DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

EXAMINATION SYLLABUS

JULY 2021

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FOREWORD

One of the cardinal objectives of any education system is to ultimately provide the economy with competent, self-driven and morally upright human capital for sustainable growth and prosperity. In order to effectively achieve this, it is important that the education system continuously adapts to market dynamics at global, regional and national levels.

For professional examination bodies such as the Kenya Accountants and Secretaries National Examinations Board (Kasneb), this translates to the need to regularly review their syllabuses to match and, in an ideal setting, surpass market expectations. The drivers of syllabuses change are wide and diverse and transcend various factors including economic, legal, social and technological spheres.

It is in the above context that The National Treasury and Planning, as the parent Ministry of Kasneb, is pleased to note the significant milestone in the completion of the major review process for Kasneb, having also participated with other stakeholders in the review process. This latest review has afforded Kasneb the opportunity to address emerging trends that define the next generation of professionals, including data mining and analytics, digital competence, soft skills and a global perspective in strategic decision making.

With the revised syllabuses, Kasneb is expected to continue playing a leading role in providing the economy with competent professionals in the areas of accounting, finance, governance and corporate secretarial practice, credit management, forensic investigations, information communication technology and related areas. This is further expected to boost the Government's development agenda as defined under the Kenya Vision 2030 development blueprint and the Big Four Agenda.

The successful implementation of the revised syllabuses will require the support of all stakeholders. I wish therefore to urge for the continued support to Kasneb including from various Government Ministries and Departments, regulatory bodies, employers, professional institutes, universities and other training institutions, among others.

It is my conviction that the revised syllabuses will reshape the professional qualifications frontier in the region and beyond and firmly place Kenya as one of the leading countries in the provision of globally competitive professionals.

Dr Julius M. Muia, PhD, CBS
The Principal Secretary/The National Treasury
The National Treasury and Planning

August 2021

PREFACE

Kasneb has been undertaking a major review of its examination syllabuses every five years and a mid-term review every two and a half years. The prime focus of the just completed major review was the need to produce enhanced, integrated and competence based curriculums whose graduates will remain well positioned to meet the dynamic global market demands for the next five years and beyond.

The major review process commenced in earnest in August 2019 with an intensive stakeholder engagement across various counties in Kenya. This was supplemented by study visits and surveys conducted in various parts of the globe, including in the USA, UK, Canada, Malaysia, Singapore, Australia and India. Further engagements with employers, practitioners and the market at large culminated in the development of a competence framework for the professional qualifications of Kasneb. A competence framework is a structure that sets out and defines each individual competency required by persons working in an organisation. The framework defines the knowledge, skills and attributes needed for people within an organization.

Complementing the competence framework were occupational standards developed for the vocational, certificate and diploma programmes. Similar to the competence frameworks for professionals, the occupational standards for various technician qualifications are statements of work performance reflecting the ability to successfully complete the functions required in an occupation, as well as the application of knowledge, skills and understanding in an occupation.

With the development of the competence frameworks and occupational standards, the next logical step was the development of the detailed syllabuses content addressing the identified required competencies. The syllabuses content was developed by various subject matter experts drawn from both public and private sectors, industry and academia, employers and practitioners among others.

As noted above, stakeholder engagement formed a critical pillar in each step of the review process. At the final stretch, stakeholders were invited to validate the syllabuses on Friday, 7 May 2021 during a national virtual conference. This paved the way for the launch of the syllabuses on Friday, 23 July 2021.

As part of the new competence-based system, Kasneb will use various assessment modes through a partnership model with other institutions to test the achievement of key competencies and skills. Among other key areas of focus is the introduction of practical experience and work-simulation, together with a requirement for students to attend workshops where matters of ethics, values, attitudes and other soft skills will be developed.

The major review of the syllabuses also witnessed the expansion of the qualifications spectrum for Kasneb to include four vocational courses, one certificate course, three diploma courses, five professional courses and one post-professional specialisation course.

We are confident that the new qualifications of kasneb will address the current and emerging skills requirements in the national, regional and international markets.

Finally, I wish to take this opportunity to thank all our partners and stakeholders for their contribution in various ways to the successful completion of the major syllabuses review.

Dr Nancy N. Muriuki, PhD
Chairman of the Board of Kasneb

August 2021

ACKNOWLEDGEMENT

I wish to take this opportunity to express our deepest appreciation to all our key stakeholders who, through their expert advice, comments, other feedback and general support contributed to the development of the revised syllabuses together with the supporting competence frameworks and occupational standards.

We are particularly grateful to the Government of Kenya through the National Treasury and Planning, the Ministry of Education, Ministry of Foreign Affairs incorporating various Kenyan Embassies and High Commissions, among others; various regulatory bodies including the Kenya National Qualifications Authority (KNQA), Technical and Vocational Education and Training Authority (TVETA), Commission for University Education (CUE), Central Bank of Kenya (CBK), Capital Markets Authority (CMA); professional bodies including the Institute of Certified Public Accountants of Kenya (ICPAK), Institute of Certified Secretaries (ICS), Institute of Certified Investment and Financial Analysts (ICIFA), Institute of Credit Management Kenya (ICM-K), Law Society of Kenya (LSK) - Nairobi Chapter; Federation of Kenya Employers (FKE) and individual employers; the Ethics and Anti-Corruption Commission (EACC); practitioners, subject matter experts and trainers, various consultants engaged; students, parents and guardians; past and present members of the Board, Committees and Sub-Committee; members of staff of Kasneb among other stakeholders.

We also extend our appreciation to all foreign regulatory and professional bodies who facilitated the study visits and provided valuable insights on global trends and emerging issues in areas relevant to the examinations of Kasneb. In this connection, we wish to highlight the following institutions for special mention:

1. United Kingdom (UK): Chartered Governance Institute; Chartered Institute of Management Accountants; Chartered Institute of Marketers; Institute of Chartered Accountants in England and Wales; Pearson Vue Limited.
2. United States of America (USA): American Institute of Certified Public Accountants; Chartered Financial Analysts Institute; International Federation of Accountants; Society for Corporate Governance.
3. Singapore and Malaysia: Chartered Secretaries Institute of Singapore; Malaysian Association of Chartered Secretaries and Administrators; Malaysian Institute of Accountants.
4. Canada: CPA Canada; Board of Canadian Registered Safety Professionals.
5. Australia: CPA Australia; Pearson Vue Australia.
6. India: Indira Gandhi National Open University; Institute of Chartered Accountants of India; Institute of Company Secretaries of India, Institute of Cost Accountants of India.
7. South Africa: South Africa Institute of Chartered Accountants (SAICA).

Kasneb remains forever grateful to all our stakeholders for your role in ensuring the development of quality and globally benchmarked syllabuses, competence frameworks and occupational standards. We look forward to your continued support in the implementation of the revised syllabuses.

Dr Nicholas K. Letting', PhD, EBS
Secretary/Chief Executive Officer, Kasneb

August 2021

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BACKGROUND INFORMATION ABOUT kasneb

1.1 Legal Foundation and Status of kasneb

kasneb was established as a state corporation under the National Treasury by the Government of Kenya on 24 July 1969. The establishment and operations of kasneb are governed by the following main Acts:

(a) The Accountants Act, No. 15 of 2008 (which repealed the Accountants Act, Cap 531 of 1977).
(b) The Certified Public Secretaries of Kenya Act, Cap 534 of 1988.
(c) The Investment and Financial Analysts Act, No. 13 of 2015.

1.2 Functions of kasneb

Section 17(1) of the Accountants Act, 2008 of the Laws of Kenya defines the functions of kasneb. These functions are:

(a) To prepare syllabuses for professional, diploma and certificate examinations in accountancy, company secretarial practice and related disciplines;
(b) To make rules with respect to such examinations;
(c) To arrange and conduct examinations and issue certificates to candidates who have satisfied examination requirements;
(d) To promote recognition of its examinations in foreign countries;
(e) To investigate and determine cases involving indiscipline by students registered with the Examinations Board;
(f) To promote and carry out research relating to its examinations;
(g) To promote the publication of books and other materials relevant to its examinations;
(h) To liaise with the Ministry of Education, Science and Technology in accreditation of institutions offering training in subjects examinable by the Examinations Board, and
(i) To do anything incidental or conducive to the performance of any of the preceding functions.

1.3 Professional Institutes/Registration Board for Kasneb graduates

1.3.1 Institute of Certified Public Accountants of Kenya (ICPAK)

ICPAK is established under Section 3 of the Accountants Act, 2008. One of the functions of ICPAK is to advise kasneb on matters relating to examination standards and policies. The Act also makes provisions for the establishment of a Registration and Quality Assurance Committee (Registration Committee) under Section 13. One of the functions of the Registration Committee is to register eligible persons as Certified Public Accountants.

1.3.2 Institute of Certified Secretaries (ICS)

ICS is established under Section 3 of the Certified Public Secretaries of Kenya Act (Cap. 534) of the Laws of Kenya. One of the functions of ICS is to advise kasneb on matters relating to examination standards and policies.

1.3.3 Registration of Certified Public Secretaries Board (RCPSB)

RCPSB is established under Section 11 of the Certified Public Secretaries of Kenya Act (Cap. 534) of the Laws of Kenya. One of the functions of RCPSB is to register eligible persons as Certified Secretaries.

1.3.4 Institute of Certified Investment and Financial Analysts (ICIFA)

ICIFA is registered under the Investment and Financial Analysts Act, No. 13 of 2015 of the Laws of Kenya. One of the functions of ICIFA is to advise

kasneb on matters relating to examination standards and policies. The Act also makes provisions for the establishment of a Registration Committee under Section 13. One of the functions of the Registration Committee is to register eligible persons as Certified Investment and Financial Analysts.

1.3.5 Institute of Credit Management Kenya [ICM (K)]

ICM (K) is registered under the Societies Act, (Cap.108) of the Laws of Kenya.

1.4 Vision, Mission, Mandate and Core Values

The vision, mission, mandate and core values of kasneb are as follows:

1.4.1 Vision

Global leader in examination and certification of business professionals.

1.4.2 Mission

Empowering professionals globally by offering quality examinations and undertaking research and innovation.

1.4.3 Mandate

The mandate of kasneb is the development of syllabuses; conduct of professional, diploma and certificate examinations and certification of candidates in accountancy, finance, credit, governance and management, information technology and related disciplines; promotion of its qualifications nationally, regionally and internationally and the accreditation of relevant training institutions in liaison with the ministry in charge of education.

1.4.4 Core Values

- Integrity
- Professionalism
- Customer focus
- Teamwork
- Innovativeness

2.0 EXAMINATIONS OF kasneb

kasneb currently offers the following examinations:

(a) Vocational certificate courses

These are short-term, skills-based programmes currently in the areas of entrepreneurship and innovation, graphic design, information and cyber security and block chain technology. The courses are ideal both for fresh high school graduates and established professionals in various areas willing to diversify their knowledge and competencies in the above areas.

The vocational certificate courses are administered in two levels, with each level requiring an average of three months, thus a total of six months.

Entrants with high school certificates will start with Level I which covers basic skills. Other entrants with post-high school qualifications covering the basic skills will enter at Level II.

The minimum entry for the vocational certificates is a KCSE certificate. The courses can be pursued through a tuition-based programme or privately. Tuition-based programmes (physical or virtual classes) are however recommended due to the interactiveness with facilitators and other students which are key in imparting the requisite technical and soft skills.

The examinations will be administered primarily on a computer-based platform.

The details on each of the vocational programmes are summarised below:

(i) **Vocational Certificate in Entrepreneurship and Innovation**
The course imparts basic knowledge, skills, values and attitudes to apply entrepreneurship skills and generate innovative ideas to start and manage a new business or grow an existing entity.

(ii) **Vocational Certificate in Graphic Design**
The course imparts basic knowledge, skills, values and attitudes to generate and enhance graphic designs according to set specifications.

(iii) **Vocational Certificate in Information and Cyber Security**
The course imparts basic knowledge, skills, values and attitudes to identify information and cyber threats and risks and implement programmes to protect information and databases.

(iv) **Vocational Certificate in Blockchain Technology**
The course imparts knowledge, skills, values and attitudes to develop a simple blockchain program and undertake blockchain transactions.

(b) Certificate in Accounting and Management Skills (CAMS) course

The course imparts knowledge, skills, values and attitudes to prepare basic accounts and financial statements for a small enterprise or non-complex environment and apply basic management and marketing skills in business.
The course is mainly for persons who wish to qualify and work as entry level accounting and management personnel.

The CAMS course is administered in two levels, with each level requiring an average of six months, thus a total of one year.

The minimum entry requirement is KCSE mean grade D or a vocational certificate.

The course is fully tuition based with requirements for students to sit for continuous assessment tests (CATs), which constitute 15% of the final score for assessment purposes.

The examinations will be administered primarily on a computer-based platform.

(c) **Diploma Courses**

Kasneb currently administers three diploma programmes; Accounting Technicians Diploma (ATD), Diploma in Data Management and Analytics (DDMA) and Diploma in Computer Networks and Systems Administration (DCNSA).

The diploma courses are administered in two levels, with each level requiring an average of one year, thus a total of two years.

The minimum entry for the diploma courses is KCSE mean grade C-. Persons with certificate and other higher qualifications from recognised institutions are also eligible for entry. The courses can currently be pursued through a tuition-based programme or privately. Tuition-based programmes (physical or virtual classes) are however recommended due to the interactiveness with facilitators and other students which are key in imparting the requisite technical and soft skills.

A summary on each of the diploma programmes is presented below:

(i) **Accounting Technicians Diploma (ATD) course**

The course imparts knowledge, skills, values and attitudes to prepare financial and management accounts and financial statements for small and medium sized enterprises and compute basic taxes for a business.

The course is aimed at persons who wish to qualify and work as middle level accountants providing technical support to professional accountants, auditors, tax practitioners and related areas.

(ii) **Diploma in Data Management and Analytics (DDMA) course**

The course imparts knowledge, skills, values and attitudes to undertake non-complex design of databases, mine and analyse data for decision making.

The DDMA will be administered on a computer-based platform.

(iii) **Diploma in Computer Networks and Systems Administration (DCNSA) course**

The course imparts knowledge, skills, values and attitudes to design, configure, test and secure and manage non-complex networks.

The DCNSA will be administered on a computer based platform.

(d) **Professional Courses**

Kasneb currently administers five professional courses, as summarised below:

(i) Certified Public Accountants (CPA)
(ii) Certified Secretaries (CS)
(iii) Certified Investment and Financial Analysts (CIFA)
(iv) Certified Credit Professionals (CCP)
(v) Certified Information Systems Solutions Expert (CISSE)

The professional courses are administered at Foundation, Intermediate and Advanced Levels. Each level requires an average of one year, though candidates are advised to provide for an additional one year to meet requirements for internship/practical experience

The minimum entry requirement for the professional courses is KCSE mean grade C+. Persons with diplomas or other higher-level qualifications from recognised institutions are also eligible for entry. The courses can be pursued through a tuition-based programme or privately. Tuition-based programmes (physical or virtual classes) are however recommended due to the interactiveness with facilitators and other students which are key in imparting the requisite technical and soft skills.
A summary on each of the professional courses is presented below:

(i) **Certified Public Accountants (CPA) course**

The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Prepare accounts and financial statements including for complex entities in both the private and public sectors.
- Use computerised accounting systems
- Practically apply data analytical tools analyse data and reach conclusions.
- Undertake audit and assurance services
- Apply advanced financial management skills to evaluate various financial aspects of a business for decision making
- Prepare management accounts
- Apply leadership and management skills in practice to manage teams and achieve results

The course is aimed at persons who wish to qualify and work or practice as professional accountants, auditors, finance managers, tax managers and consultants in related areas in both public and private sectors.

Assessment will be conducted in a variety of ways, including examinations, practical papers, workshops attendance and practical experience.

In addition to the above papers, prior to certification, candidates will be required to

- Attend workshops on ethics, soft skills and emerging issues organised by Kasneb and ICPAK and earn IPD hours)
- Obtain 1-year practical experience, or alternatively attend workshops on work based simulation organised by Kasneb and ICPAK.

In order to assist CPA students to obtain the requisite practical experience and internship opportunities, they will be registered as student members of the Institute of Certified Public Accountants of Kenya (ICPAK) under a programme called the Trainee Accountants Practical Experience Programme (TAPEF). Through TAPEF, ICPAK working in consultation with Kasneb will assist students as much as possible to link with professional accountants who will mentor them towards obtaining the necessary practical experience.

(ii) **Certified Secretaries (CS) course**

The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Practice and promote principles of good governance within public and private sector entities
- Implement and comply with legal, regulatory and ethical requirements in practice
- Ensure proper conduct and management of meetings
- Undertake consultancy and advisory services in corporate secretarial and related practices
- Manage boardroom dynamics
- Undertake governance and compliance audits

The course is aimed at persons who wish to qualify and work or practice as corporate secretaries, policy formulators and consultants in governance, governance and compliance auditors and administrators at county and national levels and in the private sector.

Assessment will be conducted in a variety of ways, including examinations, projects and workshops attendance.

(iii) **Certified Investment and Financial Analysts (CIFA) course**

The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Apply financial tools and concepts in analysis and valuation of investment and securities
- Manage and grow portfolios of investments
- Analyse various types of investments including equity investments, fixed income investments and derivatives
- Manage corporate finances
- Apply financial modelling and analytical tools in investments analysis

The course is aimed at persons who wish to qualify and work or practice as investment, securities and financial analysts, portfolio managers, investment bankers, fund managers, consultants on national and global financial markets and related areas.

(iv) **Certified Credit Professionals (CCP) course**

The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Manage the credit cycle for trade credit providers
- Manage credit risk for different entities
- Undertake credit analysis for various corporate entities
- Undertake debt collection in a professional manner
- Comply with various requirements in debt management including governance, ethical, legal and regulatory requirements.

The course is aimed at persons who wish to qualify and work or practice in various fields of credit management including credit analysis, debt management and recovery, corporate lending and related areas in both formal and informal sectors.

(v) **Certified Information Systems Solutions Expert (CISSE) course**

The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Develop information systems solutions for a business
- Design and operationalise database management systems
- Design, configure and trouble shoot computer networks
- Implement ICT projects
- Manage and analyse big data

Post-professional specialisation course

Kasneb has introduced the Certified Forensic Fraud Examiner (CFFE). The course imparts knowledge, skills, values and attitudes to, among other competencies:

- Apply analytical techniques in fraud detection
- Design and implement preventive and detective controls
- Apply and ensure compliance with the appropriate laws in fraud investigations
- Apply the burden and standards of proof in civil and criminal proceedings

- Apply the various methods and techniques of conducting fraud investigations
- Write standard investigations and expert witness reports
- Develop fraud prevention programs
- Conduct a fraud prevention health check up
- Develop and implement a fraud risk management program

The course is aimed at persons who wish to qualify and work or practice in the fields of financial fraud and corruption investigations, fraud prevention, fraud risk analysis and related areas.

The CFFE is administered in three modules, with an integrated case study and workshops at the end of the course. Each module is expected to last for three months. Examinations for the CFFE course will be administered three times in a year, thus the course is meant to last on average one year.

The minimum entry requirement to pursue the CFFE course is:

- Kasneb professional qualification; or
- Bachelor's degree from a recognised university; or
- Any other qualification considered equivalent to the above.

The course can be pursued through tuition-based learning or self-study.

Kasneb working with other partners will be rolling out another post-professional specialisation area in public financial management.

(e) **Examinations for holders of foreign qualifications wishing to be registered and practice in Kenya**

(i) **Examination for holders of foreign accountancy qualifications (FAQs)**
In consultation with the Council of ICPAK under Section 26 Sub-Sections (2) and (3) of the Accountants Act, 2008, kasneb examines holders of foreign accountancy qualifications who have applied for registration as Certified Public Accountants (CPAs) of Kenya and they are required to demonstrate their knowledge of local law and practice.

(ii) **Examination for holders of foreign secretaries qualifications (FSQs)**
In consultation with the Council of ICS under Section 20 Sub-Sections (2) and (3) of the Certified Public Secretaries of Kenya Act, Cap 534, kasneb examines holders of foreign secretaries qualifications who have applied for registration as Certified Secretaries (CSs) of Kenya and they are required to demonstrate their knowledge of local law and practice.

(iii) **Examination for holders of foreign investment and financial analysts qualifications (FIFAQs)**
In consultation with the Council of ICIFA under Section 16 Sub-Sections (2) and (3) of the Investment and Financial Analysts Act, No. 13 of 2015, kasneb examines holders of foreign qualifications who have applied for registration as Certified Investment and Financial Analysts (CIFA) and they are required to demonstrate their knowledge of local law and practice.

3.0 EXAMINATION RULES AND REGULATIONS

3.1 Registration and examination bookings

All applications for registration and examination booking must be in the prescribed manner. Students are advised to download the e-kasneb app for purposes of registration and examination booking. The deadline for registration and examination booking will be specified for each sitting but may not be later than thirty days to the date of the next examinations.

3.2 Exemptions

Exemptions may, on application, be granted to registered students who are holders of certain degrees and diplomas recognised by kasneb. Exemptions will be granted on a paper by paper basis. Details on available exemptions can be accessed on the kasneb website www.kasneb.or.ke.

3.3 Retention of Credits

Credits for papers passed by candidates will be retained without limit.

3.4 Progression Rule

A candidate will not be allowed to enter a higher level of the examination before completing the lower level.

3.5 Registration Renewal

3.5.1 A registered student must renew the studentship registration annually on the first day of July provided that newly registered students will be required to renew their registration on the first day of July following the examination sitting to which they are first eligible to enter.

3.5.2 A student who without good cause fails to renew the registration within three months of the renewal date will be deemed to have allowed the registration to lapse and may thus forfeit the right to write the examination until the renewal position is regularised. The registration number of a student who fails to renew the registration for three consecutive years will be deactivated, that is, removed from the register of students and will thus not be able to book for examinations until the registration number is reactivated.

3.5.3 A student whose registration number is deactivated for failure to renew the registration may apply for reactivation provided that if the application is accepted, the student shall:

(a) Pay the registration reactivation fee.
(b) Pay three years of registration renewal fees.

3.6 Rules Governing the Conduct of Students in the Examination Room

Kasneb will conduct examinations on both computer-based and paper-based platforms. The following rules mainly relate to paper-based examinations. Kasneb will be issuing additional rules specific to computer-based examinations in due course**.**

3.6.1 Candidates should present themselves for the examination at least 30 **minutes** before the scheduled time for the commencement of the examination they are taking.

3.6.2 A candidate who arrives half an hour or later after the commencement of the examination will not be allowed to take the examination nor will a candidate be permitted to leave the examination room until after the end of the first half hour since the commencement of the examination.

3.6.3 Each candidate is assigned a registration number upon registration as a student of kasneb. The candidate must sit at the place indicated by that number in the examination room. The registration number must be entered in the space provided at the top right-hand corner of each answer sheet.

3.6.4 The name of the candidate **must not** appear anywhere on the answer sheet.

3.6.5 Each answer sheet has a serial number indicated on the top, left hand side of the answer sheet. Each candidate must indicate the serial number of the answer sheet(s) used for each examination paper in the signature register.

3.6.6 Examination stationery will be provided in the examination room, but candidates must bring their own blue or black ink pens, pencils, and rulers.

3.6.7 **Mobile phones are strictly not allowed in the examinations room.**

3.6.8 No stationery whatsoever may be removed from the examination room.

3.6.9 Candidates **must not** carry the examination question papers from the examination room.

3.6.10 Candidates are allowed to use calculators provided that such calculators are noiseless, cordless and non-programmable.

3.6.11 Candidates will be required to positively identify themselves to the chief invigilator by producing their student identification cards and the national identity cards. Non-Kenyan candidates will be required to produce other relevant identification documents such as passports.

3.6.12 Strict **silence** must be observed during the entire duration of the examination.

3.6.13 Candidates **must not** possess any notes, printed paper or books in the examination room, but must leave any such material with the chief invigilator. Candidates using clipboards must ensure that such clipboards have no writing on them whatsoever.

3.6.14 Smoking is **not** allowed in the examination room.

3.6.15 Candidates **must not** collude in the examination room by exchanging notes or keeping the answer booklet in such a way that another candidate can read or copy from the booklet.

3.6.16 Impersonation in the examination room is not only a serious offence but also a criminal offence.

3.6.17 During the course of the examination, no candidate may leave the examination room without permission from the chief invigilator. Any candidate who does so will not be allowed to return to the examination room.

3.6.18 Candidates who finish the paper before the chief invigilator announces the end of the examination and wish to leave the examination room while the examination is in progress must inform the invigilator and hand in their scripts to the invigilator before leaving the examination room. However, no candidate will be allowed to leave the examinations room during the last fifteen (15) minutes of the examination.

3.6.19 Candidates **must not** leave the examination room with any answer booklet or answer sheets.

3.6.20 Candidates **must not** leave the examination room before their answer booklets are collected by the invigilators.

3.6.21 Candidates **must not** write notes on the examination timetable (Authority to sit the Examination).

3.6.22 Candidates with confirmed disabilities may apply to kasneb to be allowed extra time during examinations. Such application should be made at least two months prior to the examination.

3.6.23 Candidates must produce the timetables (Authority to sit the Examination) in order to be allowed to take the examination. Candidates may download their timetables (Authority to sit the Examination) from the kasneb website or through the e-kasneb. The downloaded timetables may be used as authority to sit the examination.

3.7 Action for Breach of Examination Rules and Regulations

3.7.1 kasneb is mandated by the Accountants Act, 2008 under Section 17 (1)(e) to investigate and determine cases involving indiscipline by students registered with kasneb. Section 42 of the Act further defines examination offences that are punishable under the law and the applicable penalties.

3.7.2 Disciplinary action will be taken against candidates who breach the examination rules and regulations of kasneb. A breach of the examination rules and regulations of kasneb shall include but is not limited to the following:

(a) Deficiency in identification.
(b) Impersonation.
(c) Collusion.
(d) Possession of a mobile phone in the examination room.
(e) Possession of notes in the examination room.
(f) Taking away answer booklets.
(g) Writing of names on the scripts.
(h) Possession of mobile phones in the examination room.
(i) Carrying the examination question papers from the examination room.

3.7.3 The action for breach of the examination rules and regulations of kasneb shall include but not limited to the following:

(a) De-registration as a student of kasneb.
(b) Cancellation of registration number.
(c) Nullification of candidate's results.
(d) Prohibition from taking examinations of kasneb.
(e) Written reprimand and warning.

3.7.4 Certain breaches of the rules and regulations amount to breaches of the law. In such cases, candidates will be handed over to the police for investigations and appropriate legal action.

Section 42 of the Accountants Act, 2008 provides that a person who:

(a) gains access to examinations materials and knowingly reveals the contents, whether orally, in writing or through any other form, to an unauthorised party, whether a candidate or not;
(b) wilfully and maliciously damages examinations materials;
(c) while not registered to take a particular examination, with intent to impersonate, presents or attempts to present himself to take the part of an enrolled candidate;

(d) presents a forged certificate to a prospective employer or to an institution of learning with intent to gain employment or admission; or

(e) introduces unauthorised materials into the examinations room, whether in writing or in any other form, whether a candidate or not, commits an offence and is liable on conviction to imprisonment for a term not exceeding three years, or to a fine not exceeding one hundred thousand shillings, or to both.

LEVEL ONE

PAPER NO. 1 INTRODUCTION TO COMPUTING SYSTEMS

Unit Description

This unit covers the competencies required to demonstrate foundational concepts of computers, operate computer hardware, identify computer software, perform data representation, identify computer networks, use the internet and apply computer security.

Summary of Learning Outcomes

1. Demonstrate foundational concepts of computers
2. Operate computer hardware
3. Identify computer software
4. Perform data representation
5. Identify computer networks
6. Use the Internet
7. Apply computer security

CONTENT

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Demonstrate foundational concepts of computers	• Computing terms – Computer – Input – Output – Hardware – Software – Data – Information • Computer booting process • Computer classification – Size – Type – purpose • Computer application areas – Commerce – Government – Education – Entertainment – Science and research – Communication – Trading / Marketing	• Practical • Oral questioning • Written tests

2. Operate computer hardware	• Computer components
	  – Processor
	  – Input
	  – Output
	  – Storage
	• Peripheral devices
	  – Keyboard
	  – Mouse
	  – Monitor
		• Written tests
		• Observation
		• Report writing
		• Practical

3. Identify computer software	• Computer software
	  – System
	  – Application
	  – Utility
	• Functions of operating system
	• File management using operating system
	  – Files
	  – Folders
	• Types of operating system
	  – Batch Operating System.
	  – Multitasking/Time Sharing
	  – Multiprocessing
	  – Real Time
	  – Distributed
	  – Network
	  – Mobile
	• Creating user accounts in a stand alone computer
	• Programming languages
	  – High level
	  – Low level
	• Program translators
	  – Interpreters
	  – Compilers
	  – Assembler
	• Software selection criteria
	  – Functionality and ease of use
	  – Vendor viability
	  – Technology
	  – Cost
	  – Support and training
	  – Industry expertise
	  – Implementation
		• Practical
		• Oral questioning
		• Short tests to assess underpinning knowledge.

4. Perform Data representation	• Number systems
	  – Decimal
	  – Binary
	  – Octal
	  – Hexadecimal
	• Data conversions of number systems
	• Boolean
	  – OR
	  – AND
	  – NOT
	• Truth tables
		• Practical exercises
		• Oral questioning

5. Identify computer networks	• Definition of key terms
	  – Computer network
	  – Wide area network
	  – Local area network
	• Types of computer networks
	  – LAN
	  – WAN
	  – PAN
	• Components of computer network
	  – Switch
	  – Cable
	  – Router
	  – Hub
		• Practical exercises
		• Oral questioning

6. Use the Internet	• Definition of key terms
	  – Internet
	  – Browser
	  – World wide web
	  – App
	  – Domain
	  – URL
	  – Internet service provide
	• Communicating with internet
	  – Email
	  – Instant messaging
	  – File transfer
	• Safety of Internet
		• Practical exercises
		• Oral questioning

7. Apply Computer Security	• Key terms used in computer security
	  – Computer security
	  – Cloud
	  – Domain
	  – Virtual private network
	  – Exploit
	  – Breach
		• Practical exercises
		• Oral questioning

	– Firewall • Internet security – Threats – Countermeasures	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a computer laboratory;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools 1. DVD containing operating system
Equipment Computer
Materials and supplies • Digital instructional material including DVDs and CDs
Reference materials 1. Laudon, K.C., & Laudon, J. P. (2020). Management Information Systems: Managing the Digital Firm (16th edition). London: Pearson. 2. Rainer Jr. R. K., Prince, B. & Cegielski, C. (2019). Introduction to Information Systems. (8th edition). London: John Wiley & Sons, Inc. 3. Kroenke, D. M. & Boyle R. J. (2019): Experiencing MIS, (8th edition). Washington: Pearson Education. 4. Kasneb e-learning resources (link on the kasneb website). 5. Kasneb approved study packs.

PAPER NO. 2 COMMUNICATION SKILLS AND ETHICS

Unit Description

This unit specifies competencies required to apply communication skills and ethics. It involves demonstrating concepts of communication skills and ethics, applying writing skills in communication, applying presentation skills, conducting interviews, conducting meetings, applying ethics in communication and applying ICT skills in communication.

Summary of Learning Outcomes

1. Demonstrate concepts of communication skills and ethics
2. Apply writing skills in communication
3. Apply presentation skills
4. Conduct interviews
5. Conduct meetings
6. Apply ethics in communication
7. Apply ICT skills in communication

CONTENT

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Demonstrate concepts of Communication Skills	• Meaning of communication
	• Purpose of communication
	• Elements of communication
	• Stages of the communication process
	  – Source
	  – Encoding
	  – Channel
	  – Decoding
	  – Feedback
	• Principles of effective communication
	• Formal and informal communication channels
	• Flow of formal communication
	• Forms of communication
	  – Oral communication
	  – Non-verbal communication
	  – Written communication
	  – Visual communication
	  – Audio-visual communication
	• Advantages and disadvantages of various forms of communication
	• Effective listening
	• Barriers to effective communication
		• Oral questioning
		• Written tests

	• Overcoming barriers to effective communication	
2. Apply writing skills in communication	• Steps in writing business documents _ Prewriting _ Drafting _ Revising _ Editing • Rules of writing business documents • Purposes of business documents _ Business letters _ Business reports _ Memorandum _ Circulars _ Advertisements _ Notices _ E-mail	• Written tests • Oral testing
3. Apply presentation skills	• Definition of presentation • Uses of presentation • Presentation skills • Elements of a presentation • Methods of delivering a presentation _ Manuscript _ Memorised _ Extemporaneous _ Impromtu • Basic parts of a presentation • Importance of Audience analysis in presentation • Use of visual aids in presentation	• Written tests • Practical exercises • Demonstration

4. Conduct interviews	• Meaning of;
	  – Interview
	  – Interviewer
	  – Interviewee
	• Purpose of interviews
	• Types of interviews
	  – Unstructured
	  – Semi-structured
	  – Structured
	• Skills for effective interviewing
	• Importance of non- verbal communication in interviews
	• Purpose of maintaining of interview documents
		• Written tests
		• Oral questioning

5. Conduct meetings	• Purpose of holding meetings in an organization
	• Types of meetings
	  – Formal
	  – informal
	• Stages of conducting formal meeting
	• Importance of agenda of the meeting
	• Role of the chairperson and the secretary in a meeting
	• Importance of minutes
	• Online meetings
	  – Video conferencing
	  – Teleconferencing
	  – Webinar
		• Written tests
		• Oral questioning

6. Apply ethics in communication	• Meaning of ethics and integrity • Significance of ethics and integrity in communication • Principles of ethical communication • Purpose of employees' code of ethics • Factors influencing ethical communication • Ethical dilemmas in communication • Handling ethical dilemmas in communication	• Written tests • Oral questioning • Short tests to assess underpinned knowledge.
7. Apply ICT skills in communication	• Use of ICT skills in communication	• Written tests • Oral questioning

	• Privacy and integrity of data in communication • Credibility and accuracy of • information • Ethical regulations in ICT • Advantages and disadvantages of digital communication	• Short tests to assess underpinned knowledge.

Suggested Methods of Delivery

- Role play
- Group discussions
- Presentations by both students and trainer;
- Guided learner activities and research to develop underpinning knowledge;
- The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
- Visiting media houses

Recommended Resources

Tools Text books Newspapers and Journals
Equipment Computers Mobile phones
Materials and supplies • Digital instructional material including DVDs and CDs • Sample of business documents and minute of the meetings
Reference materials 1. Warner, T. Communication Skills for Information Systems. Revised Edition. Prentice Hall. 2. Sen. L. Communication Skills (2007). PHI Learning. 3. Payne, J. 2001). Communication for Personal and Professional Applications. Perfection Learning. 4. Kasneb e-learning resources (link on the Kasneb website). 5. Kasneb approved study packs.

PAPER NO. 3 INFORMATION SYSTEMS SUPPORT AND INTEGRATION

Unit Description
This unit covers the competencies required to identify concepts of systems support and integration, assemble and disassemble computer systems, provide ICT support, perform troubleshooting, perform data protection and perform systems integration

Summary of Learning Outcomes

1. Identify Concepts of systems support and integration
2. Assemble and disassemble computer systems
3. Provide ICT support
4. Perform troubleshooting
5. Perform data protection
6. Perform systems integration

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify Concepts of systems support and integration	• Computer electronic components – The system unit – Secondary storage – Input/output devices – Communication devices • Computer maintenance tools – Simple hand tools for basic disassembly and reassembly procedures – Diagnostics software – A multimeter – Chemicals (such as contact cleaners), component freeze sprays, and compressed air for cleaning the system – Foam swabs, or lint-free cotton swabs if foam isn't available – Memory module tester • Standards operating and maintenance procedures • Safety precautions	• Practical • Oral questioning • Written tests

2. Assemble and disassemble computer systems	• Computer parts
	  – Processor
	  – Motherboard
	• Cleaning computer parts
	  – Keyboard
	  – Mouse
	  – Display
	• Identifying hardware problems
	  – Computer not starting
	  – Blank screen
	  – Frozen screen
	  – Slow computer
	  – Slow internet
	• Upgrading hardware
	• Managing electronic waste
		• Written tests
		• Observation
		• Report writing
		• Practical

3. Provide ICT support	• Methods of computer support
	  – Online
	  – Help desk
	  – Peer support
	• Health and safety issues
	• Training
		• Practical
		• Oral questioning
		• Short tests to assess underpinning knowledge.

4. Perform troubleshooting	• Fault finding
	  – Software tools
	  – Hardware tools
	• Repairing and maintaining computer parts
		• Practical exercises
		• Oral questioning

5. Perform data protection	• Levels of data security
	• Type of data
	  – Public
	  – Internal
	  – Confidential
	  – Restricted
	• Methods of data protection
	  – Access control
	  – Encryption
	  – Backup
	• Data protection controls
	  – Authentication
	  – Access control
	  – Data masking
	  – Deletions and erasure	

6. Perform systems integration	• Definition of system integration
	• Systems requirements
	  – Hardware
	  – Software
	• System integration methods
	  – Integration by Substitution
	  – Integration by Parts
	  – Integration Using Trigonometric Identities
	  – Integration of Some particular function
	  – Integration by Partial Fraction	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a computer laboratory;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools 1. DVD containing operating system 2. Screw 3. Multimeter 4. A tester
Equipment Computer
Materials and supplies • Digital instructional material including DVDs and CDs
Reference materials 1. Baltzan, P. (2019). Information System (5th edition). New York: McGraw-Hill Education. 2. Haag, S., & Cummings, M. (2012). Managing Information Systems for the Digital Age. Boston: Irwin/McGraw-Hill. 3. Turban, E. (2021). Information Technology Management (12th edition). New Jersey: Wiley. 4. Kasneb e-learning resources (link on the Kasneb website). 5. Kasneb approved study packs.

PAPER NO. 4 COMPUTER INFORMATION SYSTEMS APPLICATIONS

Unit Description

This unit covers competencies required to apply basic computer operation skills, perform word processing, use spreadsheet, perform database management, apply desktop publishing and use presentation software.

Summary of learning outcomes

1. Apply basic computer operation skills
2. Perform word processing
3. Use spread sheet
4. Perform database management
5. Apply Desktop publishing
6. Use presentation software

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Apply basic computer operation skills	• Installing application program
	• Creating files and folders
	• Using storage devices
	  – Cloud drive
	  – Flash disc
	  – DVD
	  – CD
	• Connecting printer to a computer
	• Use network resources
	  – Files
	  – Folders
	  – Printers
	• Protect files with password
		• Practical
		• Oral questioning
		• Written tests

2. Perform word processing	• Common features of word processors • Common toolbars in word processors • Using templates • Creating, saving and retrieving existing documents • Formatting and editing text • Page setup features • Manipulating a document using shortcut keys • Creating and formatting tables • Creating and formatting images and drawing	• Written tests • Observation • Report writing • Practical

	• Inserting and editing headers and footers • Inserting footnote, endnotes, citation and bibliography • Proofreading tools • Using mail merge tool • Tracking changes and comments • Inserting and manipulating shapes, clipart, pictures, graphics in word processing • Converting documents using different word processors • Generating table of content, list of figures and list of tables • Automating simple tasks • Protecting documents with passwords • Printing documents	
3. Use spread sheet	• Common features of spreadsheets • Concepts of cell, worksheets and workbooks • Creating, saving and retrieving workbooks • Cell editing and navigation • Formatting worksheets • Using formulae and functions • Manipulating data using different cell referencing methods • Sorting, filtering and data validation • Analysing data using “what if” analysis • Freezing and unfreezing pane • Creating and manipulating charts/graphs including pivot tables • Summarizing, consolidating and outlining data • Automating simple tasks • Protecting and sharing workbooks • Printing worksheets	• Practical exercises • Oral questioning • Short tests to assess underpinning knowledge

4. Apply database management	• Overview of database concepts • Common features of a database • Creating, saving and retrieving databases • Identifying tables, fields, data types and records • Establishing relationships between tables • Creating forms and queries • Data manipulation in database applications • Data sorting and filtering • Adding charts, diagrams, tables and attachments • Securing a database • Automating simple tasks • Configuring database start-up options • Printing from a database	• Practical exercises • Oral questioning
5. Apply Desktop publishing	• Overview of desktop publishing software • Common features of desktop publishing software • Creating different types of publications • Creating, saving and retrieving publications • Setting page layout • Using frames • Typing and manipulating text • Identifying and using various icons in toolbars of the program including toolbox • Drawing and manipulating various shapes • Inserting and using the colour palette • Inserting and manipulating graphics • Importing and exporting files • Setting borders • Using merge tool • Working with tables • Linking and embedding • Automating simple tasks • Printing a publication	• Practical exercises • Oral questioning

6. Use presentation software	• Common feature of presentation applications • Working with master slides and templates • Creating presentations from scratch • Inserting a slide, typing and formatting text in a slide • Importing and exporting content • Editing slide content • Drawing and formatting various objects • Working with graphics and charts • Inserting and formatting images • Animation effects • Reviewing presentation • Saving, copying and deleting slides • Presentation views • Automating simple tasks • Collaboration in creating presentations • Printing handouts and slides	• Practical exercises • Oral questioning

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a computer laboratory;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools 1. DVD containing operating system
Equipment Computer
Materials and supplies • Digital instructional material including DVDs and CDs
Reference materials

1.	Laudon, K.C., & Laudon, J. P. (2020). Management Information Systems: Managing the Digital Firm (16th edition). London: Pearson.
2.	Rainer Jr. R. K., Prince, B. & Cegielski, C. (2019). Introduction to Information Systems. (8th edition). London: John Wiley & Sons, Inc.
3.	Kroenke, D. M. & Boyle R. J. (2019): Experiencing MIS, (8th edition). Washington: Pearson Education.
4.	Kasneb e-learning resources (link on the kasneb website).
5.	Kasneb approved study packs.

LEVEL TWO

PAPER NO. 5 DATABASES

Unit Description

This unit specifies competencies required to design and develop databases. It enables the learner to identify key database concepts, design relational databases, use structured query language, and monitor database performance.

Summary of Learning Outcomes

1. Identify key Database concepts
2. Design relational Databases
3. Use Structured Query Language
4. Monitor Database Performance

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify key Database concepts	❑ Definition of: ✓ Data ✓ Database ✓ Database Management System (DBMS) ❑ Terminologies related to database ✓ Relation ✓ Tuple ✓ Attributes ✓ Degree ✓ Cardinality ❑ Characteristics of the DatabaseApproach ❑ Purpose of a database ❑ Types of Databases ✓ Centralized Database ✓ Distributed Database ✓ Relational Database ✓ Cloud Database ✓ Hierarchical Databases ✓ Network Databases ❑ Advantages of using a database ❑ Functions of DBMS ❑ Components of DBMSEnvironment ✓ Hardware ✓ Software ✓ Data ✓ Procedures	• Observation • Oral assessment • Trainee presentation • Written assessments

	✓ Database Access Language ✓ Users - Application Programmers - Database Administrators - End-Users ❑ Characteristics of DatabaseManagement System ❑ Examples of popular DBMS ❑ Advantages and Disadvantages of aDBMS ❑ Definition of Describing andStoring Data in a DBMS ✓ Data Models ✓ Level of Abstraction ✓ Data Independence ❑ Types of DBMS Languages andInterfaces ✓ Data Definition Language-DDL ✓ Data Manipulation Language (DML) ✓ Data Control Language (DCL) Transaction Control (TCL)	

2. Design relational Databases	❑ Database design Phases areexplained ❑ Entity Relational (ER) Model ✓ Entity ✓ Entity Set ✓ Attributes ✓ Keys ✓ Relationships ❑ Working with ER Diagrams ✓ Components of ER Diagram ❑ Codd's Rule for Relational DBMS ❑ Relational Data Structure ✓ table ✓ Tuple ✓ Attribute ✓ Relation Schema ✓ Relation Key ❑ Relational Integrity Constraints ❑ Characteristics of RelationalDatabase ❑ Relational Database Design Process ❑ Logical Database Design ❑ Database normalization ✓ Definition of Normalisation ✓ Database Normal Forms • First normal form (1NF) • Second normal form(2NF) • Third normal form(3NF) ❑ Destroying/Altering Tables and ❑ Views Tables	• Observation • Oral assessment • Trainee presentation • Written assessments

3. Use Structured Query Language	❑ Advantages Of SQL ❑ SQL Data Types and Literals. ❑ Types of SQL Commands ❑ SQL Operators and Theirprecedence ❑ Tables, Views and Indexes ❑ Queries and Sub Queries ❑ Aggregate Functions ❑ Insert, Delete and UpdateOperations ❑ SQL Joins ✓ Inner join ✓ Left join . ✓ Right join ✓ Full join ✓ Self join ✓ Cartesian join ❑ Cursors in SQL ❑ Definition of Structured QueryLanguage (SQL) ❑ Characteristics of SQL	• Trainee presentation • Written assessments
4. Monitor Database Performance	❑ Definition of database monitoring ❑ Purpose of Database Monitoring ❑ Perform Database Monitoring ✓ Common Approaches to Database Monitoring • Proactive • Reactive ✓ Key Metrics to Track • Query Execution Performance • Hardware • Concurrency Problems ❑ Database Monitoring Best Practices ✓ Monitor Changes to theDatabase ✓ Measure Throughput ✓ Monitor Availability and Consumption of Resources ❑ Track Database Logs ❑ Examples of Database	❑ Observation ❑ Oral assessment ❑ Trainee presentation ❑ Written assessments

	❑ Performance Monitoring Tools ✓ SolarWinds Database Performance Analyzer ✓ SQL Power Tools ❑ Database performance tuning	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunityallows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools 1. DBMS Software 2. SQL Server Software 3. antivirus 4. anti-spy ware **5.** password management software
Equipment Computer CD/DVD Drive
Materials and supplies • **Digital instructional material including DVDs and CDs**

Reference materials

1. Laudon, K.C., & Laudon, J. P. (2020). Management Information Systems: Managing the Digital Firm (16th edition). London: Pearson.
2. Rainer Jr. R. K., Prince, B. & Cegielski, C. (2019). Introduction to Information Systems. (8th edition). London: John Wiley & Sons, Inc.
3. Kroenke, D. M. & Boyle R. J. (2019): Experiencing MIS, (8th edition). Washington: Pearson Education.
4. Kasneb e-learning resources (link on the kasneb website).
5. Kasneb approved study packs.

PAPER NO. 6 WAREHOUSING AND DATA MINING

Unit Description

This unit specifies competencies required to perform warehousing and data mining. It enables the learner to identify key concepts in warehousing and data, design and implement a data warehouse,mine and manage data and apply mined data

Summary of Learning Outcomes

1. Identify key concepts in Warehousing and Data
2. Design and implement a data warehouse
3. Mine and Manage Data
4. Utilize mined data

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify key concepts in Warehousing and Data	❑ Definition of data warehousing ❑ Characteristics of a data warehouse ❑ The Data Warehousing Process ❑ Components of Data warehouse ✓ Load manager ✓ Warehouse Manager ✓ Query Manager ✓ End-user access tools ❑ Users and Uses of Data warehouse ❑ Basic Data Warehouse Architecture ❑ Data warehousing and online transaction processing systems(OLTP) ❑ Online Analytical Processing (OLAP) ✓ Basic analytical operationsof OLAP - Roll-up - Drill-down - Slice and dice - Pivot (rotate) ❑ Data Warehousing Schemas ✓ Star Schema ✓ Snowflake Schema ✓ Fact Constellation Schema Advantages and Disadvantages Datawarehousing	• Observation • Oral assessment • Trainee presentation • Written assessments

2. Design and implement a data warehouse	❑ Definition of: ✓ Metadata ✓ Data Mart ❑ Importance of metadata in datawarehouses ❑ Types of Metadata ✓ Operational Metadata ✓ Extraction and Transformation Metadata ✓ End-User Metadata ❑ Metadata Interchange Initiative ❑ Metadata Interchange StandardFramework ❑ Metadata Repository ❑ Reasons for creating a data mart ❑ Types of Data Marts ✓ Dependent Data Marts ✓ Independent Data Marts ✓ Hybrid Data Marts ❑ Steps in Implementing a Data Mart ❑ Steps to Implement Data Warehouse ❑ Coping with business risks associated with a Data warehouseimplementation ✓ Enterprise strategy ✓ Phased delivery ✓ Iterative Prototyping ❑ Data Warehouse Tools ✓ MarkLogic ✓ Oracle ✓ Amazon RedShift ❑ Best practices to implement a Data Warehouse	• Observation • Oral assessment • Trainee presentation • Written assessments

3. Mine and Manage Data	❑ Definition of Data Mining ❑ Data Mining tools ✓ R ✓ Python ✓ Orange Data Mining ✓ SAS Data Mining ✓ DataMelt Data Mining ✓ Rattle ✓ Rapid Miner ❑ Data Mining Functions ❑ Data Mining Techniques ✓ Cluster Analysis ✓ Induction ✓ Decision trees ✓ Rule induction ✓ Neural networks ❑ Criteria for choosing a Data Mining Software ❑ Data mining functionalities and the variety of knowledge they discover ✓ Characterization ✓ Discrimination ✓ Association analysis ✓ Classification ✓ Prediction ✓ Clustering ✓ Outlier analysis ✓ Evolution and deviation analysis ❑ Issues in Data Mining ✓ Security and social issues ✓ User interface issues ✓ Mining methodology issues ✓ Performance issues ✓ Data source issues	• Observation • Oral assessment • Trainee presentation • Written assessments

4. Utilize mined data	❑ Data Mining Applications □ Financial Analysis □ Telecommunication Industry □ Intrusion Detection □ Retail Industry □ Higher Education □ Energy Industry □ Spatial Data Mining □ Biological Data Analysis □ Other Scientific Applications □ Manufacturing Engineering □ Criminal Investigation □ Counter-Terrorism ❑ Technology Trends in Data Mining	• Observation • Oral assessment • Trainee presentation • Written assessments

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools

1. Mining Software (R, Python, Orange)
2. Antivirus
3. Anti-spy ware
4. Password management software

Equipment

CD/DVD Drive

Computer

Materials and supplies

- Digital instructional material including DVDs and CDs

Reference materials

1. Alla, S. (2018). Big Data Analytics with Hadoop 3. Birmingham: Packt.
2. Ankam, V. (2016). Big Data Analytics. Birmingham: Packt.
3. Bhatia, A., Bansal, V., & Bhatia, A. B. (2015). Database Management System. Alpha Science.
4. Pathak, N. (2011). Database Management System. Himalaya Publishing House.
5. Sedkaoui, S. (2018). Data Analytics and Big Data: Information Systems, Web and Pervasive Computing. London: ISTE Ltd.
6. Walkowiak, S. (2016). Big Data Analytics with R: Leverage R Programming to uncover hidden patterns in your Big Data. Birmingham: Packt.
7. Kasneb e-learning resources (link on the Kasneb website).
8. Kasneb approved study packs.

PAPER NO. 7 MATHEMATICAL CONCEPTS IN DATA SCIENCE

Unit Description

This unit specifies competencies required to apply mathematical concepts in data science. It enables the learner to perform linear algebra operations, handle operations involving calculus, predict occurrences using probability theory and manage data using statistical methods.

Summary of Learning Outcomes

1. Perform Linear Algebra operations
2. Handle operations involving calculus
3. Predict occurrences using probability theory
4. Manage data using statistical methods

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Perform Linear algebra operations	❑ Linear Equations ❑ Linear equation in one variable ❑ Equation of a line ❑ Forms of linear equation ✓ General form ✓ Slope intercept form ✓ Point form ✓ Intercept form ✓ Two-point form ❑ Standard form of linear equation ✓ Slope intercept form ✓ Point slope form ✓ Intercept form ✓ Two-point form ❑ How to solve linear equations ❑ Solution of linear equations in one variable ✓ Solution of linearequations in twovariables ❑ System of two linearequations in two unknowns Vector operations ❑ Operations on vectors ❑ External ❑ Vector subtraction ❑ Properties of vector addition andscalar multiplication ❑ Unit vectors	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

	❑ Direction angles ❑ Angle between vectors ❑ Forces in equilibrium ❑ Determine the dimensions of amatrix. ❑ Dimensions/order of matrices ❑ Operations on 2 x 2 matrices ✓ Addition of matrices ✓ Subtraction of matrices ✓ Scalar multiplication ofmatrices ✓ Multiplication of matrices ❑ Inverse of 2 x 2 matrices	
2. Handle operations involving calculus	❑ Definition of calculus ❑ Limits and continuity ❑ Functions, domain and range ❑ Evaluating limits ✓ Graphically ✓ Numerically ✓ Algebraically ❑ Definition of derivative ❑ Derivative as a function ❑ Derivative rules ❑ Applications of derivatives ❑ Approximating areas ❑ The definite integral ❑ The fundamental theorem of calculus ❑ Applications of integration	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

3. Predict occurrences using probability theory	❑ Definition of terms ✓ Events ✓ Outcome ✓ Experiment ✓ Sample space ✓ ❑ Types of events ✓ Simple ✓ Elementary, ✓ Mutually exclusive, ✓ Mutually inclusive, ✓ Dependent ✓ Independent ❑ Laws of probability ✓ Addition ✓ Multiplication ❑ Basic probability trees ❑ Finite probability spaces and conditional probability	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation
4. Manage data using statistical methods	❑ Sources of data: ✓ Primary ✓ Secondary ❑ Methods of collecting primary data: ✓ observation ✓ interviews ✓ questionnaires ❑ Sampling methods ✓ Probabilistic ✓ Non-probabilistic ❑ Data presentation: ✓ Frequency tables ✓ Histograms ❑ Measures of central tendency: ✓ Arithmetic mean ✓ Mode, ✓ Median ❑ Measures of dispersion/Spread ✓ Range, ✓ Mean deviation, ✓ Standard deviation,	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

	✓ Variance, ✓ Coefficient of variation ✓ Quartiles and Interquartile Range ❑ Importance of measuring the dispersion of data	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools 1. Whiteboards 2. Dice 3. Mathematical tables 4. Scientific calculator 5. Rulers, pencils, erasers 6. Square exercise books 7. Graph books
Equipment 1. Computers with internet connection 2. Measuring equipment
Materials and supplies • Digital instructional material including DVDs and CDs

Reference materials

1. Kothari, U. D. (2017). Quantitative Techniques in Business, Management and Finance: A Case-Study Approach. CRC Press.
2. Taha, H. A. (2018). Operations Research: An Introduction. New Delhi: Pearson India.
3. Groebner, D., Shannon, P., & Fry, P. (2017). Business Statistics: A Decision-Making Approach (10th edition). New York: Pearson.
4. Berenson, M., Levine, D., Szabat, K., & Stephan, D. (2018). Basic Business Statistics: Concepts and Applications. New York: Pearson.
5. Kasneb e-learning resources (link on the Kasneb website)
6. Kasneb approved study packs.

PAPER NO. 8 QUANTITATIVE MODELLING SKILLS

Unit Description

This unit specifies competencies required to apply quantitative modelling skills. It enables the learner to identify key quantitative modelling concepts, perform regression modelling, perform linear programming and apply simulation modelling technique

Summary of Learning Outcomes

1. Identify key quantitative modelling concepts
2. Perform regression modelling
3. Perform linear programming
4. Apply simulation modelling techniques

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify key quantitative modellingconcepts	❑ Definition of: ✓ Model ✓ Quantitative model ❑ Modelling methodology ✓ Model type selection ✓ Definition and formulation ✓ Target expressions type ✓ Key mathematical functions ❑ Examples of models ✓ Linear models ✓ Probabilistic/stochas ticmodels ✓ Regression models ✓ Multiple regression ✓ Line fitting\ ❑ Advantages of quantitativemodelling ❑ Mathematical modelling paradigms ✓ Differential equations - ordinary differential equations ❑ Types of quantitative modelling ✓ Simple analysis ✓ Econometric estimation ✓ Systems of equations ✓ Input-output analysis ✓ Partial modelling	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

2. Perform Regression Modelling	❑ Definition of regression analysis ✓ Linear regression ✓ Multiple linear regression ✓ Non-linear regression ❑ Linear regression modelassumptions ❑ Simple linear regression model ❑ Multiple linear regression model ❑ Obtaining dataset from appropriatesources ❑ Choosing the best regressionmodel ❑ Regression analysis in spreadsheets ❑ Interpreting regression analysisresults ✓ Interpret p-values ✓ Coefficients in regressionanalysis ❑ Advantages and disadvantages of ❑ Linear regression	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation
3. Perform Linear Programming	❑ Linear programming ❑ Constrained optimization models ✓ Decision variables ✓ Objective function ✓ Constraints: ✓ Non-negativity restriction ❑ Advantages and disadvantages of using optimization models ❑ Linear programming process ❑ Assumptions of linear programming models ❑ Solve linear program ✓ Graphical method ✓ Using r ❑ Using ms excel	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

4. Apply simulation modelling techniques	❑ Concepts of modelling &simulation ✓ Models and events ✓ System state variables ✓ Classification of models ❑ Definition of: ❑ Simulation ❑ Modelling ❑ Principles for simulation modelling And experimentation ❑ The modelling process ❑ Monte carlo / risk analysis Simulation ❑ Agent-based modelling and Simulation ❑ Discrete event simulation ❑ System dynamics simulation ❑ Solutions ❑ Developing simulation models ❑ Simulation models components ❑ Input variables, ❑ Performance measures ❑ Functional relationships ❑ Simulation model procedure ❑ Performing simulation analysis ❑ Procedure ❑ The modelling process ❑ Verification and validation ❑ Modelling and simulation ✓ Continuous ✓ Discrete system simulation ✓ Monte carlo simulation ✓ Database ❑ Modelling and simulation ✓ Advantages and disadvantages ❑ Application areas	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises

- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools 1. Whiteboards 2. Dice 3. Mathematical tables 4. Scientific calculator 5. Rulers, pencils, erasers 6. Square exercise books 7. Graph books
Equipment 3. Computers with internet connection Measuring equipment
Materials and supplies Digital instructional material including DVDs and CDs
1. Kothari, U. D. (2017). Quantitative Techniques in Business, Management and Finance: A Case-Study Approach. CRC Press. 2. Taha, H. A. (2018). Operations Research: An Introduction. New Delhi: Pearson India. 3. Groebner, D., Shannon, P., & Fry, P. (2017). Business Statistics: A Decision-Making Approach (10th edition). New York: Pearson. 4. Berenson, M., Levine, D., Szabat, K., & Stephan, D. (2018). Basic Business Statistics: Concepts and Applications. New York: Pearson. 5. Kasneb e-learning resources (link on the Kasneb website) 6. Kasneb approved study packs.

LEVEL THREE

PAPER NO.9 PYTHON DATA VISUALIZATION

Unit Description

This unit specifies competencies required to use python to visualize data. It enables the learner toidentify foundations of python programming, explore python environment, perform data operations in python, perform data visualization using python and apply statistical data analysis.

Summary of Learning Outcomes

1. Identify foundations of Python Programming
2. Explore python environment
3. Perform data operations in Python
4. Perform Data Visualization using Python
5. Apply Statistical Data Analysis

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify foundations of Python Programming	❑ Description of python language ✓ Python version, packages anddatasets ✓ keywords and identifiers ✓ statements and comments ✓ python datatypes and variables ✓ python type conversion ✓ python input/output and import ✓ Arithmetic, operators, loops ❑ Python syntax ✓ Script mode programming ✓ Python line structure ✓ Joining two lines ✓ Multi-line statements indentation ✓ Python coding style ❑ Definition of python library ❑ Python libraries for data science ✓ Data mining - scrapy - beautifulsoup	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

	✓ Data processing and modeling - NumPy - SciPy - Pandas - Keras - SciKit-Learn ✓ Data Visualization - Matplotlib - Seaborn - Bokeh - Plotly - pydot ✓ Why Python is preferred language for data science	
2. Explore the Python environment	❑ Install Python ✓ Download the latest version of Python ✓ Run the installer file and follow the steps to install Python ❑ Python environment set up ✓ Setting up PATH ✓ Python Environment Variables - PYTHONPATH - PYTHONSTARTUP - PYTHONCASEOK - PYTHONHOME ❑ Running Python ✓ Interactive interpreter ✓ Script from the command-line ✓ Integrated, development , environment ❑ Installing SciPy Pack	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

3. Perform data operations in Python	❑ Data Operations in Numpy ✓ NumPy – A Replacement for MatLab ✓ ndarray object ❑ Data operations in pandas ✓ Key features of pandas ✓ Pandas series ✓ Pandas dataframe ✓ Pandas panel ❑ Data operations in scipy ✓ Scipy sub-packages ✓ Data structure ❑ Data operations in matplotlib ❑ Python data cleansing ❑ Python processing csv data ❑ Python processing xls data ❑ Python data wrangling ✓ Merging data ✓ Grouping data ✓ Concatenating data ❑ Python data aggregation ❑ Python reading html pages ❑ Python processing unstructureddata	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation
4. Perform Data Visualization using Python	❑ Python chart properties ✓ Creating a chart ✓ Labling the axes ✓ Formatting line type and colour ✓ Adding annotations ✓ Adding legends ✓ Chart presentation style ❑ Python box plots ✓ Drawing a box plot ❑ Python heat maps ❑ Python scatter plots ❑ Python bubble charts ❑ Python 3d charts ❑ Python time series ❑ Python geographical data ❑ Python graph data	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

5. Apply Statistical Data Analysis	❑ Python measuring ❑ Central tendency ✓ Mean ✓ Median ✓ Mode ❑ Python measuring variance ✓ Standard Deviation ✓ Skewness ❑ Python normal distribution ❑ Python binomial distribution ❑ Python poisson distribution ❑ Python bernoulli distribution ❑ Python P-Value ❑ Python correlation ❑ Python chi-square Test ❑ Python linear regression	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools

1. Python Software
2. firewalls
3. antivirus
4. anti-spy ware
5. password management software

Equipment

Computer

CD/DVD Drive

Materials and supplies

- Digital instructional material including DVDs and CDs

Reference materials

1. Alla, S. (2018). Big Data Analytics with Hadoop 3. Birmingham: Packt.
2. Ankam, V. (2016). Big Data Analytics. Birmingham: Packt.
3. Bhatia, A., Bansal, V., & Bhatia, A. B. (2015). Database Management System. Alpha Science.
4. Pathak, N. (2011). Database Management System. Himalaya Publishing House.
5. Sedkaoui, S. (2018). Data Analytics and Big Data: Information Systems, Web and Pervasive Computing. London: ISTE Ltd.
6. Walkowiak, S. (2016). Big Data Analytics with R: Leverage R Programming to uncover hidden patterns in your Big Data. Birmingham: Packt.
7. Kasneb e-learning resources (link on the Kasneb website).
8. Kasneb approved study packs.

PAPER NO. 10 DATA MANAGEMENT AND ANALYTICS

Unit Description

This unit specifies competencies required to apply R for big data management and analytics. It enables the learner to identify key concepts in big data management, visualize real world big dataproblems, apply statistical tools for big data analysis and manage big data using R and perform data analytics using R.

Summary of Learning Outcomes

1. Identify key concepts in big data management
2. Visualize real world big data problems
3. Apply statistical tools for big data analysis
4. Manage big data using R
5. Perform data analytics using R

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify key concepts in Big data management	❑ Definition of: ✓ Big data ✓ Big data Analytics ✓ Big data management ❑ Characteristics of big data ✓ Volume ✓ Velocity ✓ Variety ✓ Veracity ✓ Value ❑ Different types of data ✓ Structured data ✓ Unstructured data ✓ Semi-structured data ✓ Metadata ✓ Big data life cycle ❑ Examples of big data ❑ Techniques of big data analytics ✓ Predictive analytics ✓ Collective intelligence ✓ Machine learning ❑ Big data analytics business uses andexamples ❑ Big data analytics benefits and challenges	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

2. Visualize real world big data problems	❑ Definition of data visualization tools ❑ Types of data visualization ✓ Charts, tables, graphs, maps ✓ Infographics ✓ Dashboards ❑ Examples of methods to visualizedata ✓ Area chart ✓ Box-and-whisker plots ✓ Bubble cloud ✓ Bullet graph ✓ Cartogram ✓ Circle view ✓ Dot distribution map ✓ Gantt chart ✓ Highlight table ✓ Histogram ✓ Matrix ✓ Network ✓ Polar area ✓ Radial tree ✓ Scatter plot (2d or 3d) ❑ Examples of big data visualization tools ✓ tableau ✓ infogram ✓ chartblocks ✓ datawrapper ✓ plotly ❑ Excel data analysis ✓ Visualizing data with charts ✓ Chart elements and chart styles ✓ Using pictures in column charts ✓ Sparklines ✓ Pivotcharts	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

3. Apply statistical tools for Big Data Analysis	❑ Excel data validation ❑ Data visualization in r ✓ Basic visualization - Histogram - Bar / line chart - Box plot - Scatter plot ✓ Advanced visualization - Heat map - Mosaic map - Map visualization - 3D graphs - Correlogram ❑ data visualization use cases ✓ Data visualizations for business intelligence ✓ Data visualizations on internet for public consumption ✓ Data visualizations for research and data mining ❑ Advantages and benefits of good data visualization □ Definition of dataset □ Purpose of datasets ❑ Types of data sets ✓ numerical dataset ✓ bivariate dataset ✓ multivariate dataset ✓ categorical dataset correlation dataset ❑ Properties of dataset ✓ Centre of data ✓ Skewness of data ✓ Spread among the data members ✓ Presence of outliers ✓ Correlation among the data ✓ Type of probability distribution that the data follows Examples of datasets	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

4. Manage Big Data usingR	❑ Setting Up R Environment ✓ R and R studio ✓ Installation of R Studio ✓ Console ✓ Script Editor ✓ Installation of R Packages ✓ R Calculator ✓ R help ❑ R Operations ✓ R Syntax - Using the Console - Using R Scripts - R Comments ✓ R Operators ✓ Variables ✓ Data Structures - Vectors including Scalars - Matrices - Arrays - Data frames - Lists - Reading Data Frames - Manipulating Data - Exporting Data ❑ Descriptive Statistic Measures	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation
5. Perform Data Analytics using R	❑ Big Data Ecosystem ✓ The Hadoop ecosystem ✓ Hadoop core components ✓ Concepts of Hadoop Distributed File System (HDFS) ✓ MapReduce Architecture - The MapReduce Programming Model ✓ Other Components Of Hadoop - Hive - Pig - Sqoop - Spark - HBase - Zookeeper	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

	- Oozie ✓ Run MapReduce programs ❑ Big Data techniques ✓ Text Analytics ✓ In Memory Analytics ✓ Graph Analytics ✓ Statistical methods ✓ Data Mining ✓ Machine Leaning ✓ Social Media Analytics ✓ Predictive Analytics ❑ Big data analytics lifecycle ❑ Big data analytics problems ❑ Big data analytics using machine learning techniques ❑ Setting up the environment for Big Data Analytics using Spark ❑ Applying supervised Machine Learning techniques using Spark ❑ Applying unsupervised Machine ❑ Learning Techniques	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools

1. R Software
2. Hadoop Software
3. firewalls
4. antivirus
5. anti-spy ware
6. password management software

Equipment

Computer
CD/DVD Drive

Materials and supplies

- Digital instructional material including DVDs and CDs

Reference materials

1. Alla, S. (2018). Big Data Analytics with Hadoop 3. Birmingham: Packt.
2. Ankam, V. (2016). Big Data Analytics. Birmingham: Packt.
3. Sedkaoui, S. (2018). Data Analytics and Big Data: Information Systems, Web and Pervasive Computing. London: ISTE Ltd.
4. Walkowiak, S. (2016). Big Data Analytics with R: Leverage R Programming to uncover hidden patterns in your Big Data. Birmingham: Packt.
5. Kasneb e-learning resources (link on the Kasneb website).
6. Kasneb approved study packs.

PAPER NO. 11 CLOUD DATA SOLUTIONS

Unit Description

This unit specifies competencies required to manage cloud data solutions. It enables the learner toidentify key concepts of cloud computing, apply database solutions using Microsoft Azure, manage cloud database security and privacy and troubleshoot database implementation in Azure.

Summary of Learning Outcomes

1. Identify key concepts of cloud computing
2. Apply database solutions using Microsoft Azure
3. Manage cloud database security and privacy
4. Troubleshoot Database implementation in Azure

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify key concepts of cloud computing	❑ Definition of cloud computing ❑ Cloud computing service models ✓ Software as a service (saas) ✓ Platform as a service (PaaS) ✓ Infrastructure as a service(IaaS) ❑ Cloud deployment models ✓ Private cloud ✓ Public cloud ✓ Hybrid cloud ✓ Community cloud ❑ Characteristics of cloudcomputing ❑ Cloud computing technologies ✓ Virtualization ✓ Service-Oriented Architecture(SOA) ✓ Grid computing ✓ Utility Computing ❑ Advantages and disadvantages of Microsoft Azure □ Examples of cloud service providers	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

2. Apply database solutions using Microsoft Azure	□ Description of Microsoft Azure □ Uses of Microsoft Azure ✓ Virtual machines ✓ SQL databases ✓ Azure active directoryDomain services ✓ Application services ✓ Visual studio team services ✓ Storage □ Components of Azure ✓ Compute ✓ Storage ✓ Database ✓ Security and authentication ✓ Networking ✓ Monitoring ✓ Web services ✓ Mobile services □ Use Azure Functions □ Azure Storage Account ✓ The need for Azure Storage account ✓ creating an Azure StorageAccount □ Types of Azure Storage account □ Azure SQL Database ✓ Deployment models - Single database - Elastic pool - Database server ✓ Scalable performance andpools □ Logical SQL server in Azure SQLDatabase □ Azure Synapse □ Manage servers, databases, andfirewalls using the Azure portal □ SQL Server on Azure VirtualMachines □ Azure SQL managed instance	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

	□ Azure SQLdatabase	
3. Manage cloud database security and privacy	□ Azure SQL Server Data base security issues ✓ Network security - Firewall ✓ Access management - Authentication and Authorization - Row-level security ✓ Threat protection - SQL auditing in Azure Monitor logs and eventhubs - Information protection and encryption - Key management with Azure key vault ✓ Security management - Vulnerability assessment - Data discovery and classification □ Compliance	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

4. Troubleshoot Database implementation in Azure	❑ Monitoring and performance tuningin Azure SQL Database and Azure SQL Managed Instance ✓ CPU and I/O resources monitoring □ Monitoring and tuning capabilities in the Azure portal □ Monitor with SQL insights □ Azure SQL Database and Azure SQL Managed Instance resource monitoring □ Database advisors in Azure SQL Database □ Query Performance Insight in Azure SQL Database Generate intelligent assessments of performance issues □ Enable the streaming export of metrics and resource logs □ Log Analytics workspace in Azure monitor □ Azure event hubs □ Stream logs to third-party logging and telemetry systems □ Build a custom telemetry and logging platform □ View service health by streaming data to Power BI □ Azure Storage □ Use extended events	• Oral assessment • Practical assessment • Written assignments • Observation • Trainee presentation

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer
- Guided learner activities and research to develop underpinning knowledge
- Supervised activities and projects in a workshop
- Group discussions
- Presentations, practical demonstrations and exercises
- Workplace experimental learning
- Supervised activities and projects
- Case studies
- Simulation

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.
- Direct instruction method

Recommended Resources

Tools 1. Server Software Microsoft Azure 2. Firewalls 3. Antivirus 4. Anti-spy ware 5. Password management software
Equipment Computer CD/DVD Drive
Materials and supplies • Digital instructional material including DVDs and CDs
Reference materials 1. Alla, S. (2018). Big Data Analytics with Hadoop 3. Birmingham: Packt. 2. Ankam, V. (2016). Big Data Analytics. Birmingham: Packt. 3. Sedkaoui, S. (2018). Data Analytics and Big Data: Information Systems, Web and Pervasive Computing. London: ISTE Ltd. 4. Walkowiak, S. (2016). Big Data Analytics with R: Leverage R Programming to uncover hidden patterns in your Big Data. Birmingham: Packt. 5. Kasneb e-learning resources (link on the Kasneb website). 6. Kasneb approved study packs.