision of at least two qualified supervisors'

development and submitted for examination in line with the relevant University school of graduate studies rules.

- (b) The thesis shall be provided of the candidate's ability to conduct independent research and communicate scientifically.
- (c) The thesis shall be presented in English language, the format and form as provided in the School of Graduate Studies guidelines.
- (d) Before a candidate is allowed to defend the thesis work:
  - (i) There must be evidence of a candidate's publication or acceptance for publication of at least one (1) paper in peer reviewed journals in the field of Computing;
  - (ii) Shall provide evidence of having passed the plagiarism test of all scholarly writings at percentage prescribed by the school of graduate studies from time to time;
  - (iii) Shall have been written in English language and shall normally consist of not less than 20,000 words excluding appendices following the format prescribed by the School of graduate studies.
  - (iv) Shall have attained the pass mark from the three examiners (at least from an external examiner and one internal examiner).

## **2.8 Course Evaluation**

Before the end-of-semester examinations commence, a thorough assessment of the courses is carried out, taking into account various essential factors. This evaluation covers the examination of course content, instructional methods, the sufficiency of infrastructure and equipment for effective teaching, and the availability of instructional and reference materials. Moreover, this assessment includes the examination of the methods used for evaluating student performance.

At the end of each semester, students are invited to participate in an online questionnaire designed to gather feedback about different aspects related to the quality of education. This questionnaire explores topics such as the teaching approach, course content, suitability of facilities and equipment used for teaching, access to instructional and reference materials, the evaluation methods employed, and overall satisfaction with the course.

The feedback provided by students is then carefully analysed by the Quality Assurance department to assess the overall quality of the programme. The conclusions drawn from this analysis are shared with the Department of Information Technology. This feedback plays a key role in aiding informed decision-making and, when necessary, in enhancing the programme. This iterative feedback mechanism ensures that there is a consistent and continuous effort to improve the quality of education delivered.

## **2.9 Management and Administration of the Programme**

- i. The programme shall be housed in the Department of Information Technology within the school of computing and informatics.
- ii. The programme leader shall be at least a senior lecturer and above and supported by other staff (See Appendix IV).
- iii. The programme shall be subject to Internal Quality Management Systems as outlined in Appendix VI. Several activities will be carried out as quality assurance measures to: (a) measure the general extent to which the required skills have been achieved; (b) ascertain the implementation of the methodological changes proposed and (c) create feedback benchmarks for possible future revisions in the curriculum. The following activities will be carried out in the process of monitoring and assuring quality in the programme:
  - a) Feedback from students enrolled
  - b) Class meetings
  - c) Use of ICT in availing lecture materials
  - d) Peer review
  - e) Analysis of External examiners' reports
  - f) Program Audit

## **2.10 Courses/ Units Offered for the Programme per Semester**

### **2.10.1 Duration of the Programme**

The MSc. IT degree Programme will cover two (2) academic years of study.

### 2.10.2 Expected Learning Outcomes Courses Alignment Matrix

Expected Learning Outcome (ELO)	Year one				Year two			
	Semester 1		Semester 2		Semester 1		Semester 2	
	Courses	Credit	Courses	Credit	Courses	Credit	Courses	Credit
Demonstrate understanding of principles and methods underpinning computing and Information Technology	MIT810	3						
	MIT814	3						
	MIT815	3						
Communicate technical and business Information Technology concepts to a range of audiences	MIT811	3	MIT820	3			MIT825	3
	MIT812	3	MIT821	3			MIT826	3
	MIT813	3	MIT822	3				
	MIT814	3	MIT823	3				
	MIT815	3	MIT824	3				
Conduct research in Information Technology and related areas	MIT 815	3	MIT898	3	MIT899	6	MIT 899	3
							MIT 826	3
Analyse emerging Information Technology challenges and opportunities within the dynamically changing business environment	MIT811	3	MIT820	3			MIT825	3
	MIT812	3	MIT821	3			MIT826	3
	MIT813	3	MIT822	3			MIT827	3
	MIT814	3	MIT823	3				
			MIT824	3				

### 2.10.3 Distribution Table comprising a Summary of Courses

Year One Semester I			
Code	Title	Units	Hours/ Semester
<b>Core courses</b>			

MIT810	Advanced Database Systems and Information Modelling	4	60
MIT811	Advanced Information Technology Project Management	4	60
MIT812	Advanced Computer Architecture	4	60
MIT813	Advanced Object-Oriented Analysis and Design	4	60
MIT814	Advanced Computer Networking	4	60
MIT815	Advanced Research Methods	4	60
	<b>Total Units Semester I</b>	<b>24</b>	<b>360</b>
<b>Year One Semester II</b>			
<b>Core Courses</b>			
MIT820	Advanced Software Engineering	4	60
MIT821	Advanced Enterprise Application Development	4	60
MIT822	Advanced Cyber Security	4	60
MIT823	Artificial Intelligence and Machine Learning	4	60
MIT824	Advanced Web Design	4	60
	<b>Total Semester II</b>	<b>20</b>	<b>300</b>
	<b>Total Year one</b>	<b>44</b>	<b>660</b>
<b>Year Two Semester One</b>			
MIT825	Advanced Network Management	4	60
MIT826	Advanced Architectures for Software Systems and Emerging Issues	4	60
MIT827	Foundations of E-Learning	4	60
MIT828	Digital Markets Architecture	4	60
MIT898	MSc. IT Research Proposal Development	4	60
	<b>Total Units for Semester I</b>	<b>20</b>	<b>300</b>
<b>Year Two Semester Two</b>			
MIT899 (I)	Thesis I	8	120
MIT899 (II)	Thesis II	8	120
	<b>Total Semester II</b>	<b>16</b>	<b>240</b>

	<b>Total Year Two</b>	<b>36</b>	<b>540</b>
	<b>Grand Total</b>	<b>80</b>	<b>1200</b>

### **Course Coding**

Students will be expected to take all the courses. The codes are as defined below:

MIT stand for Master in Information Technology

First digit refers to Master level

Second Digit indicate the Semester

Third digit indicates Unit or Course

Fourth digit indicates revision version

### **3.0 Course Outlines**

#### **YEAR I SEMESTER I**

#### **MIT810 Advanced Database Systems & Information Modelling**

#### **Pre –requisite**

None

#### **Purpose**

The purpose of this course is to provide students with an in-depth understanding of advanced concepts in database systems and information modelling in preparing students for complex database challenges, emerging technologies, and specialized application scenarios.

#### **Expected Learning outcomes**

By the end of the course, the learner should be able to:

- i. Demonstrate advanced knowledge of database architecture, including distribution and security.
- ii. Analyze query optimization and employ advanced indexing for improved database performance.
- iii. Evaluate and select appropriate database technologies to meet specific application needs.
- iv. Apply complex data modeling techniques for handling diverse data scenarios.



- v. Design and implement advanced data warehousing solutions, including real-time integration and OLAP operations.

### **Course Content**

Advanced Database Concepts: Database architecture and components, Transaction management and concurrency control, Database security and authorization, Distributed databases and replication; Advanced Data Modeling: Entity-Relationship (ER) model extensions, Enhanced normalization techniques, Multivalued, derived, and recursive attributes, Handling temporal and spatial data; Advanced Query Optimization: Query processing and execution, Cost-based optimization, Indexing strategies and advanced indexing techniques, Query rewriting and transformation; Database Architecture and Components: Advanced database architecture and components, Database system architectures (client-server, cloud-based, distributed), Transaction management and concurrency control mechanisms, Database security, authentication, and authorization strategies, Replication and distributed databases for high availability; Advanced Database Technologies: In-memory databases and columnar storage, Exploring NoSQL databases (document, graph, key-value), Introducing NewSQL databases and their advantages, Big data platforms and technologies for massive datasets, Integrating advanced database technologies in real-world scenarios; Advanced Data Warehousing: Dimensional modeling for complex business scenarios, Handling slowly changing dimensions (SCDs), Advanced OLAP operations (advanced data cube concepts), Data visualization and reporting tools for business intelligence, Real-time data warehousing and streaming analytics applications; Advanced Database Applications: Geographical Information Systems (GIS) and spatial databases, Multimedia databases and content retrieval techniques, Social media data analysis (sentiment analysis, network analysis), Web and text mining using advanced database technologies, Real-world case studies of advanced database application domains; Emerging database Technologies: Big data analytics, blockchain databases, cloud databases; Ethical and Legal Considerations in Business Intelligence;

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

Connolly, T. M. & Begg, C. E. (2015). Database Systems: A Practical Approach to Design, Implementation, and Management. 6th ed., Pearson Education Limited.

Elmasri R, & Navathe S. (2010) Fundamentals of Database Systems. Addison-Wesley

Silberschatz, A., Korth, H. F., Sudarshan S. (2019). Database System Concepts 7<sup>th</sup> edition, McGraw-Hill

### **Recommended Reference Materials**

Meier, A., & Kaufmann, M. (2019). SQL & NoSQL databases. Berlin/Heidelberg, Germany: Springer Fachmedien Wiesbaden.

Kifer M. Bernstein and Lewis P.M. (2005). Database Systems, An application oriented approach Addison –Wesley

Ramakrishan R. and Gehrke(2002). Database Management. McGraw –Hill

International Journal of Advanced Research in Computer and Communication Engineering. 2278-1021. <http://www.ijarcce.com>

International Journal of Advanced Research in Computer Engineering & Technology. ISSN 2333-9721. <http://ijarcet.org/index.php/ijarcet/index>

Journal of Emerging Technologies and Innovative Research. ISSN: 2583-0554. [www.iciset.in](http://www.iciset.in)

IOSR Journal of Computer Engineering (IOSR-JCE). ISSN 2278-0661. <https://www.iosrjournals.org/IOSR-JCE.html>

Journal of Information Engineering and Applications. ISSN 2225-0506. <https://doi.org/10.7176/JIEA>

International Journal of Scientific Research in Science, Engineering and Technology. ISSN 2394-4099. <https://ijsrset.com/>

International Journal of Computer Science Trends and Technology. ISSN 2347-8578. <http://www.ijcstjournal.org/>

## **MIT811 Advanced Information Technology Project Management**

### **Pre –requisite**

None

### **Purpose**

The purpose of this course is to equip students with the specialized skills and knowledge required to manage complex IT projects successfully.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i. Demonstrate a comprehensive understanding of advanced project management frameworks and methodologies in the context of IT projects.
- ii. Apply advanced project initiation, planning, execution, monitoring, and control techniques to effectively manage IT projects with diverse requirements.
- iii. Analyze complex project risks, develop mitigation strategies, and employ advanced risk management techniques to ensure project success.
- iv. Utilize advanced communication and stakeholder engagement strategies to manage project teams and stakeholders effectively.
- v. Evaluate and implement Agile practices in IT project management, adapting Agile methodologies to complex IT projects and integrating them with traditional project management approaches.

### **Course Content**

Project Management Framework: Introduction to advanced project management concepts, overview of project management frameworks (PMI, PRINCE2, Agile, etc.), understanding project

success criteria; Project Initiation and Planning: Advanced project initiation techniques, stakeholder analysis and engagement strategies, detailed project planning, scope definition, and work breakdown structures; Project Execution and Control: Advanced project execution strategies, resource allocation, team management, risk identification and mitigation, change management, quality assurance, and project tracking; Advanced Project Monitoring and Reporting: Techniques for real-time project monitoring, advanced reporting methods, dashboards, key performance indicators (KPIs), and project health assessments; Stakeholder Communication and Engagement: Advanced communication strategies, managing diverse stakeholders, conflict resolution, negotiation, and effective team communication; Project Risk Management: Advanced risk assessment techniques, quantitative and qualitative risk analysis, risk response strategies, and continuous risk monitoring; Procurement and Vendor Management: Advanced procurement strategies, vendor selection, contract negotiation, performance monitoring, and managing vendor relationships; Agile Project Management: In-depth understanding of Agile methodologies (Scrum, Kanban, etc.), advanced Agile practices, implementing Agile in complex projects, and integrating Agile with traditional project management; Project Leadership and Team Dynamics: Advanced leadership skills, motivational techniques, fostering a collaborative team environment, and managing virtual and cross-functional teams; Advanced Project Closing and Transition: Project closure techniques, handing over deliverables, conducting lessons learned, finalizing documentation, and ensuring smooth project transition.

**Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

**Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

**Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

## **Core Reading Materials**

Sommerville I, (2011). Software Engineering Pearson Education Inc.

Pressman R, (2010). Software Engineering a Practitioner approach McGraw –Hill

## **Recommended Reference Materials**

Schwabe & Kathy (2009): Managing information Technology Projects, Thomson Technology

Gray C. F. & Larson E.W. (2010) Project Management. The Managerial process

Kernzner H. (2009) Project Management John Wiley & Wiley dw

International Journal of Advanced Computer Science and Applications (IJACSA) ISSN 2156-5570 (online) <http://thesai.org/Downloads/>

International journal of computers & Technology (IJCT). ISSN 2277-3061 <http://cirworld.com/index.php/IJCT/>

International Journal of Application or Innovation in Engineering & Management (IJAIEM). ISSN 2319 –4847. <http://www.ijaiem.org/>

International Journal of Advanced Computer Science and Applications (IJACSA) ISSN 2156-5570 (online) <http://www.ijacsa.thesai.org/>

International Journal of Computer Science and telecommunications ISSN 2047-3338 <http://www.ijest.org/>

International Journal of Science and Technology. ISSN 2224-3577 <http://ejournalofsciences.org/>

International Journal of Information and Communication Technology Research. ISSN 2223-4985 <http://esjournals.org/journaloftechnology/>

Journal of Information Technology Education: Research (JITE) ISSN: online 1539-3585; <http://www.jite.org/>

ACM & IEEE journals Journal of Emerging Trends in Computing and Information Sciences ISSN 2079-8407. [www.cisjournal.org/journalofcomputing](http://www.cisjournal.org/journalofcomputing)

International Journal of Computers & Technology. ISSN 2277-3061. <http://cirworld.org/journals/>

International Journal for Management Science and Technology (IJMST). ISSN: 2320-8848 (Online) <http://ijmst.com>

Eastern African Journal of Engineering, Science and Technology. ISSN 2219-8598

## **MIT812 Advanced Computer Architecture**

### **Pre-requisite**

None

### **Purpose**

The purpose of this course is to provide students with an in-depth understanding of the design principles, techniques, and innovations that underlie advanced computer architectures.

### **Expected Learning Outcomes**

By the end of the course the learner should be able to:

- i. Demonstrate a comprehensive understanding of advanced computer architecture concepts and their applications in designing high-performance systems.
- ii. Evaluate advanced processor design techniques, including superscalar execution, out-of-order execution, and speculative execution.
- iii. Design and optimize memory hierarchies, including multi-level caching strategies and efficient memory access mechanisms.
- iv. Explore advanced parallel architectures, multi-core systems, and programming models for exploiting thread-level parallelism.
- v. Evaluate interconnection network designs, scalability challenges, and communication efficiency in large-scale computing systems.
- vi. Assess emerging trends in computer architecture, such as quantum computing and neuromorphic computing.

### **Course Content**

Introduction to Advanced Computer Architecture: Overview of advanced computer architecture concepts, historical evolution, and the significance of architectural innovations in modern computing; Advanced Processor Design: In-depth study of superscalar and out-of-order execution processors, pipelining optimizations, advanced instruction level parallelism, and speculative execution techniques; Memory Hierarchy and Advanced Caching: Advanced memory hierarchy design, cache coherence protocols, multi-level caches, cache optimization strategies, and memory access latency reduction; Advanced Parallel Architectures: Multi-core and many-core

architectures, thread-level parallelism, SIMD and SIMT execution models, parallel programming paradigms, and efficient synchronization mechanisms; Interconnection Networks and Scalability: Advanced interconnection network topologies (mesh, torus, fat-tree), network-on-chip (NoC) designs, scalability challenges, and communication efficiency in large-scale systems; Energy-Efficient Architectures: Techniques for designing energy-efficient processors, dynamic voltage and frequency scaling (DVFS), power management strategies, and hardware-level energy optimization; Advanced Instruction Set Architectures: Complex instruction set computer (CISC) vs. reduced instruction set computer (RISC), vector architectures, VLIW architectures, and custom instruction set design for specific applications; Advanced Virtual Memory Systems: Virtual memory management techniques, TLB design, advanced page replacement policies, and memory protection mechanisms; Advanced Input/Output Architectures: Exploring high-speed I/O interfaces (PCI Express, NVMe), memory-mapped I/O, advanced interrupt handling, and I/O virtualization techniques; Performance Analysis and Benchmarking: Techniques for analyzing architectural performance, benchmark selection, performance measurement tools, and profiling applications on advanced architectures.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

"Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A. Patterson (2018) ISBN-13: 978-0128119051

"Advanced Computer Architecture: Parallelism, Scalability, Programmability" by Kai Hwang and Naresh Jotwani (2011) ISBN-13: 978-0073380696

"Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy (2017) ISBN-13: 978-0123747501

### **Recommended Reading Materials**

"Modern Processor Design: Fundamentals of Superscalar Processors" by John Paul Shen and Mikko H. Lipasti (2013) ISBN-13: 978-1305635142

"High-Performance Computer Architecture" by Harold S Stone (2014) ISBN-13: 978-1606505571

## **MIT813 Advanced Object-Oriented Analysis and Design**

### **Pre-requisite**

None

### **Purpose**

The purpose of this course is to provide students with a deep understanding of advanced concepts and techniques in software design using object-oriented principles.

### **Expected Learning Outcomes**

By the end of the course the learner should be able to:

- i. Apply advanced object-oriented analysis techniques to model complex system requirements.
- ii. Apply architectural patterns and principles to design scalable and modular software systems.
- iii. Utilize advanced UML modelling techniques to communicate and visualize software designs effectively.
- iv. Employ design patterns to solve recurring design problems and enhance software maintainability.
- v. Implement advanced testing strategies such as Test-Driven Development (TDD) to ensure software quality and reliability.



## **Course Content**

Recap of Object-Oriented Analysis and Design: Review of fundamental concepts and principles in object-oriented analysis and design; Advanced Analysis Techniques: Advanced techniques for identifying and modelling complex system requirements, including use case refinement, scenario-based analysis, and domain modelling; Software Architecture: Designing software architectures using architectural patterns such as layered architecture, MVC (Model-View-Controller), and micro services architecture; Advanced UML Modelling: Advanced UML diagrams and their application, including interaction diagrams (sequence diagrams, collaboration diagrams), state diagrams, and component diagrams; Design Patterns: In-depth study of design patterns, including creational, structural, and behavioural patterns, and their application to real-world design problems; Design Principles: Applying design principles such as SOLID (Single Responsibility, Open-Closed, Liskov Substitution, Interface Segregation, Dependency Inversion); Design Refactoring: Techniques for refactoring existing designs to improve code quality, readability, and maintainability; Software Design Process: Understanding the complete software design process, including requirements analysis, system design, architectural design, and detailed design; Case Studies: Analysing and discussing real-world case studies that demonstrate the application of advanced object-oriented analysis and design techniques.

## **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

## **Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

## **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

## **Core Reading Materials**

"Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development" by Craig Larman (2014) ISBN-13: 978-0131489066

"Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides (1994) ISBN-13: 978-0201633610

"Domain-Driven Design: Tackling Complexity in the Heart of Software" by Eric Evans (2003) ISBN-13: 978-0321125217

"Clean Architecture: A Craftsman's Guide to Software Structure and Design" by Robert C. Martin (2017) ISBN-13: 978-0134494166

### **Recommended Reference Materials**

"Refactoring: Improving the Design of Existing Code" by Martin Fowler (2018) ISBN-13: 978-0134757599

### **MIT814 Advanced Computer Networking**

#### **Prerequisite**

None

#### **Purpose**

The purpose of this course is to provide students with an in-depth understanding of advanced topics in computer networking.

#### **Learning Outcomes**

By the end of the course the learner should be able to:

- i. Analyse advanced network protocols and architectures.
- ii. Design and implement secure and scalable network infrastructures.
- iii. Optimize network performance through traffic engineering and quality of service techniques.
- iv. Apply advanced topics in network security and privacy.
- v. Explore emerging trends and technologies in computer networking, such as software-defined networking (SDN), network function virtualization (NFV), and Internet of Things (IoT) networking.

- vi. Conduct independent research and present findings on current networking challenges and solutions.

### **Course Content**

Advanced Network Protocols: In-depth study of advanced protocols such as Border Gateway Protocol (BGP), Multiprotocol Label Switching (MPLS), and Internet Protocol version 6 (IPv6). Network Architecture Design: Design principles and methodologies for building scalable and robust network architectures, including hierarchical and peer-to-peer architectures. Network Performance Optimization: Traffic engineering, quality of service (QoS), and network resource management techniques to optimize network performance and ensure efficient utilization of network resources. Network Security: Advanced topics in network security, including intrusion detection and prevention, secure communication protocols, network access control, and security in wireless networks. Network Privacy and Anonymity: Privacy-enhancing technologies and techniques to protect user privacy and ensure anonymity in network communication. Software-Defined Networking (SDN): Understanding the principles, architecture, and applications of SDN, including OpenFlow and network programmability. Network Function Virtualization (NFV): Virtualizing network functions for flexible and scalable network services delivery. Research Topics in Advanced Networking: Exploration of current research topics and trends in advanced computer networking.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

"Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross (2016)

ISBN-13: 978-0133594140

"Computer Networks: A Systems Approach" by Larry L. Peterson and Bruce S. Davie (2011)

ISBN-13: 978-0123850591

"Computer and Communication Networks" by Nader F. Mir (2017) ISBN-13: 978-0133814743

"Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner (2013) ISBN-13: 978-0130460196

### **Recommended Reference Materials**

"SDN: Software Defined Networks" by Thomas Nadeau and Ken Gray (2013) ISBN-13: 978-1449342302

### **MIT815 Advanced Research Methods**

Pre –requisite: None

### **Purpose**

The purpose of this course is to provide students with an in-depth understanding of advanced research methodologies and techniques. It aims to equip students with the skills and knowledge needed to design, conduct, and analyze complex research projects in various fields.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i Apply advanced qualitative and quantitative research methods to design and execute comprehensive research projects.
- ii Demonstrate proficiency in analyzing and interpreting complex research data using advanced statistical and data analysis techniques.
- iii Evaluate ethical considerations and maintain research integrity throughout the research process.

- iv Synthesize and critically analyze existing literature to identify research gaps and formulate research questions.
- v Develop advanced research proposals and effectively present research findings to diverse audiences.

### **Course Content**

Review of Research Fundamentals: Recap of research basics, types of research, research process, research design, and research paradigms; Qualitative Research Methods: In-depth exploration of qualitative research methodologies (ethnography, case study, grounded theory, phenomenology), data collection techniques, coding and analysis, and validity in qualitative research; Quantitative Research Methods: Advanced quantitative research techniques (experimental, quasi-experimental, survey research), sampling methods, data collection tools, statistical analysis, and interpretation; Mixed-Methods Research: Integrating qualitative and quantitative approaches, understanding the strengths and challenges of mixed-methods research, designing mixed-methods studies, and analyzing mixed-methods data; Advanced Data Analysis: Advanced statistical techniques (multivariate analysis, regression analysis, factor analysis), data visualization, and software tools for data analysis (SPSS, R, Python); Research Ethics and Integrity: Ethical considerations in research, ethical guidelines and codes of conduct, avoiding research misconduct, and addressing ethical dilemmas; Literature Review and Synthesis: Techniques for conducting systematic literature reviews, synthesizing research findings, identifying research gaps, and formulating research questions; Research Proposal Development: Developing advanced research proposals, including problem statement, research objectives, research questions, hypotheses, and research design; Research Implementation: Strategies for data collection, participant recruitment, data management, and ensuring research rigor; Advanced Research Presentation: Effective ways to present research findings to diverse audiences, including conference presentations and academic publications.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

Kothari CR (2006). Research Methodology: Methods and Techniques, New Age

International Publishers

Kathleen M and Jonathan W (2011). How to Write Dissertations and Project Reports. Harlow UK:

Pearson Education Ltd.

### **Recommended Reference Materials**

Rubin A and Babbie E. (2005), Research Methods for Social Work, Wadsworth/Thomson.

ACM & IEEE journals

*International Journal of Science and Technology*.ISSN 2224-3577 <http://ejournalofsciences.org/>

*International Journal of Information and Communication Technology Research*. ISSN 2223-4985

<http://esjournals.org/journaloftechnology/>

*Journal of Information Technology Education: Research (JITE)*ISSN: online 1539-3585;

<http://www.jite.org/>

*Journal of Emerging Trends in Computing and Information Sciences* ISSN 2079-8407.

[www.cisjournal.org/journalofcomputing](http://www.cisjournal.org/journalofcomputing)

*International Journal of Computers & Technology*.ISSN 2277-3061. <http://cirworld.org/journals/>

*International Journal for Management Science and Technology (IJMST)*. ISSN: 2320-8848

(Online) <http://ijmst.com>

*Eastern African Journal of Engineering, Science and Technology*. ISSN 2219-8598

*International Journal of Advanced Computer Science and Applications (IJACSA)* ISSN 2156-5570 (online) <http://thesai.org/Downloads/>

*International journal of computers & Technology (IJCT). ISSN 2277-3061*<http://cirworld.com/index.php/IJCT/>

*International Journal of Application or Innovation in Engineering & Management (IJAIEM). ISSN 2319 –4847.*<http://www.ijaiem.org/>

International Journal of Advanced Computer Science and Applications (IJACSA) ISSN 2156-5570 (online))<http://www.ijacsa.thesai.org/>

*International Journal of Computer Science and telecommunications* ISSN 2047-3338  
<http://www.ijcst.org/>

## **YEAR I SEMESTER II**

### **MIT 820 Advanced Software Engineering**

#### **Pre-requisite**

MIT813 Advanced Object-oriented analysis and design

#### **Purpose**

The purpose of this course is to provide students with advanced knowledge and skills in the field of software engineering. It aims to enhance students' understanding of software development processes, methodologies, and techniques used to design, develop, and maintain complex software systems.

#### **Expected Learning Outcomes**

By the end of the course the learner should be able to:

- i. Apply advanced software development methodologies and process models to real-world software projects.
- ii. analyse software architectures using advanced architectural patterns and principles.
- iii. Implement advanced software testing and quality assurance strategies to ensure software reliability.
- iv. Apply secure coding practices and techniques to design and develop secure and privacy-conscious software systems.
- v. Manage and lead software projects effectively, considering project management best practices and team dynamics.

## **Course Content**

Software Development Process Models: In-depth exploration of advanced software development methodologies (Agile, DevOps, Lean, etc.), their principles, benefits, and challenges; Requirements Engineering: Advanced techniques for gathering, analyzing, and managing software requirements, including stakeholder engagement, use case modeling, and requirement validation; Software Architecture Design: Advanced architectural patterns (microservices, event-driven architecture, etc.), architectural decisions, trade-offs, and architectural documentation; Software Testing and Quality Assurance: Advanced testing strategies (test-driven development, continuous testing, etc.), automated testing frameworks, performance testing, and code quality metrics; Software Maintenance and Evolution: Strategies for maintaining and evolving complex software systems, handling legacy code, refactoring techniques, and version control; Software Security and Privacy: Advanced topics in software security, secure coding practices, vulnerability assessment, penetration testing, and ensuring data privacy; Software Project Management: Advanced project management techniques for software projects, including risk management, resource allocation, project estimation, and managing distributed teams; Software Metrics and Measurement: Advanced software metrics for evaluating software quality, productivity, and performance, and their role in process improvement; Software Documentation and Communication: Advanced techniques for documenting software designs, code, and user manuals, as well as effective communication within development teams; Emerging Trends in Software Engineering: Exploration of emerging technologies (AI, blockchain, IoT) and their impact on software engineering, as well as industry best practices.

## **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

## **Instructional materials/equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

## **Course assessment**



CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

"Software Engineering: A Practitioner's Approach" by Roger S. Pressman (2019) ISBN-13: 978-1259872976

"Clean Code: A Handbook of Agile Software Craftsmanship" by Robert C. Martin (2008) ISBN-13: 978-0132350884

"Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides (1994) ISBN-13: 978-0201633610

"The Pragmatic Programmer: Your Journey to Mastery" by Andrew Hunt and David Thomas (2019) ISBN-13: 978-0135957059

### **Recommended Reference Materials**

"Software Project Survival Guide" by Steve McConnell (1998) ISBN-13: 978-1572316218

## **MIT821 Advanced Enterprise Application Development**

### **Pre –requisite**

MIT813 Advanced Object-oriented analysis and design

### **Purpose**

The purpose of this course is to equip students with advanced skills in developing enterprise-level applications that are scalable, maintainable, secure, and optimized for modern technological demands. The course aims to prepare students for the challenges of building complex applications for organizations by providing in-depth knowledge of advanced programming techniques, architecture, security, and deployment practices.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i Apply advanced programming paradigms and design patterns to develop efficient and maintainable enterprise applications.
- ii Design, develop, and deploy microservices-based applications using industry best practices.
- iii Build cloud-native applications that leverage containerization, orchestration, and serverless computing.
- iv Design and integrate APIs with external systems and services, ensuring efficient communication.
- v Implement advanced security measures to protect enterprise applications and data.

### **Course Content**

Advanced Programming Paradigms: Exploring advanced programming concepts and paradigms such as functional programming, reactive programming, and aspect-oriented programming; Microservices Architecture: In-depth study of microservices architecture, design principles, communication patterns, and deployment strategies; Cloud-Native Development: Advanced techniques for developing applications optimized for cloud environments, including containerization, orchestration, and serverless computing; API Design and Integration: Advanced topics in designing and developing APIs, RESTful services, GraphQL, and integration with external systems; Advanced Database Integration: Integrating databases into enterprise applications using advanced techniques like ORM (Object-Relational Mapping), NoSQL databases, and data caching; Security in Enterprise Applications: Advanced security measures for protecting enterprise applications, including authentication, authorization, encryption, and secure communication; DevOps and Continuous Integration/Continuous Deployment (CI/CD): Implementing advanced DevOps practices, automating the CI/CD pipeline, and ensuring smooth deployment; Performance Optimization: Techniques for optimizing application performance, including profiling, load testing, caching strategies, and database optimization; Scalability and Fault Tolerance: Designing and implementing scalable and fault-tolerant enterprise applications, handling distributed systems challenges; Monitoring and Logging: Implementing advanced monitoring and logging mechanisms for tracking application health, performance, and issues.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

LMS, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

Vesterli S.E. (2014), Oracle Enterprise Application Development, Packt Publishing,

Sommerville I, (2011) Software Engineering Pearson Education Inc.

Pressman R, (2010) Software Engineering a Practioner approach McGraw –Hill

### **Recommended Reference Materials**

Draheim, Dirk, Weber, and Gerald (Eds.) (2006), Trends in Application Architecture. Springer

*International Journal of Computers & Technology*.ISSN 2277-3061. <http://cirworld.org/journals/>

International Journal of Advanced Computer Science and Applications (IJACSA) ISSN 2156-5570 (online))<http://www.ijacsa.thesai.org/>

*International Journal of Computer Science and telecommunications* ISSN 2047-3338

<http://www.ijcst.org/>

### **MIT822 Advanced Cybersecurity**

#### **Pre –requisite**

MIT814 Advanced Computer Networking

#### **Purpose**

The purpose of this course is to provide students with advanced knowledge and skills in cybersecurity to address the evolving and complex threats faced by organizations. The course aims

to prepare students to become proficient cybersecurity professionals capable of implementing advanced security measures, analyzing and responding to threats, and safeguarding digital assets and data.

### **Expected Learning outcomes**

By the end of the course unit the student should be able to:

- i Implement advanced threat detection and response techniques to proactively identify and mitigate cybersecurity threats.
- ii Design and secure complex network architectures using advanced network security protocols and encryption methods.
- iii Perform advanced malware analysis to dissect and understand sophisticated malware behavior.
- iv Develop and implement advanced identity and access management strategies to ensure secure user authentication and authorization.
- v Apply advanced security practices to cloud environments, IoT devices, and blockchain technology.

### **Course Content**

Overview and Importance of Cybersecurity: Understanding the scope and significance of cybersecurity in today's digital world; Information Security Aspects: Concepts of information security, human factors in information security, and social engineering techniques; Threat Landscape: Exploration of the current threat landscape, including different types of cyber threats; Elements of Cybersecurity: In-depth study of network security, system security, cryptography, web application security, mobile and IoT security, and cloud security; Risk Management: The purpose of risk management, the risk management process, and strategies for identifying and mitigating cybersecurity risks; Information Security Governance: Benefits of implementing information security governance, principles of effective information security governance; Information Security Management System (ISMS): Understanding the necessity of an ISMS, creating information security policies and procedures, evaluating ISMS effectiveness; Incident Response and Cyber Incident Management: Developing incident response plans, handling and analyzing cybersecurity incidents, containment and eradication of threats, post-incident recovery

and reporting, disaster recovery and business continuity planning; Legal and Ethical Aspects of Cybersecurity: Exploring cybersecurity laws, regulations, and ethical considerations, privacy laws, intellectual property rights, and the legal implications of cybercrime; Emerging Trends in Cybersecurity: Impact of artificial intelligence in cybersecurity, blockchain security, and cloud-native security.

**Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

**Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

**Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

**Core Reading Materials**

Stallings W. (2021). Network Security Essentials: Applications and Standards. Pearson. ISBN-13: 978-0137489569

Reddy, N. (2019). Practical cyber forensics. Apress.

Daimi, K., Francia, G., Ertaul, L., Encinas, L. H., & El-sheikh, E. (Eds.). (2018). Computer and network security essentials. Springer.

**Recommended Reference Materials**

Tsado, L. K., & Osgood, R. (2022). Exploring careers in cybersecurity and digital forensics. Rowman & Littlefield.

International Journal of Computer Science Trends and Technology. ISSN 2347-8578. <http://www.ijestjournal.org/>

International Journal of Advanced Research in Computer and Communication Engineering. 2278-1021. <http://www.ijarce.com>

International Journal of Advanced Research in Computer Engineering & Technology. ISSN 2333-9721. <http://ijarcet.org/index.php/ijarcet/index>

Journal of Emerging Technologies and Innovative Research. ISSN: 2583-0554. [www.iciset.in](http://www.iciset.in)

IOSR Journal of Computer Engineering (IOSR-JCE). ISSN 2278-0661. <https://www.iosrjournals.org/IOSR-JCE.html>

Journal of Information Engineering and Applications. ISSN 2225-0506. <https://doi.org/10.7176/JIEA>

International Journal of Scientific Research in Science, Engineering and Technology. ISSN 2394-4099. <https://ijsrset.com/>

## **MIT823 Artificial Intelligence and Machine Learning**

### **Pre –requisite**

None

### **Purpose**

The purpose of this course is to provide students with advanced knowledge and skills in the field of artificial intelligence and machine learning. The course aims to equip students with the expertise required to tackle complex real-world AI challenges, develop advanced machine learning models, and address ethical considerations in AI technologies.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i Apply data preprocessing techniques and perform feature engineering to prepare datasets for machine learning tasks.
- ii Implement a variety of supervised and unsupervised learning algorithms for classification, regression, clustering, and dimensionality reduction.
- iii Employ computer vision techniques for object detection, image segmentation, and image generation.

- iv Explore applications of AI in domains like healthcare, finance, robotics, and autonomous systems.
- v Evaluate ethical concerns, fairness, bias, and transparency in AI systems and propose strategies to mitigate them.

### **Course Content**

Overview of AI and ML: Introduction to the field of artificial intelligence and machine learning; historical perspective, key concepts, and its impact on various industries; Machine Learning Fundamentals: Understanding supervised, unsupervised, and reinforcement learning; the process of training, validation, and testing of machine learning models; common evaluation metrics for measuring model performance; strategies to prevent overfitting and underfitting; Data Preprocessing and Feature Engineering: Techniques for cleaning and preparing raw data, handling missing values, selecting relevant features, transforming categorical variables, and normalizing data for optimal performance; Supervised Learning Algorithms: In-depth exploration of algorithms such as linear regression, logistic regression, decision trees, random forests, support vector machines (SVM), Naive Bayes, and k-Nearest Neighbors (k-NN); Unsupervised Learning Algorithms: Detailed study of clustering techniques like k-means and hierarchical clustering, dimensionality reduction methods like Principal Component Analysis (PCA) and t-Distributed Stochastic Neighbor Embedding (t-SNE), and association rule mining using the Apriori algorithm; Neural Networks and Deep Learning: Introduction to artificial neural networks (ANN), deep learning architectures such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), training strategies for deep models, and the concept of transfer learning; Natural Language Processing (NLP): Basics of text preprocessing and tokenization, word embeddings like Word2Vec and GloVe, applications of NLP including text classification, sentiment analysis, Named Entity Recognition (NER), and language generation for chatbots and text synthesis; Ethical and Social Implications of AI: Discussion on the ethical challenges posed by AI and ML, issues of fairness, bias, and discrimination in AI systems, privacy and security considerations, responsible development and deployment of AI in domains like healthcare and finance;

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

Behrooz H. and Hayeri Y. M. (2022). Machine Learning Applications in Surface Transportation Systems: A Literature Review.

Stuart R. and Peter N., (2003). Artificial Intelligence: A Modern Approach, Second Edition, Prentice-Hall

### **Recommended Reference Materials**

Joshi P. (2017). Artificial Intelligence. ISBN: 13 978-1786464392

IOSR Journal of Computer Engineering (IOSR-JCE). ISSN 2278-0661.  
<https://www.iosrjournals.org/IOSR-JCE.html>

Journal of Information Engineering and Applications. ISSN 2225-0506.  
<https://doi.org/10.7176/JIEA>

International Journal of Scientific Research in Science, Engineering and Technology. ISSN 2394-4099. <https://ijsrset.com/>

International Journal of Computer Science Trends and Technology. ISSN 2347-8578.  
<http://www.ijestjournal.org/>

International Journal of Advanced Research in Computer and Communication Engineering. 2278-1021. <http://www.ijarce.com>



International Journal of Advanced Research in Computer Engineering & Technology. ISSN 2333-9721. <http://ijarcet.org/index.php/ijarcet/index>

Journal of Emerging Technologies and Innovative Research. ISSN: 2583-0554. [www.iciset.in](http://www.iciset.in)

## **MIT824 Advanced Web Design**

### **Prerequisite**

None

### **Purpose**

The purpose of this course is to provide students with an advanced understanding of web design principles, techniques, and emerging trends. The course aims to enhance students' skills in designing user-friendly, responsive, and visually appealing websites.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i Design and develop responsive and accessible web layouts using advanced HTML and CSS techniques.
- ii Apply advanced JavaScript concepts to create dynamic and interactive web content.
- iii Implement advanced user interface design principles to enhance user experiences.
- iv Optimize website performance by applying advanced web performance optimization techniques.
- v Incorporate advanced graphics and animations into web designs using SVG, canvas, and other techniques.

### **Course Content**

Introduction to Web Design: Evolution of web design, Importance of user-centred design, Key design elements and principles, Web design trends and best practices; User Experience (UX) Design: Understanding user behaviour and psychology, Wireframing and prototyping, Information architecture and navigation design, Usability testing and feedback collection; Responsive Web Design: Advanced techniques for creating responsive and adaptable web layouts using HTML5 and CSS3; media queries, flexible grids, and fluid images; Web Accessibility: In-depth

understanding of web accessibility standards (WCAG), designing for different disabilities, implementing ARIA roles, and ensuring inclusive user experiences; CSS Styling: CSS preprocessors (Sass or Less), CSS animations and transitions, advanced typography and font styling, creating custom shapes using CSS, and exploring CSS frameworks; JavaScript for Web Design: JavaScript concepts for interactivity and dynamic content, using DOM manipulation, handling user input, asynchronous programming, and integrating third-party libraries; User Interface Design: UX principles, designing effective user interfaces, implementing interactive elements, micro-interactions, and user feedback mechanisms; Web Performance Optimization: Techniques for optimizing website performance, reducing page load times, minimizing HTTP requests, leveraging browser caching, and optimizing images and assets; Web Graphics: SVG graphics, icon fonts, creating and animating SVG elements, working with canvas for interactive graphics and animations; Web Design Trends: Exploring current design trends, such as minimalism, flat design, material design, and using design systems for consistency; Mobile-First Design: Creating web designs with a mobile-first approach, optimizing for various screen sizes and devices, touch-friendly interactions, and designing mobile UI patterns; Web Design Workflow: Advanced design tools and workflows, version control for web projects, collaboration tools, and integrating design systems into the workflow.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

## **Core Reading Materials**

Frain B. (2022). Responsive Web Design with HTML5 and CSS: Build future-proof responsive websites using the latest HTML5 and CSS techniques, 4th Edition. Packt Publishing. ISBN: 978-1803242712

Vickler A. (2021). Web development. Independently published. ISBN: 979-8735618966

Bright S. (2018). Web Design and Development: Website Technologies Fundamentals. Monday Sadiku. ISBN: 978-1393509806

## **Recommended Reference Materials**

Jennifer Robbins, (2018), Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics 5th Edition, Kindle Edition, O'Reilly Media, ASIN: B07DQ5RZJV

IOSR Journal of Computer Engineering (IOSR-JCE). ISSN 2278-0661.  
<https://www.iosrjournals.org/IOSR-JCE.html>

Journal of Information Engineering and Applications. ISSN 2225-0506.  
<https://doi.org/10.7176/JIEA>

International Journal of Scientific Research in Science, Engineering and Technology. ISSN 2394-4099. <https://ijsrset.com/>

International Journal of Computer Science Trends and Technology. ISSN 2347-8578.  
<http://www.ijestjournal.org/>

International Journal of Advanced Research in Computer and Communication Engineering. 2278-1021. <http://www.ijarce.com>

International Journal of Advanced Research in Computer Engineering & Technology. ISSN 2333-9721. <http://ijarcet.org/index.php/ijarcet/index>

Journal of Emerging Technologies and Innovative Research. ISSN: 2583-0554. [www.iciset.in](http://www.iciset.in)

## **YEAR II SEMESTER I**

### **MIT825 Advanced Network Management**

#### **Pre-requisite**

MIT814

#### **Purpose**

The purpose of this course is to provide advanced knowledge and skills in network administration, focusing on managing and optimizing complex network infrastructures. The course aims to equip students with the expertise to design, configure, secure, and troubleshoot advanced networks. Students will learn about the latest trends in network management, virtualization, and software-defined networking, preparing them for roles as network administrators and managers.

### **Expected Learning Outcomes**

By the end of the course the learner should be able to:

- i Configure and manage advanced network devices and services, optimizing network performance and security.
- ii Analyze and monitor network performance using advanced techniques such as packet capture and traffic analysis.
- iii Implement advanced network security measures, including access control, firewalls, and intrusion detection systems.
- iv Design and implement network monitoring and troubleshooting systems for efficient network management.
- v Understand network virtualization, SDN principles, and automation strategies for modern network environments.

### **Course Content**

**Advanced Network Configuration:** In-depth network device configuration, including routers, switches, and firewalls; advanced routing protocols and route optimization; **Network Services Management:** Managing network services like DNS, DHCP, and NTP; configuring and optimizing network services for performance and reliability; **User Access Control:** Advanced user authentication and authorization techniques; **Role-Based Access Control (RBAC),** implementing network segmentation and VLANs; **Network Performance Analysis:** Techniques for monitoring and analyzing network performance, including packet capture and analysis, network traffic monitoring, and optimization strategies; **Network Security Management:** Implementing advanced network security measures, including access control policies, firewall configuration, intrusion detection and prevention systems, and vulnerability management; **Network Monitoring and Troubleshooting:** Designing and implementing network monitoring systems, fault management

techniques, troubleshooting methodologies, and root cause analysis; Network Virtualization and SDN: Understanding network virtualization technologies, SDN principles, network programmability, and automation using software-defined networking; Network Configuration Management: Effective techniques for network configuration management, including version control, configuration backup, change management, and compliance monitoring; Network Management Protocols: In-depth study of network management protocols such as SNMP, NetFlow, RMON, and their practical application in monitoring and managing networks; Network Management Standards and Frameworks: Overview of network management standards like ITIL, ISO/IEC 20000, and ITSM, and their implementation for effective network management; Research Topics in Advanced Network Management: Exploration of current research topics and emerging trends in advanced network management, including SD-WAN, 5G networks, and network automation.

**Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

**Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

**Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

**Core Reading Materials**

Network Management: Principles and Practice" by Mani Subramanian (2014) ISBN-13: 978-8132216248

"Network Performance and Security: Testing and Analyzing Using Open Source and Low-Cost Tools" by Chris Chapman and Michal Sikorski (2017) ISBN-13: 978-0128053930

"Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner (2013) ISBN-13: 978-0130460196

"Software-Defined Networking: Design and Deployment" by Mustafa A. Bassiouni (2018) ISBN-13: 978-1498760139

### **Recommended Reference Materials**

Network Programmability and Automation: Skills for the Next-Generation Network Engineer" by Jason Edelman, Scott S. Lowe, and Matt Oswalt (2018) ISBN-13: 978-1491931257

## **MIT826 Advanced Architectures for Software Systems and Emerging Issues**

### **Pre –requisite**

MIT 820 Advanced Software Engineering

### **Purpose**

The purpose of this course is to provide students with advanced knowledge and skills in designing modern and efficient software architectures to meet the demands of contemporary computing environments. The course aims to equip students with the expertise to design scalable, secure, and resilient software systems that align with emerging architectural trends and address ethical and societal considerations.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i. Design software architectures using advanced architectural patterns such as microservices, serverless, and event-driven architectures.
- ii. Apply cloud-native principles and containerization techniques to create scalable and efficient software systems.
- iii. Incorporate security measures into software architectures to ensure data protection and secure communication.
- iv. Design resilient and fault-tolerant software systems capable of handling failures and disruptions.

- v. Analyze and address emerging architectural trends, ethical considerations, and sustainability in software architecture design.

### **Course Content**

Introduction to Software Architectures: Definitions and importance of software architecture, Architectural styles and patterns, Architectural components and their interactions; Architectural Design Principles: Separation of concerns and modularity, Abstraction and encapsulation, Coupling and cohesion, Single Responsibility Principle (SRP), Open-Closed Principle, Liskov Substitution Principle, Dependency Inversion Principle (DIP), Flexibility and Extensibility, Scalability, Performance Optimization, Security, Testability, Usability, Standardization and Consistency, Adaptability to Technology Change; Architectural Styles and Patterns: Monolithic architecture, Client-server architecture, Microservices architecture, Event-driven architecture, Layered architecture, Model-View-Controller (MVC) pattern, Observer pattern, Singleton pattern; Quality Attributes in Architecture Design: Performance, scalability, and reliability, Maintainability and reusability, Security and privacy considerations, Usability and user experience; Advanced Software Architectures: Exploration of microservices architecture, serverless architecture, and event-driven architecture; comparison of monolithic and distributed architectures; Cloud-Native Architectures: Designing applications for cloud environments, containerization (Docker, Kubernetes), and cloud-native patterns; Scalability and Performance: Strategies for designing highly scalable and performant software architectures; load balancing, caching, and distributed databases; Security in Software Architectures: Incorporating security measures into software architectures, including encryption, authentication, authorization, and secure communication; Resilience and Fault Tolerance: Designing for resilience and fault tolerance in distributed systems (techniques such as circuit breakers and graceful degradation); Data Integration and Interoperability: Approaches to integrating data from various sources and systems (API design, data sharing, and interoperable architectures); Emerging Architectural Trends: Exploring emerging trends such as edge computing, serverless computing, and quantum computing and their impact on software architectures; Ethics and Social Responsibility: Addressing ethical considerations in software architectures, including privacy, bias, and fairness (implications for societal impact); Sustainability and Green Computing: Designing eco-friendly software architectures that minimize resource consumption and contribute to sustainable

computing; Architectural Decision-Making: Techniques for making informed architectural decisions, including trade-offs, risk assessment, and cost analysis; Emerging Issues in Software Architecture: Cloud computing and distributed systems, Internet of Things (IoT) architecture challenges, Edge computing and its implications, Big data and analytics in architecture design; Research Topics and Emerging Issues: Investigation of current research topics and challenges in advanced software architectures, including AI-driven architectures and blockchain-based architectures.

**Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

**Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

**Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

**Core Reading Materials**

Gorton I. (2011), Essential Software Architecture: Second edition, Springer  
Sommerville I, (2011) Software Engineering Pearson Education Inc.  
Pressman R, (2010) Software Engineering a Practioner approach McGraw –Hill

**Recommended Reference Materials**

Buschmann R. Meunier H., Rohnert P. and Sommerlad M, (1996) Pattern-Oriented Software Architecture (Part I), A System of Patterns John Wiley& sons  
Bruegge B, Dutoit A.H (2000) Object-oriented Software Engineering Prentice Hall,



Journal of Computer Science and Technology ISSN: 1000-9000 <http://www.springer.com/computer/journal/11390>

The International Journal of Technology Law and Practice ISSN: 0267-3649 <http://www.journals.elsevier.com/computer-law-and-security-review/>

International Journal of Applied Mathematics and Computer Science ISSN: 2083-8492 <http://www.journals.elsevier.com/computer-law-and-security-review/>

Information Systems Journal ISSN: 1365-2575 <http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291365-2575>

IEEE Transactions on Mobile Computing ISSN: 1558-0660

Mobile Computing and Communications Review ISSN: 1931-1222 <http://dl.acm.org/citation.cfm?id=J548>

Mathematics and Computer Education ISSN: 0730-8639 <http://www.macejournal.org/>

Journal of Multimediae ISSN 1796-2048 <http://www.academypublisher.com/jmm/>

Computer Law & Security Reviewe ISSN 0267-3649 <http://www.journals.elsevier.com/computer-law-and-security-review/>

International Journal of Wireless Information Networkse ISSN: 1572-8129 <http://link.springer.com/journal/10776>

ACM Transactions on Database Systemse ISSN: 1557-4644 ACM Transactions on Database Systemse ISSN: 1557-4644

## **MIT827 Foundations of E-Learning**

### **Pre –requisite**

None

### **Purpose**

The purpose of this course is to provide students with a foundational understanding of e-learning concepts, pedagogical principles, and technological tools. The course aims to equip students with the knowledge and skills to design and facilitate effective and engaging online learning experiences.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i. Explain the principles and theories underlying e-learning and its comparison with traditional learning.
- ii. Apply instructional design principles to design and develop effective e-learning courses.
- iii. Utilize technology tools and platforms for creating interactive and engaging online learning content.
- iv. Facilitate learner interaction and collaboration in online environments.
- v. Evaluate and apply accessibility considerations, assessment strategies, and quality assurance techniques in e-learning.

### **Course Content**

Introduction to E-Learning: Definition, history, and evolution of e-learning; comparison with traditional learning methods; benefits and challenges of e-learning; Learning Theories in E-Learning: Overview of behaviorism, constructivism, and connectivism in the context of e-learning; application of learning theories to online education; E-Learning Pedagogy: Designing effective online learning experiences; instructional strategies, content presentation, learner engagement, and assessment methods; Technology for E-Learning: Exploring learning management systems (LMS), multimedia tools, web conferencing, social media, and gamification in e-learning; Course Design and Development: Planning and designing e-learning courses; content organization, multimedia integration, interactive activities, and assessments; Interaction and Engagement: Facilitating learner interaction and collaboration in online environments; discussion forums, peer assessment, and virtual group projects; Assessment and Feedback in E-Learning: Designing assessments for online courses, formative and summative assessment strategies, providing timely feedback; Accessibility and Inclusivity: Ensuring e-learning materials are accessible to diverse learners; considerations for learners with disabilities and different learning styles; Quality Assurance in E-Learning: Standards and guidelines for designing and delivering high-quality e-learning courses; continuous improvement of e-learning content; E-Learning Trends and Future Directions: Exploration of emerging trends such as mobile learning, microlearning, virtual reality, and AI in e-learning.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

Friesen N. (2017). Re-Thinking E-Learning Research: Foundations, Methods and Practices

### **Recommended Reference Materials**

Simonson M., Smaldino S. and Zvacek S. (2015). Teaching and Learning at a Distance. Foundations of Distance Education. Sixth Edition. Information Age Publishing, Inc.

International Journal of Scientific Research in Science, Engineering and Technology. ISSN 2394-4099. <https://ijsrset.com/>

International Journal of Advanced Research in Computer and Communication Engineering. 2278-1021. <http://www.ijarcce.com>

International Journal of Advanced Research in Computer Engineering & Technology. ISSN 2333-9721. <http://ijarcet.org/index.php/ijarcet/index>

Journal of Emerging Technologies and Innovative Research. ISSN: 2583-0554. [www.iciset.in](http://www.iciset.in)

IOSR Journal of Computer Engineering (IOSR-JCE). ISSN 2278-0661. <https://www.iosrjournals.org/IOSR-JCE.html>

Journal of Information Engineering and Applications. ISSN 2225-0506. <https://doi.org/10.7176/JIEA>

International Journal of Computer Science Trends and Technology. ISSN 2347-8578. <http://www.ijestjournal.org/>

## **MIT828 Digital Markets Architecture**

### **Pre-requisite**

MIT814 Advanced Computer Networking

### **Purpose**

The purpose of this course is to provide students with a comprehensive understanding of the architecture, components, and strategies involved in digital markets. The course aims to equip students with the knowledge and skills to design, manage, and optimize digital marketplaces and e-commerce platforms.

### **Expected Learning Outcomes**

By the end of the course the learner should be able to:

- i. Describe the characteristics and key components of digital markets and e-commerce models.
- ii. Analyze and design e-commerce infrastructure, including cloud computing and serverless architecture.
- iii. Develop effective digital marketing strategies to enhance customer engagement and experience.
- iv. Evaluate data analytics techniques for gaining insights into customer behavior and market trends.
- v. Address security, privacy, legal, and ethical considerations in digital market architecture.

### **Course Content**

Overview of Digital Markets: Definition, evolution, and significance of digital markets; comparison with traditional commerce models; digital economy trends; E-Commerce Models: Exploration of various e-commerce models (B2C, B2B, C2C, etc.); understanding value chains and revenue streams in digital markets; Architectural Components of Digital Markets: Key architectural elements of digital marketplaces, designing intuitive user interfaces, effective product catalogs, secure payment systems, and efficient inventory management; Scalable and Distributed Systems: Principles of designing scalable and distributed architectures to handle high user traffic

and transaction volumes (load balancing, microservices, and cloud computing); Security and Privacy in Digital Markets: Addressing security challenges such as secure payment processing, data protection, and identity management; privacy concerns and compliance with regulations; Data-driven Decision Making: Importance of data analytics for market insights; customer behavior analysis, personalized recommendations, and effective decision-making; Digital Marketing Strategies: Utilizing digital marketing techniques including SEO, social media marketing, content creation, and online advertising to drive engagement and conversions; Mobile Commerce and Omnichannel Integration: Designing mobile commerce applications for seamless user experiences; integrating multiple sales channels to create a cohesive omnichannel strategy; Emerging Technologies in Digital Markets: Exploration of technologies shaping digital markets, such as blockchain for trust, AI for personalization, and IoT for connected commerce; Case Studies and Industry Best Practices: Analysis of real-world digital market platforms; studying successful business models, architectural strategies, and lessons from industry leaders.

### **Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

### **Instructional materials/ equipment**

Learning Management System, LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

### **Core Reading Materials**

"E-commerce 2020: Business, Technology, Society" by Kenneth C. Laudon and Carol Guercio Traver (2020) ISBN-13: 978-0135205832

"Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World" by Chuck Hemann and Ken Burbary (2018) ISBN-13: 978-1119265702

"Building Microservices: Designing Fine-Grained Systems" by Sam Newman (2015) ISBN-13: 978-1491950357

"Digital Business Models: Driving Transformation and Innovation" by Peter Weill and Stephanie L. Woerner (2018) ISBN-13: 978-1633692702

### **Recommended Reference Materials**

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher (2017) ISBN-13: 978-1484226032

### **MIT898 MSc. IT Research Proposal Development**

#### **Pre –requisite**

MIT 815 Research Methods and Scientific Writing in Computing

#### **Purpose**

The purpose of this course is to equip students with the skills required to develop advanced research proposals in the field of Information Technology. The course aims to guide students through the entire process of formulating research questions, identifying gaps in existing literature, selecting appropriate methodologies, and crafting comprehensive research proposals.

#### **Expected learner outcomes**

By the end of the course the learner should be able to:

- i. Demonstrate an understanding of the research proposal development process and its components.
- ii. Identify relevant and impactful research problems in the IT field.
- iii. Conduct thorough literature reviews and analyze gaps in existing research.
- iv. Develop research frameworks, objectives, and hypotheses for IT research proposals.
- v. Design research methodologies, including data collection and analysis techniques.

#### **Course Content**

Understanding Research Proposal Development: Introduction to research proposals, their purpose, components, and importance in advancing IT research; Research Problem Identification: Techniques for identifying relevant and impactful research problems in the field of IT; Literature Review and Gap Analysis: Conducting thorough literature reviews, identifying gaps in existing research, and formulating research questions; Research Design and Methodology: Selecting appropriate research methodologies, data collection techniques, and research design for IT projects; Ethical Considerations: Addressing ethical considerations in IT research, including data privacy, informed consent, and research integrity; Developing a Research Framework: Creating conceptual and theoretical frameworks to guide the research proposal's structure and content; Crafting Research Objectives and Hypotheses: Formulating clear research objectives, hypotheses, or research questions to guide the study; Research Proposal Structure: Organizing the research proposal with sections like introduction, literature review, methodology, and expected outcomes; Data Analysis and Interpretation: Exploring methods for analyzing and interpreting data collected during the research; Impact and Contribution: Discussing how the proposed research contributes to the field of IT and its potential impact; Writing and Presentation Skills: Enhancing academic writing skills, creating clear and compelling proposals, and effective presentation techniques; Peer Review and Feedback: Engaging in peer review processes to improve the quality of research proposals.

**Mode of delivery**

60% face to face, 40% online (LMS, Lectures, directed reading, practical demonstrations, and hands-on laboratory sessions and projects)

**Instructional materials/equipment**

LCD projector, White board, Textbooks, computers, journals, E-books and Internet

**Course assessment**

CAT	40%.
Exam	60%.
<b>Total</b>	<b>100%</b>

## **YEAR II SEMESTER II**

### **MIT899(I) Thesis I**

#### **Pre –requisite**

MIT 898 MSc. IT Research Proposal Development

#### **Purpose**

The course aims to foster advanced research skills, critical thinking, and the ability to contribute to the IT field through original research.

#### **Expected learner outcomes**

By the end of the course the learner should be able to:

- i. Define relevant research problems in the IT field.
- ii. Conduct a comprehensive literature review and critically analyze gaps in existing research.
- iii. Design and implement appropriate research methodologies for data collection and analysis.
- iv. Develop a theoretical framework that align with the research objectives and hypotheses.
- v. Produce a well-structured research thesis that contributes to the field of Information Technology.

#### **Course Content**

Introduction to IT Research Thesis: Overview of the research thesis process, understanding the structure and components of a thesis, and its significance in contributing to the field of IT; Research Problem and Hypothesis: Identifying a relevant research problem, formulating clear research hypotheses, and establishing the research scope; Literature Review and Gap Analysis: Conducting a comprehensive literature review, identifying gaps in existing research, and positioning the research within the broader IT context; Research Methodology: Selecting appropriate research methodologies, data collection techniques, and research design for the thesis; Data Collection and Analysis: Gathering and analysing data using suitable tools and techniques, and interpreting the results; Theoretical Framework: Developing a robust theoretical framework that supports the research objectives and hypotheses; Writing and Structuring the Thesis: Organizing the thesis with sections including introduction, literature review, methodology, results,



discussion, and conclusion; Ethical Considerations: Addressing ethical considerations in data collection, analysis, and reporting; Peer Review and Feedback: Engaging in peer review processes to improve the quality of the thesis; Presentation Skills: Developing effective presentation skills for defending the thesis; Emerging Technologies and Trends: Integrating insights from emerging IT trends (AI, blockchain, IoT) into research topics and exploring their implications; Defending thesis at the departmental and school level.

### **Mode of delivery**

60% face to face, 40% online (LMS, Seminars, Group discussion, Presentations)

### **Instructional materials/equipment**

LCD projector, White board, Textbooks, computers, journals, E-books and Internet

### **Course assessment**

Progress reports

### **MIT899(II) Thesis II**

#### **Pre –requisite:**

MIT899 Thesis I

### **Purpose**

The purpose of this course is to guide students through the final stages of their research journey, ensuring the quality of their research output and facilitating its dissemination. This course aims to refine research theses through expert feedback, enhance students' skills in scholarly writing, and prepare them to submit their work to both academic and administrative bodies.

### **Expected Learning outcomes**

By the end of the course the learner should be able to:

- i. Integrate critical feedback received from experts and peers to enhance the rigor and contribution of the research thesis.

- ii. Prepare the research findings for publication by following the guidelines and standards of reputable academic journals or conferences.
- iii. Ensure that the research thesis meets the required formatting, structure, and administrative standards set by the School of Graduate Studies.
- iv. Demonstrate advanced skills in scholarly writing and communication, suitable for academic publication and administrative submission.
- v. Develop the ability to disseminate research findings effectively through publication and submission processes.

### **Course Content**

Research Thesis Refinement: Receiving critical feedback from experts, peers, and supervisors to improve the quality and rigor of the research thesis; Manuscript Preparation and Submission: Adhering to guidelines for preparing research manuscripts suitable for publication in high-impact journals or conferences; Thesis Preparation and Submission: Aligning the research thesis with the standards set by the School of Graduate Studies for final submission and processing.

### **Mode of delivery**

60% face to face, 40% online (Seminars, Group discussion, Presentations)

### **Instructional materials/equipment**

LCD projector, White board, Textbooks, computers, printers, journals, E-books and Internet

### **Course assessment**

Progress Reports

+