

**Ministry of Education**

**BSc in Information Systems**

**Test Blueprint Document for Exit Examination**

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# Introduction

The Ministry of Education of Ethiopia has announced the implementation of exit exam for all undergraduate program students (public and private), beginning with the 2022/2023 academic year, in order to improve the quality of graduates produced by higher learning institutions. The exit exam aimed at checking whether students have acquired the required knowledge, skills and attitudes or not. To implement this, it requires determining competency areas for a specific program, which is already completed. Based on the competency areas prepared, it needs to plan the construction of tests.

Planning of a test is a first and vital step in the construction of an achievement test. An achievement test demands very systematic and careful planning, as a fact that good planning is a symbol of success. Tests are the tools that provide scores that measure level of student learning and study program learning outcomes. In order to achieve the valid and reliable measurement of student learning and program learning outcomes, the development of valid and reliable test is the mandatory. Test should be able to measure student performance in all dimensions of knowledge, skill and attitude. The carefully planned test construction contributes to improve the overall quality of the test in terms of test content validity, difficulty level, discrimination power and test reliability. Test preparation is not an easy task; it requires a careful planning and guideline to make the task simple. Test construction needs the preparation of test blue print. Test blueprint is defined as a complete plan that explains how to develop a test. The term refers to a map or specification of assessment to ensure that all aspects of the curriculum and educational domains are covered by the assessment programs over a specified period of time. It helps curriculum developers/test constructors to match various competencies with the course content and the appropriate modality of assessment.

Generally, test blueprint will help to ensure tests: 1) Appropriately assess the achievement of instructional objectives of the course; 2) Appropriately reflect key course goals, objectives and the material learned or covered during the instruction period; and 3) Include the appropriate item formats along with the knowledge and skills being assessed.

Keeping this in mind, the team has prepared this test blueprint document in order to help the test developers or content specialists in their process of valid and reliable test construction. The major points considered in the process of preparing this test blue print guideline were the core competencies that have been already identified for the themes of courses, the course contents, course credit hours, and the learning outcomes with their corresponding levels of achievement by learning domains. In line with these, the number of test items that should adequately assess the performance of students in all the content topics will be determined through discussion with the content specialists who construct the blueprint and test for their corresponding study program.

Therefore, the main purpose of this manual is to give direction on how to develop blueprint for content specialists so that they can develop a test blueprint for their respective program.

# Objective/significance of Test Blueprint Preparation

It is important to develop a blueprint for information systems undergraduate program in order to evaluate its effect as a tool to increase the content validity of assessment with an appropriate distribution of questions across topics, weightage given to topics, and the examinations quality to become fair and measuring graduates based of learning outcome in terms of cognitive, affective and psychomotor domains. Generally the significance developing a blueprint of the program help to ensure alignment with course goals, selected competency and program objectives.

# Expected Profile of the Graduates

A graduate profile is a document that uses to specify the cognitive, personal, and interpersonal competencies that students should have when they graduate. It describes the attributes that the students should have at the end. The graduate profile for information systems program are shows as follow:

|  |  |
| --- | --- |
| **Graduate Profile (Competence)** | **Professional Profile** |
| 1. Analyze, Design, Implement, Test and Maintain Information Systems | * Develop business application * analyze information systems * Design information systems * Write software programmes * Analyze business processes * Design user interfaces |
| 2. Design, Implement, Test, Administer and Maintain Database Systems | * Administer database systems * Analyze database systems * Develop database |
| 3. Analyze, Design, Configure, Test, Administer and Maintain Networks and Network Resources | * Design and Develop Computer Networks |
| 4. Plan, Organize, Direct, Control, Lead Information Systems, Services and Resources | * Manage web content * Manage e-business * Serve as ERP specialist * Serve as chief information officer * Shoulder responsibility of information auditing and compliance specialist * Manage information systems architectures * Manage information systems assets * Manage information systems operations * Manage information system projects |

Table 1: Professional and Graduate Profile

# Objective (General and specific) of the program

Graduates, in general, will specifically have the chance to have knowledge and understanding in the following major areas: Theoretical background on the functionalities of computer and application of computer to businesses; Theories, principles, processes and techniques of organization, storage, retrieval, dissemination and utilization of all forms of information; Understanding of computers and communication systems, including basic software engineering, network design, database development, implementation and management; Various types of academic and business information resources, systems and services; Knowledge of basic principles of ICT-based business information processing techniques; Theories, practices and principles of information systems analysis, design, development and management in the business environment; Principles and different approaches of computer programming and algorithm development to solve real world problems; Theories, practices and principles of business process engineering in a creative manner to solve information related problem of businesses and organizations.

Major Practical Skills of the Graduates will be:

To be able to write high and middle level computer programs using different technologies to solve information related problems like storage, retrieval and management of information.

* to design, implement and evaluate various information systems and multimedia resources including the Internet;
* to manage business information systems and services (organization and retrieval of business information);
* to manage and actively participate in information system development projects;
* to analyze, design, develop, manage and evaluate business information systems from different perspectives;
* to provide information system/technology consultancy services;
* to solve problems in business enterprises through application of Information communication technology and development of decision support information systems;
* to plan and execute projects related to information systems development and resources and services;

Graduates will have the chance to be equipped with transferable skills:

* to work in teams specially in information systems projects and systems development;
* to have good communication skill
* to have time and self-management skill

Attitudes and Values: The graduates will be inspired:

* to have professionalism at the center of their mentality;
* to have a positive and responsive attitude towards the value of information resources;
* to have good personal confidence in their jobs and professional activities;
* to have a positive attitude towards their profession (love, dedication, commitment, etc.);
* to have the sense of co-operation, honesty, loyalty, etc.; and

1. to be ethical.

# Themes, List of Course and credit hours

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Themes** | **List of courses** | **Course credit hours** | **themes credit hours** |
| 1 | Computer programming and Web-Technology | Basic Computer Programming | 3 | 10 |
| Object Oriented Programming | 4 |
| Internet Programming | 3 |
| 2 | Computer networking and information security | Data Communication and Computer Networks | 3 | 6 |
| Information System Security | 3 |
| 3 | Database and Information Management | Database Systems | 3 | 9 |
| Introduction to Information Storage and Retrieval | 3 |
| Multimedia Information Systems | 3 |
| 4 | Intelligent Systems | Fundamentals of Artificial Intelligence | 3 | 9 |
| Knowledge Management | 3 |
| Introduction to Machine Learning | 3 |
| 5 | Information Systems Development and Management | Management of Information Systems and Services | 3 | 12 |
| Information Systems Project Management | 3 |
| Enterprise Systems | 3 |
| System Analysis and Design | 3 |

Table 2: Themes, Courses and Cr. Hrs.

# Share of the Themes/Courses/Items in Percentage (%)

To know the share of the identified themes, courses and question items are calculated using the following formula stated blow and the expected results is and the number of items for themes and courses in sated in table 5 at appendix 1 and alignments of the competency, selected course goals and program at appendix 2.

***Percent share for Theme i =*** *100*

***Percent share for Course i*** *= Percent share for Theme i*

***Total test items for Theme i*** *= for the program*

***Total of items for course i*** *=*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Themes and Share of the themes in %** | **Name and Share of the Courses in %** | **Credit hour** | **General objective/Competency** | **Specific objectives /learning outcomes** | **Learning outcomes** | | | | | | | | | | | | | | | | **No. of items** | |
| **Cognitive** | | | | | | | | | | | | **Affective** | | **Psychomotor** | |
| Remembering | | Understanding | | Application | | Analysis | | Evaluation | | Creation/Synthesis | |
| Computer programming and Web-Technology  (22%) | Basic Computer Programming  (6.6%) | 3 | * Understand programming principles and logic | understand the principles of fundamental programming concepts using C++ |  | | x | |  | | x | |  | | x | |  | | x | |  | |
| develop a program that uses each of the following fundamental programming constructs: structures, arrays, functions, pointers |  | |  | | x | |  | | x | | x | |  | |  | |  | |
| Implement I/O functionality to read from and write to data and text files. |  | |  | |  | |  | |  | | x | |  | |  | |  | |
| Internet Programming  (6.6%) | 3 | * Design and develop static and dynamic web-based systems and applications | Demonstrate knowledge of website development concepts and terminology | x | |  | | x | |  | |  | |  | |  | |  | |  | |
| Design and develop static websites using HTML, CSS, JavaScript |  | |  | | x | | x | | x | | x | | x | |  | |  | |
| Design and develop dynamic data driven websites using PHP and MySQL |  | |  | | x | |  | |  | | x | |  | |  | |  | |
| Object Oriented Programming (8.8%) | 4 | * Develop applications using object oriented programing paradigm | Understand object-oriented programming major concepts such as abstraction, encapsulation, inheritance, polymorphism, interface etc. |  | | x | |  | |  | |  | |  | | x | |  | |  | |
| design and implement data and file driven small-scale object-oriented program using Java |  | |  | | x | | x | | x | | x | |  | |  | |  | |
| Computer network and information security (13%) | Data Communication and Computer Networks (6.5%) | 3 | * Understand the underlying principles of Data Communication and computer networking | Describe the basics of data communications and network: types of Network, network devices, data transmission, and Reference Model | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Demonstrate cable crimping, establishing, setup and troubleshooting Networks |  | |  | | x | | x | |  | | x | |  | |  | |  | |
| Understand network addressing, sub netting, network security and data integrity |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Information System Security  (6.5%) | 3 | * Understand and identify security threats to information systems | Understand basic issues, concepts, principles, and mechanisms in information security |  | | x | |  | |  | |  | |  | | x | |  | |  | |
| Identify risks and threats to information systems | x | |  | |  | |  | |  | | x | |  | |  | |  | |
| analyze both early and contemporary threats to information security |  | |  | | x | | x | |  | |  | |  | |  | |  | |
| Data and Information Management  (20%) | Database Systems  (6.7%) | 3 | * Design ,Develop and administer database systems | Explain database system, data management approaches, types and its applications |  | | x | |  | |  | |  | |  | | x | |  | |  | |
| Design conceptual, logical and physical database models. |  | |  | | x | |  | | x | |  | |  | |  | |  | |
| Design ER models and map them into relational tables |  | |  | | x | | x | |  | | x | |  | |  | |  | |
| Understand database functional dependency and normalization |  | | x | |  | |  | | x | | x | |  | | x | |  | |
| Explain database query processing, optimization, transaction management and database security |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Introduction to Information Storage and Retrieval (6.7 %) | 3 | * Understand concepts of information storage and retrieval : models; evaluations metrics and techniques for enhancing retrieval effectiveness | Understand the various Information Retrieval Systems and processes | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Understand the processes of information storage and retrieval |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Design ,develop and evaluate information retrieval models |  | |  | | x | | x | | x | | x | |  | | x | |  | |
| Multimedia Information Systems  (6.7 %) | 3 | * Understand content-based multimedia systems and compression techniques | Understand multimedia systems, multimedia elements and data characteristics, format and models | x | | x | |  | | x | | x | | x | | x | |  | |  | |
| Describe the multimedia data representation techniques | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Intelligent Systems  (19%) | Fundamentals of Artificial Intelligence  (6.3% | 3 | Understand different intelligent agents types and characteristics and their applications | Describe different types and characteristics of intelligent agents | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Explain the different perspectives and historical background of Artificial Intelligence, and its type |  | | x | |  | | x | | x | |  | |  | |  | |  | |
| Knowledge Management  (6.3%) | 3 | * Understand knowledge management system concepts, representations, sharing principles and management aspects | Understand the fundamental concepts of knowledge and knowledge creation, acquisition, representation, dissemination, use and re-use, and management. |  | | x | |  | |  | |  | | x | | x | |  | |  | |
| Apply knowledge generation, engineering, and transfer, and in the representation, organization, and exchange of knowledge. |  | |  | | x | | x | |  | | x | |  | | x | |  | |
| Describe the role and use of knowledge in organizations and institutions, and the typical obstacles that KM aims to overcome. | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Understand the core concepts, methods, techniques, and tools for computer support of knowledge management. |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Introduction to Machine Learning  (6.3%) | 3 | Able to prepare data and apply machine learning algorithms to achieve a learning goal within an intelligent system. | Understanding about the fundamental concepts in machine learning, the different classes of machine learning algorithms | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Apply machine learning methods to achieve a learning goal within an intelligent system on prepared datasets. |  | |  | | x | | x | |  | |  | | x | |  | |  | |
| Be able to evaluate the performance of learning systems. |  | |  | |  | |  | | x | |  | |  | |  | |  | |
| Information Systems Development and Management  (26%) | Management of Information Systems and Services  (6.5%) | 3 | * Understand the principles and theories of Management Information Systems (MIS) and its impact on organizations and businesses. | Understand the principles and theories of Management Information System (MIS) and its impact on organizations. |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Describe IT’s strategic importance in business and the essential elements of strategic plan development, | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Apply computer-based information systems and how they are used in supporting for decision making. |  | |  | |  | | x | |  | | x | | x | |  | |  | |
| Understand contemporary managerial issues in effectively choosing, deploying, and utilizing IT/IS to gain competitive advantage, |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Information Systems Project Management  (6.5%) | 3 | * Understand the concepts, best practices of managing IS/IT related projects and coordinate them in professional manner | Understand and value the essence of Project management within the context of organizational information systems |  | | x | |  | |  | |  | |  | |  | |  | |  | |
| Develop project proposal/ project plan by applying project management phases. |  | |  | | x | | x | |  | | x | | x | |  | |  | |
| Understand the concepts, experiences and practices of managing IS/IT related projects | x | | x | |  | |  | |  | |  | |  | | x | |  | |
| Enterprise Systems  (6.5%) | 3 | * Understand how enterprise systems integrate functional areas into enterprise wide information system | Understand the fundamentals of enterprise systems and issues associated with their implementation. |  | | x | |  | | x | | x | |  | |  | |  | |  | |
| Understand how enterprise systems integrate functional areas into one enterprise wide information system. | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Identify, describe, and evaluate the major enterprise system software providers and their packaged systems. | x | | x | |  | | x | | x | | x | | x | | x | |  | |
| System Analysis and Design  (6.5%) | 3 | * Understand and apply software development process principles, and practices and create a high quality software * using UML diagrams | Understand the system development process, from planning though analysis and design to implementation and maintenance. | x | | x | |  | |  | |  | |  | |  | |  | |  | |
| Demonstrate the application of Unified Modeling Language (UML) |  | |  | | x | |  | |  | | x | |  | |  | |  | |
| Apply software development process principles, and practices to create a high-quality software |  | |  | | x | | x | |  | | x | | x | | x | |  | |
| **Total Number of Items** | | | | | | **14** | | **27** | | **15** | | **16** | | **11** | | **19** | | **11** | | **7** | | **120** | |

Table 3: Shares of Themes, Courses and Items

# Learning outcomes in terms of the three domains (Cognitive, Affective and Psychomotor)

In this document try to touch three domains such knowledge attainment (Cognitive), emotional (Affective) arena and learning behavior (Psychomotor). As it shown in the table 4 below.From the selected 15 core courses (46 credits hours) 120 question proposed. Learning outcome in terms of Cognitive, Affective and Psychomotor are try to address proportionally to align with program goals and selected competency.

# Test blueprint Table (Table of Specification)

| **Discipline** | **Course** | **Competencies** | **Sample Learning Outcomes** |
| --- | --- | --- | --- |
| Information Systems | Basic Computer Programming | * Understand programming principles and logic | * understand the principles of fundamental programming concepts * develop a program that uses each of the following fundamental programming constructs: structures, arrays, functions, pointers * Implement I/O functionality to read from and write to data and text files. |
| Object Oriented Programming | * Develop applications using programming languages concepts, tools and techniques * To have good personal confidence on application and system development * To have interpersonal group skills in software development | * Understand object-oriented programming major concepts such as abstraction, encapsulation, inheritance, polymorphism, interface etc. * design and implement data and file driven small-scale object-oriented program using Java |
| Multimedia Information Systems | * Understand content-based multimedia systems and compression applications * Develop multimedia systems | * Describe digital multimedia data characteristics, format and models * Describe the multimedia data representation |
|  | Internet Programming | * Elaborate the underlying principles of Internet and Web-Technology * Develop web-based systems * To have good personal confidence on application and system development * To have interpersonal group skills in software development | * Demonstrate knowledge of website development concepts and terminology * Design and develop static websites using HTML, CSS, JavaScript * Design and develop dynamic data driven websites using PHP and MySQL |
|  | System Analysis and Design | * Explain the system development process, from planning though analysis and design to implementation and maintenance * Explain the need for object-oriented systems analysis and design * Understand the object technology and modeling principles. * Apply software development process principles, and practices and create a high quality software * Design systems using UML diagrams * To have good personal confidence on application and system development * To have interpersonal group skills in software development | * Understand the system development process, from planning though analysis and design to implementation and maintenance. * Demonstrate the application of Unified Modeling Language (UML) * Apply software development process principles, and practices to create a high-quality software |
|  | Database Systems | * Understand the underlying principles of database and database management systems * Design ,Develop and administer database systems * To have good personal confidence on application and system development | * Explain database system, data management approaches, types and its applications * Design conceptual, logical and physical database models . * Design ER models and map them into relational tables * Understand database functional dependency and normalization * Explain database query processing, optimization,transaction management and database security |
|  | Introduction to Information Storage and Retrieval | * Explain the data and file structures for information retrieval * Understand concepts of Information Storage and Retrieval : models; evaluations and techniques for enhancing retrieval effectiveness | * Understand the various Information Retrieval Systems and processes * Understand the processes of information storage and retrieval * Design ,develop and evaluate information retrieval models |
|  | Data Communication and Computer Networks | * Explain the underlying principles of computer networks and network resources * Design and configure computer networks | * Describe the basics of data communications and network: types of Network, network devices, data transmission, and Reference Model * Demonstrate cable crimping, establishing, setup and troubleshooting Networks * Understand network addressing, sub netting, network security and data integrity |
|  | Information System Security | * Acquire an understanding of network security and its changing character * Identify and investigate threats to information systems security * To have information systems ethics | * Understand basic issues, concepts, principles, and mechanisms in information security * Identify risks and threats to information systems * analyze both early and contemporary threats to information security |
|  | Fundamentals of Artificial Intelligence | * Describe different types and characteristics of intelligent agents | * Describe different types and characteristics of intelligent agents * Explain the different perspectives and historical background of Artificial Intelligence, and its type |
|  | Knowledge Management | * Understand knowledge management system concepts * Represent knowledge and implement inference techniques to provide solutions partially observable environments | * Understand the fundamental concepts of knowledge and knowledge creation, acquisition, representation, dissemination, use and re-use, and management. * Apply knowledge generation, engineering, and transfer, and in the representation, organization, and exchange of knowledge. * Describe the role and use of knowledge in organizations and institutions, and the typical obstacles that KM aims to overcome. * Understand the core concepts, methods, techniques, and tools for computer support of knowledge management. |
|  | Introduction to Machine Learning | * Develop intelligent systems * Able to prepare data and apply machine learning methods to achieve a learning goal within an intelligent system. | * Understanding about the fundamental concepts in machine learning, the different classes of machine learning algorithms * Apply machine learning methods to achieve a learning goal within an intelligent system on prepared datasets. * Be able to evaluate the performance of learning systems. |
|  | Management of Information Systems and Services | * Understand the principles and theories of Management Information Systems (MIS) and its impact on organizations. * Describe IT’s strategic importance in business and the essential elements of strategic plan development * Define strategies for the effective utilization of IS/IT in organizations. * To have the sense of co-operation in system development. | * Understand the principles and theories of Management Information System (MIS) and its impact on organizations. * Describe IT’s strategic importance in business and the essential elements of strategic plan development, * Apply computer-based information systems and how they are used in supporting for decision making. * Understand contemporary managerial issues in effectively choosing, deploying, and utilizing IT/IS to gain competitive advantage, |
|  | Information Systems Project Management | * Understand the concepts, experiences and practices of managing IS/IT related projects * Develop project proposal and project plan * To have the sense of co-operation in system development. * Coordinate and facilitate system projects in a professional manner * To have interpersonal communication * To have responsibilities, and characteristics of the IS professional | * Understand and value the essence of Project management within the context of organizational information systems * Develop project proposal/ project plan by applying project management phases. * Understand the concepts, experiences and practices of managing IS/IT related projects |
|  | Enterprise Systems | * Understand how enterprise systems integrate functional areas into one enterprise wide information system * To have the sense of co-operation in system development. | * Understand the fundamentals of enterprise systems and issues associated with their implementation. * Understand how enterprise systems integrate functional areas into one enterprise wide information system. * Identify, describe, and evaluate the major enterprise system software providers and their packaged systems. |
|  | | | |

Table 4: Specification of Competencies and Learning Outcomes

# Conclusion

Exit examination can have a vital role in producing knowledgeable, skillful and attitudinally matured graduates. It contributes to prepare competent graduates as it can serve as a quality check for effectiveness. It also helps in improving academic programs quality and effectiveness. Furthermore, it can create the platform for cooperation among academic programs at different universities to work jointly to improve the programs quality.

In view of this, this document is produced to assist the setting of the exit examinations for all programs, which is being delivered by Ministry of Education. To meet the graduation profile, competency and learning outcome, exit exam competency selection and identifying core course was done for 2015 EC graduating students. As a result, preparing test blueprint is necessary to prepare fairly distributed items based on the above criteria.

Appendix 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Themes** | **Course Name** | **Learning outcomes** | **Cr. Hrs.** | **Weight for the course** | **Number of Test Items for each course** | **Cognitive Domain** | | | | | |  |  |  |
| **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Affective** | **Psychomotor** | **Total** |
| Theme 1 Item = 25 Items from the total | 1 |  | 3 | 3/10= 0.3 | 0.3\*25=8 | - | 2 | 1 | 2 | 1 | 1 | - | 1 | 8 |
| 2 |  | 4 | 4/10=0.4 | 0.4\*25=10 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 10 |
| 4 |  | 3 | 3/10=0.3 | 0.3\*25=8 | 1 | 1 | 1 | 2 | 1 | 1 | - | 1 | 8 |
| **Sub-total** |  |  | **10** |  |  | **2** | **5** | **4** | **5** | **3** | **3** | **1** | **3** |  |
| Theme 2  Item = 15  Items from the total | 1 |  | 3 | 3/6= 0.5 | 0.5\*15=8 | - | 1 | 2 | 1 | 1 | 2 | 1 | - | 8 |
| 2 |  | 3 | 3/6=0.5 | 0.5\*15=8 | 1 | 1 | 2 | 1 | 1 | 1 | - | 1 | 8 |
| **Sub-total** |  |  | **6** |  |  | **1** | **2** | **4** | **2** | **2** | **3** | **1** | **1** |  |
| Theme 3  Item = 25 items from the total | 1 |  | 3 | 3/9=0.33 | 0.33\*25=8 | 1 | 1 | 1 | 1 | 1 | 2 | - | 1 | 8 |
| 2 |  | 3 | 3/9=0.33 | 0.33\*25=8 | - | 1 | 2 | 1 | 2 | 1 | - | 1 | 8 |
| 3 |  | 3 | 3/9=0.33 | 0.33\*25=8 | 1 | 2 | 1 | - | 1 | 2 | 1 | - | 8 |
| Sub-total |  |  | 9 |  |  | **2** | **4** | **4** | **2** | **4** | **5** | **1** | **2** |  |
| Theme 4  Item = 20 items from the total |  |  | 3 | 3/9=0.33 | 0.33\*20=6 | 1 | - | 1 | - | 1 | 2 | 1 | - | 6 |
|  |  | 3 | 3/9=0.33 | 0.33\*20=6 | - | 1 | 2 | 1 | - | 1 | - | 1 | 6 |
|  |  | 3 | 3/9=0.33 | 0.33\*20=6 | 2 | 2 | - | - | 1 | - | 1 | - | 6 |
| **Sub-total** |  |  | 9 |  |  | **3** | **3** | **3** | **1** | **2** | **3** | **2** | **1** |  |
| Theme 5  Item = 35 items from the total |  |  | 3 | 3/12=0.25 | 0.25\*35=9 | 1 | - | - | 1 | 2 | 2 | 2 | 1 | 9 |
|  |  | 3 | 3/12=0.25 | 0.25\*35=9 | - | 2 | 1 | 1 | - | 2 | 2 | 1 | 9 |
|  |  | 3 | 3/12=0.25 | 0.25\*35=9 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 9 |
|  |  | 3 | 3/12=0.25 | 0.25\*35=9 | - | 2 | 1 | 2 | 2 | - | 2 | - | 9 |
| **Sub-total** |  |  | **12** |  |  | **2** | **5** | **3** | **6** | **5** | **5** | **7** | **3** |  |
| **Grand Total** |  |  |  |  |  | **10** | **19** | **18** | **16** | **16** | **19** | **12** | **10** | 120 |
| Total for the program in % |  |  | **46** |  |  | 8% | 16% | 15% | 13% | 13% | 16% | 10% | 8% | 100% |

Table 5: Determination of Number of Items for each Courses

Appendix 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Course** | **Student Learning Outcomes** | **Level of Emphasis** | | |
| **1 = Some Emphasis** | **Moderate Emphasis** | **Substantial Emphasis** |
|  | Basic Computer Programming | LO1 |  | x |  |
| LO2 |  |  | x |
| LO3 | x |  |  |
|  | Object Oriented Programming | LO1 |  | x |  |
| LO2 |  |  | x |
|  | Internet Programming | LO1 |  | x |  |
| LO2 |  |  | x |
| LO3 |  |  | x |
|  | Multimedia Information Systems | LO1 | x |  |  |
| LO2 |  | x |  |
|  | System Analysis and Design | LO1 |  | x |  |
| LO2 |  |  | x |
| LO3 |  | x |  |
|  | Database Systems | LO1[[1]](#footnote-1) | x |  |  |
| LO2[[2]](#footnote-2) |  |  | x |
| LO3[[3]](#footnote-3) |  |  | x |
| LO4[[4]](#footnote-4) |  | x |  |
| LO5[[5]](#footnote-5) |  |  | x |
|  | Introduction to Information Storage and Retrieval | LO1 | x |  |  |
| LO2 |  | x |  |
| LO3 |  |  | x |
|  | Data Communication and Computer Networks | LO1 | x |  |  |
| LO2 |  |  | x |
| LO3 |  | x |  |
|  | Information System Security | LO1 | x |  |  |
| LO2 |  | x |  |
| LO3 |  | x |  |
|  | Fundamentals of Artificial Intelligence | LO1 |  | x |  |
| LO2 |  | x |  |
|  | Knowledge Management | LO1 |  | x |  |
| LO2 | x |  | x |
| LO3 |  |  |  |
| LO4 |  | x |  |
|  | Introduction to Machine Learning | LO1 |  | x |  |
| LO2 |  | x |  |
| LO3 | x |  |  |
|  | Management of Information Systems and Services | LO1 |  | x |  |
| LO2 |  | x |  |
| LO3 |  | x |  |
| LO4 | x |  |  |
|  | Information Systems Project Management | LO1 |  | x |  |
| LO2 |  | x |  |
| LO3 |  | x |  |
|  | Enterprise Systems | LO1 |  | x |  |
| LO2 |  | x |  |
| LO3 |  | x |  |

Table 6: Linking the Curriculum to Course/program Learning Outcomes

1. LO1:*Learning Outcome 1* [↑](#footnote-ref-1)
2. LO2:*Learning Outcome 2* [↑](#footnote-ref-2)
3. LO3:*Learning Outcome 3* [↑](#footnote-ref-3)
4. LO4:*Learning Outcome 4* [↑](#footnote-ref-4)
5. LO5:*Learning Outcome 5* [↑](#footnote-ref-5)