

**EXAMINATION REQUIREMENTS**

**&**

**SYLLABUS**

**FOR**

**THE NIGERIAN INSTITUTE OF  
QUANTITY SURVEYORS**

**2020 HARMONIZED PROFESSIONAL  
EXAMINATIONS**

**BY**

**EDUCATION AND TRAINING  
COMMITTEE**

**TPC & GDE**

## **INTRODUCTION**

The idea behind this harmonization exercise is to bring together the 2019 and 2020 syllabi. The 2019 professional examination syllabus introduced specialization/division routes, such as Building Cost Management Division, Engineering Services Cost Management Division, Project Management Division and Civil Engineering Cost Management Division for both TPC and GDE with their corresponding courses like Professional Practice and Procedure, Construction Technology, Contract Administration and Practice and Construction Commercial Management are compulsory for all divisions. Project Management, Measurement of Building Works, Measurement of Engineering Services and Measurement of Civil and Heavy Engineering were allotted to their respective divisions as classified above. Equally, Courses like Project Cost Control, Construction Technology, Law and Construction Commercial Management were made compulsory for all divisions with Project Management, Measurement of Building Works, Measurement of Engineering Services and Measurement of Civil and Heavy Engineering also allotted to their respective divisions as classified above.

Going by the divisions as stated above, it was observed that measurement which is the core of the quantity surveying competence is not given the required priority. For example, there is no measurement of any kind under project management, It therefore becomes necessary for the institute through the Examination Board to revert to the status quo which are for:

### **TPC Courses**

1. Professional Practice and Procedure
2. Construction Technology
3. Project Management and
4. Measurement of Construction Works (Building and Heavy Engineering)

### **Graduateship Courses**

1. Project Cost Control
2. Construction Law
3. Construction Technology
4. Project Management and
5. Measurement of Construction Works (Building and Heavy Engineering)

The Education and Training Committee in harmonizing the two situations as enumerated above hereby proposes as follows;

## **TEST OF PROFESSIONAL COMPETENCE**

Construction Commercial Management to be subsumed into Professional Practice and Procedure. Others to remain as before as: -

1. Professional Practice and Procedure
2. Contract Administration and Practice

3. Project Management while
4. Construction Technology and
5. Measurement of Construction Works remain as proposed by the Board.

### **GRADUATESHIP**

1. Project Management be merged with Project Cost Control while the following remain as proposed by the Board:
2. Construction Law
3. Construction Technology and
4. Measurement of Construction Works

Summarily, it is proposed that division/specialization should be introduced after the induction as a Professional Quantity Surveyor. Hence, measurement is generally compulsory as a basic competency required to attain the cooperate membership of the institute.

# **TEST OF PROFESSIONAL COMPETENCE**

## **1.0 PROFESSIONAL PRACTICE AND PROCEDURE (3 HOUR PAPER)**

### **AIM:**

To give the candidate a detailed understanding of the construction industry, quantity surveying professional ethics, office management, quantity surveyor's duties including remuneration, procurement options, claims and impact of information technology on quantity surveying practice.

### **LINKAGES**

This paper is linked with Law, Project Cost Control, Measurement, Project Management, Construction Technology and information Technology.

### **CONTENTS**

#### **SECTION A (30%)**

- 1.1 Principles of Professional conduct and Misconducts. Professional Indemnity Insurance.
- 1.2 Definition of professional services firms.  
Concept of professional services firms, management ideas applicable to professional Firms, how to make professional firms profitable (levels of profitability)
- 1.3 Management methods, criteria and decision-making relating to the internal organization and economics of Consultancy Firms engaged in the construction Industry. Application of methods, criteria and decision-making techniques on administration of projects.
- 1.4 Organization of the construction industry. Structures of the construction industry; Inter-relationship among the various consultants and contractors in the construction Industry (Quantity Surveyor, Architect, Project Management Main and subcontractors) Roles played by each of them with client.
- 1.5 **Consultancy Fee Administration.**
  - 1.5.1 Principle of Fee Calculations and claims.
  - 1.5.2 Negotiation of Fee and Consultancy Agreement
  - 1.5.3 Fee competition and negotiation technique.
- 1.6 The nature, formation and construction of building and civil engineering contracts Types of Contracts. The functions and inter-relationship of associated documents: Advantages and disadvantages of the various types of Contract systems and procedures.
- 1.7 A detailed knowledge of the Standard Forms of Building and Civil Engineering contracts and subcontracts including their interpretation and application. Legal differences between nominated/named and domestic contractors. The requirements and responsibilities of the external contractor, domestic contractor and the client as well as their inter- relationship under the contract.
- 1.8 Drafting of Articles of Agreement for Building and Civil Engineering contracts.
- 1.9 Tendering procedures and factors which influence the method and the procedure to adopt.
  - 1.9.1 The roles and functions of the Quantity Surveyor in tender invitation, opening, processes and reporting, tender negotiation processes. Methods and Techniques

- 1.9.2 The detailed requirements of a tender report
- 1.9.3 Cost reduction and adjustment exercise on projects exceeding budgetary estimates
- 1.9.4 Tender evaluation, communication with tenderers and preparation of final reports.

## **SECTION B (30%)**

- 1.10 Financial reports, cash flow forecast, interim valuations, valuation of variations and Architect's instructions, preparation of National and final accounts including claims.
- 1.11 Fundamental requirement and assessment of fluctuation claims and conduct of site meetings.
- 1.12 Preparation of financial statements.
- 1.13 Contractor's insolvency and the quantity Surveyor's roles.
- 1.14 Value and Investment - methods of valuation, factors affecting demand/value of property, Relationship between value and returns.
- 1.15 Pricing Techniques and Estimating**
  - 1.15.1 Principles and methods for estimating based on user requirements, designs and approximate measurements and quantities.**
  - 1.15.2 An overview of the applications and limitations of preliminary estimating methods: Unit, superficial or floor area, storey enclosure and cubic methods, elemental cost model, approximate quantities, etc.
- 1.16 Constituents of all-in-rates: analysis and synthesis of rates in all trades.**
- 1.17 Understand the concept of pricing and costing.
  - 1.17.1 Pricing of bill: pre-pricing activities (collection of materials, role of consultants, market surveys/research, measure of profitability, risk analysis, cash flow consideration and gearing).
  - 1.17.2 Explain economic considerations and factors relating to use of mechanical plants.
  - 1.17.3 All-in rates: Detailed analysis showing the basis upon which prices of bills of quantities items are compiled.
  - 1.17.4 Building-up of rates for certain works items: Excavations and earthwork, concrete works (including ancillaries), block work, plastering, carpentry work and roofing, plumbing, electrical works, etc.
- 1.18 Pricing of Preliminaries P.C. Sums including attendances and Day work items and Overheads**
  - 1.18.1 Price preliminaries, Prime cost sums including attendances, overheads, day works and plant items.
  - 1.18.2 Calculate cost of variation from day work sheet.
  - 1.18.3 Explain the expenditure of P.C sums and contingency sum allocated in the bill of Quantities.
  - 1.18.4 Preparation of construction resources schedules using SMRS 1 of the NIQS.

## **SECTION C (40%)**

- 1.19 Application and use of cost analyses and cost checking during design and construction stages.
  - 1.19.1 Cost control and information technology.
  - 1.19.2 Computer technology as a tool in cost management process.
- 1.20 Life cycle costing - Concept and time value of money. Taxation and life cycle costing. Cost capital allowances.
- 1.21 Sources of Finance, Investment Appraisal, Developers Budget. Cost Benefit Analyses.
- 1.22 Land use and value determinants - Town Planning Control and Development, Legal interest in property. Mortgages and Negotiable instruments and their implications to development costs and values.
- 1.23 Cost in Use / Life Cycle Costing**
  - 1.23.1 Concept of cost in use
  - 1.23.2 Present and future payments - concept and time value of money
  - 1.23.3 Maintenance and running cost; Life of building and components including effects of errors in prediction.
- 1.24 Economics of Building Development**
  - 1.24.1 Land acquisition problems
  - 1.24.2 Financial Considerations and Sources of development Finance
  - 1.24.3 Developer's budget.
  - 1.24.4 Choice between building lease or purchase.
- 1.25 Land use & Value determinants**

Factors determining land use & Value.  
Town planning control & development.  
Legal interest in property. Land use planning.
- 1.26 Value Engineering**
  - 1.26.1 Definition
  - 1.26.2 Basic requirements
  - 1.26.3 Structure of a typical value Engineering team
  - 1.26.4 Procedure or phases of value Engineering
  - 1.26.5 Value Management - advantages and disadvantages
  - 1.26.6 Earned value management
  - 1.26.7 Time value management

## **2.0 CONSTRUCTION TECHNOLOGY (3HRS PAPER)**

**NOTES FOR GUIDANCE:** Detailed knowledge is required of the technology of building, including the use of plant, methods and operations. For civil engineering works, detailed knowledge and understanding of the problems involved are essential. In matters of Engineering Services, Knowledge appropriate to the functions of the quantity surveyor

is required.

## Content

- **Advanced building works**
- **Maintenance technology**
- **Civil engineering works**
- **Engineering services**

### **2.1 ADVANCED BUILDING WORKS**

- 2.1.1 Basements, multi-storey construction, associated problems of design, construction, excavation and support. Advanced Foundation Types.
- 2.1.2 Construction methods in industrialized and non-industrialized buildings with special reference to sequencing of erection, accuracy, fit, safety and mechanical plant requirements
- 2.1.3 High rise buildings, design and construction in steel and concrete, construction joints and curtain walling
- 2.1.4 Roofing of buildings particularly those with large floor areas
- 2.1.5 Safety requirements on building sites.

### **2.2 MAINTENANCE TECHNOLOGY:**

- 2.2.1 Planned and Preventive maintenance; defects and remedial treatments, inspections and reports; dilapidation; conservation.
- 2.2.2 Dilapidation report for use in assets valuation
- 2.2.3 Principles, planning and procurement processes in facilities management. Principles and methods of out-sourcing. Packages and Schedules of maintenance

### **2.3 CIVIL ENGINEERING WORKS**

- 2.3.1 Earthworks, embankments and cuttings and retaining walls
- 2.3.2 Soil Stabilization
- 2.3.3 Piling
- 2.3.4 Roads
- 2.3.5 Railway
- 2.3.6 Bridges, underpasses and tunnels
- 2.3.7 Airfield construction
- 2.3.8 Simple Tunneling in free air
- 2.3.9 Pipelines
- 2.3.10 Marine work, Water Towers and Tanks
- 2.3.11 Large sewers and drains
- 2.3.12 Sewage treatment installations
- 2.3.13 Power stations



## 2.4 **ENGINEERING SERVICES.**

- 2.4.1 Plumbing installations, Boreholes, Water Treatment Plant, Water Distribution and Control;
- 2.4.2 conditioning: Forms, plant, equipment and installations;
- 2.4.3 Electrical installations, Generation, Distribution, Heavy-Duty control gear;
- 2.4.4 Lighting: illumination levels, Data and Design Calculations, Lighting Conductors;
- 2.4.5 Fire protection, Equipment and systems
- 2.4.6 Mechanical movement systems, Flow and design criteria, Lateral and vertical systems.
- 2.4.7 Communication Systems
- 2.4.8 Acoustics: Sound control, Noise problems and their elimination.
- 2.4.9 Solar Energy System.

## **3.0 CONTRACT ADMINISTRATION AND PRACTICE (3HRS PAPER)**

- **Contract Administration**
- **Contract practice**

### **Contract Administration**

- i. Candidates are required to understand and demonstrate capacity to undertake the role of a surveyor administering a construction contract. Candidates should be aware of the roles and responsibilities of the administrator under the main forms of contract.
  - ii. They should have a detailed understanding of the contractual provisions relating to the forms of contract that they have administered.
  - iii. Candidates are required to comprehend the various forms of contract used in the construction industry.
  - iv. Candidates should have an awareness of all of the main standard forms of contract (Nigeria Construction Industry) and a thorough understanding of contract law, legislation (Public Procurement Act) and the specific forms that they have used
- 3.1 Candidates will be tested to demonstrate knowledge and understanding of the contractual, legislative and statutory terminology/requirements, of a construction contract as it concerns:
- 3.1.1 The various standard forms of contract and sub-contract used in the industry
  - 3.1.2 Basic contractual mechanisms and procedures applied at various stages of the contract
  - 3.1.3 The roles and responsibilities of the administrator.
- 3.2 Implementation of administrative procedures necessary to run a construction contract.
- 3.2.1 Issuing instructions
  - 3.2.2 Dealing with payment provisions
  - 3.2.3 Managing change procedures
  - 3.2.4 Involvement with dispute avoidance

- 3.2.5 Dealing with completion and possession issues
- 3.2.6 Issuing certificates
- 3.2.7 Issues of claims and claims management.
- 3.3 Advise on the administrative procedures necessary for the smooth running of a construction contract including document control techniques and systems, meetings and reporting procedures.
  - 3.3.1 Understanding various dispute resolution mechanism and their methods of resolution
  - 3.3.2 Assessing entitlement for extension of time
  - 3.3.3 Assessing entitlement for loss and expense
  - 3.3.4 Advising all parties of their contractual rights and obligations.

### **3.4 Contract Practice**

Candidates are required to comprehend the various forms of contract used in the construction industry. Candidates should have an awareness of all of the main standard forms of contract and a thorough understanding of contract law, legislation and the specific forms that are in use. Demonstrate knowledge and understanding of the various forms of contract used in the construction industry and/or in area of business. Candidates will be tested on:

- 3.4.1 Basic contract law and legislation
- 3.4.2 Contract documentation
- 3.4.3 The various standard forms of contract and sub-contract
- 3.4.4 When the different forms would be used
- 3.4.5 Basic contractual mechanisms and procedures at various stages of the contract
- 3.4.6 Third party rights including relevant legislation and the use of collateral warranties.
- 3.5 Application of knowledge acquired in the use of the various standard forms of contract at project level, including the implications and obligations that apply to the parties to the contract as it concerns.
  - 3.5.1 Producing contract documentation
  - 3.5.2 Carrying out the contractual mechanisms and procedures relevant to the financial management aspects of your project, such as change procedures, valuations, loss and expense and final accounts
  - 3.5.3 Understanding general contractual provisions such as letters of intent, insurances, retention, bonds, liquidated and ascertained damages, early possession, practical completion and other common contractual mechanisms.
- 3.6 Providing evidence of reasoned advice, preparation and presentation of reports on the selection of the appropriate form of contract and warranties for a chosen procurement route. This should include advising on the most appropriate contractual procedure at the various stages of a construction or other contract to cover
  - 3.6.1 Selecting the appropriate form of contract and/or sub-contract for your chosen procurement route
  - 3.6.2 Advising on the most appropriate contractual procedure at the various stages of a

contract

- 3.6.3 Evaluating the appropriateness and implications of proposed contractual amendments.

## **4.0 PROJECT MANAGEMENT (3 HOUR PAPER)**

### **Content**

- **Procurement methods**
- **Construction financing**
- **Procurement of engineering contracts**
- **Financing of engineering contracts**
- **Management theories and principles**
- **Project management and information technology**
- **Information technology**
- **Marketing**

### **4.1 Procurement Methods**

Types and process of different procurement methods; Traditional, Design and Build, Management Contracting, Construction Management and Fast Track Systems. Shortcomings of traditional procurement techniques and the emergent need for project and facilities management.

### **4.2 Construction Financing**

4.2.1 Construction financing sources, equity, loans grants, subsidies, investment and taxation allowances, unit trusts, Government funding, programming, budgeting and Control, Sources of finance in both public and private sectors, debt equity swaps, national and international finance, Capital budgeting Including Discounted Cash Flow Techniques.

4.2.2 Principles and operation of Build-Operate and Transfer (BOT) system of project financing.

4.2.3 Construction Economics and Environment

### **4.3 Procurement of Engineering Contracts**

Technological licensing and patenting. Offshore and local sourcing, Turnkey procurement of heavy engineering projects, preliminary definition, performance specification and bidding procedures, Bid evaluation and construction documentation. Roles of the monitoring consultants.

### **4.4 Financing of Engineering Contracts**

Feasibility studies, Contractor versus Client-financing, letter of credit, suppliers Credit Contractor-financing, comparative management and post-construction assistance.

### **4.5 Management Theories and Principles**

4.5.1 Technique and principles of Total Quality Management (TQM), Marking and Process Re-Engineering.

4.5.2 The benefits of these systems over traditional management methods like work-study.

4.5.3 Education and training as a fulcrum of implementing these management processes. Differences and similarities of these systems.

#### 4.6 **Project Management and Information Technology**

4.6.1 The use of Computer in project planning and scheduling

4.6.2 Software use in project management, MS project, etc.

4.6.3 CAFGEN - Contract Administration, Form for Windows.

#### 4.7 **Information Technology**

Use of computer in estimating, cost planning, bills of quantities production, valuations, final accounts preparation, financial reports, work processing, spreadsheets, databases; telecommunications - fax, e-mail, voice mail, electronic tendering, websites, the internet; use of export systems.

#### 4.8 **MARKETING**

4.8.1 Marketing's Role in the Nigerian Economy

- a) The meaning of Marketing to Business.
- b) Government and Non-profit sectors of the Economy.
- c) Marketing management, philosophies and goals of national industry.
- d) Corporate marketing systems.

4.8.2 Marketing Role in the Corporation

- a) Organizational and environmental analysis of companies, private practices and employers.
- b) Strategic planning and marketing process marketing planning and control, marketing information system, marketing organization.

4.8.3 Target Market Analysis

Analysis of marketing environments, consumer markets and buying behaviour, organizational markets and behaviour, market segmentation targeting.

4.8.4 Marketing Mix strategy

- a) New product Development, product life cycle, concepts and strategies, product branding, packaging and service strategy, pricing strategy, marketing channel and physical distribution strategy.
- b) Retailing and wholesaling strategy, marketing communications, advertising, sales promotions and publicity strategy.
- c) Personal selling and sales management strategies.

4.8.5 Marketing of Service, Organizations and persons

- a) Services marketing, nature and characteristics of the services business's analysis of construction services business, Differences between marketing professional services and construction services.
- b) Organization marketing, Image assessment, image choice, image planning

and control.

- c) Mission statements as marketing tool.
- d) Person marketing; Celebrity Marketing, political Candidate marketing, personal marketing.
- e) Location marketing: Domicile marketing, business site marketing, Land investment marketing, vacation. Marketing, nation marketing.

#### 4.8.6 Professional Ethics and Marketing

- a) Social criticism of marketing, impact on individual and societal welfare and on other businesses.
- b) Citizens and Governmental action to regulate marketing, Enlightened marketing, controlled marketing, professional ethics and marketing.
- c) The O.S Registration Board Decree No. 31 of 1986 recommended Standards of Ethical behaviour, the social responsibilities of the O.S profession.

#### 4.8.7 Professional Services and Bidding strategies

- a) Bidding for professional services. Fee competition
- b) Preparation of Technical and financial reports.
- c) Funding agencies bidding processes and procedures. World Bank, IMF, USAID, ADB, APDB etc.

## **5.0 MEASUREMENT**

### **5.1 MEASUREMENT OF CONSTRUCTION WORKS (3HOUR PAPER)**

#### **NOTE:**

**CANDIDATES** will be allowed to bring into the Exam hall only relevant and approved publications he/she may require for this paper. Textbooks and pre-take off materials will no longer be allowed.

#### **AIM:**

To enable the candidate to understand in detail the provisions and application of the BUILDING and ENGINEERING STANDARD METHOD OF MEASUREMENT (BESMM) to construction works, specification and Contract documentation.

#### **LINKAGES**

This paper is closely linked with Construction Technology and Professional Practice and Procedures.

Generally, candidates are expected to have good knowledge of Intermediate Examination syllabus.

Candidates are expected to have a clear understanding of the following:

- a) Application of measurement principles to all forms of construction works in accordance with the latest edition of the Nigerian Standard Method of Measurement.
- b) Preparation of Bills of Quantities from dimensions including an understanding of

- abstracting methods and the application of computers for data processing production of document.
- c) Purpose and uses of different Bills of Quantities Formats: Trade bills, elemental bills, Operational bills etc.
  - d) Approximate Bills of Quantities, Schedule of rates etc.
  - e) Writing of preliminary and preamble items
  - f) The significance of standard phraseology in Bills of Quantities.
  - g) Prime Cost' and Provisional Sums.
  - h) Nominated Suppliers and Nominated Sub-contractors, and the assessment of allowances for associated general attendance items and profit.
  - i) Preparation, editing and presentation of tendering control information (j) Specification writing
  - j) Details of items under preliminaries section of Bills of Quantities.
  - k) Computer aided measurements and tender documentation.
  - l) (m)Understanding and use of different software and packages available for pre-contract documentation.

#### Content

- **Measurement of Building Works**
- **Measurement of Engineering Services** (Mechanical Installations and Electrical Installation)

#### **5.1.1 Measurement of Building Works**

Candidates are expected to have advanced knowledge of measurement of Building works comprising residential estates development, high rise commercial properties, sports and recreational facilities.

#### **5.1.2 Measurement of Engineering Services**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of services in construction works. Importance should be attached to a systematic and logical approach to measurements and suitability of descriptive statements. They should be able to measure and prepare bills of quantities as well as carry out the pricing of the works in accordance with the Nigeria standard Method of measurement of Building works and services in the following areas.

##### **5.1.2.1 Mechanical Installations**

- a) Firefighting installation Pipe work, appliances, equipment, fittings and builder's work.
- b) Air Handling installation identifying whether ventilation supply, ventilation extract, ventilation with heating, (air heated locally or centrally), Air conditioning systems (room/window/split units and central packaged systems) or foul air extract, air conditioning (air cooling- room/window/split units and central packaged systems) including duct works and associated pipe works.

- c) Mechanical Movement Systems
  - i Lifts, hoists, escalators, conveyors, etc. and their associated builder works.
  - ii Refuse disposal systems
- d) Special equipment identifying whether incinerator and flues, kitchen and laundry, equipment.
- e) Builder Work
  - i. Builder's work associated with plumbing and mechanical installations
  - ii. Electrical work associated with plumbing and mechanical installations.

#### **5.1.5.1 Electrical Installation**

- a) Incoming Services up to but excluding main medium voltage switch gear.
- b) Standby equipment
- c) Mains installation excluding final sub-circuits
- d) Power installation
- e) Lighting installation
- f) Electrical installation
- g) Electric appliances
- h) Electric work associated with plumbing and mechanical engineering installation
- i) Telephone installation
- j) Clock installation
- k) Sound distribution installation
- l) Alarm system installation
- m) Earthing system installation
- n) Lighting protection installation
- o) Special services identifying whether direct current, extra I low voltage, flame-proof, pressurized installation,
- p) Any other installation,
- q) Trunking, ducting and cable trays associated with more than one installation.

***Measurement shall be in accordance with latest BESMM4R for industrial engineering.***

## **5.2 MEASUREMENT OF ENGINEERING SERVICES WORKS (3 HRS PAPER)**

**NOTE:** CANDIDATES will be allowed to bring into the Exam Hall only relevant and approved publications he/she may require for this paper. Textbooks and Pre-takeoff materials will not be allowed.

### **AIM:**

To broaden the scope of measurement and detailed description of engineering services construction components. To equip candidates with more advanced engineering services construction technology details to enable them measure and provide cost advice to clients.

## **LINKAGES:**

This paper is closely linked with Engineering Services Construction Technology, Engineering Services Construction Management, Engineering Services Estimating, Information Technology, and Professional Practice and Procedure.

## **MEASUREMENT OF ENGINEERING SERVICES WORKS (3 HRS PAPER)**

- Application of engineering services works
- Measurement of mechanical services
- Measurement of electrical services
- **Measurement of communication, security & control services**
- Measurement of transportation systems

### **5.2.1 SECTION A: APPLICATION OF ENGINEERING SERVICES WORKS**

- 5.2.1.1 The application of measurement principles to all forms of Engineering Services works in accordance with the current latest edition of the Building & Engineering Standard Method of Measurement (BESMM).
- 5.2.1.2 The purpose and uses of: Trade bills, Elemental bills, Operational bills, Sectional bills and Approximate Bills of Quantities, Schedule of Rates, Development and application of Preliminaries/General Items (Conditions), the significance/application of standard phraseology in Bills of Quantities.
- 5.2.1.3 An understanding of the terms; Prime Cost and Provisional Sums, Nominated Suppliers and Nominated Sub-contractors including the assessment of allowances for associated general attendance items and profit.
- 5.2.1.4 The preparation of Bills of Quantities from dimensions and the application of standard phraseologies and developing a phraseology library for the production of documentation.
- 5.2.1.5 Preparation, editing and presentation of tendering and control information. Specification writing, understanding details of items under the preliminaries section of the Bills of Quantities.
- 5.2.1.6 Computer aided measurements and tender documentation
- 5.2.1.7 Understanding and use of different software and packages available for pre-contract documentations.

### **SECTION B: MEASUREMENT OF MECHANICAL SERVICES**

#### **AIM:**

- 5.3** Candidates are required to demonstrate an advanced and clear understanding of the basic principles of planning, design and installation of mechanical services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of pipelines/duct lines, pipeline/duct line ancillaries and pipeline/duct line control equipment across the following installations. Candidates should



be able to measure and prepare bills of quantities as well as carry out the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 5.3.1 Furniture, Fittings, Equipment and Appliances, Kitchen/Catering equipment, sanitary fittings and appliances.
- 5.3.2 Rainwater installations, Drainage and sewerage systems disposal and treatment plant, sanitary installation, industrial waste drainage, refuse disposal/chute, incineration plant, swimming pool water treatment systems, etc.
- 5.3.3 Hot and cold-water supply and distribution pipe work and storage, Boreholes and water treatment systems, Gas supply installation and distribution, fuel oil storage/distribution installation
- 5.3.4 Fire-fighting equipment, inlets and appliances, fire hose reel system, dry/wet riser systems, sprinkler system, fire hydrant installations, gas firefighting system, foam fire-fighting installations.
- 5.3.5 Chilled water systems, central refrigeration plant.
- 5.3.6 Ventilation Systems: Air handling installations–Ventilation supply and extract equipment, supply and extract duct lines and pipelines with associated fittings, general ventilation installation, toilet ventilation installation, kitchen ventilation installation, car park ventilation system, smoke extract/smoke control system.
- 5.3.7 Air-Conditioning Systems: Air conditioning systems–VAV air-conditioning, Dual duct air-conditioning, Multi-zone air-conditioning, Fan-coil air-conditioning, and Air-conditioning units (room/window/split units and central packaged systems) including duct works and associated pipe works and fittings.
- 5.3.8 Insulation, Fire Stopping and Fire Protection
- 5.3.9 Builders work associated with mechanical services installations

#### **5.4 SECTION C: MEASUREMENT OF ELECTRICAL SERVICES**

##### **AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of electrical services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/ trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carry out the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 5.4.1 HV/LV Supply/Public Utility/Distribution. Incoming services up to but excluding main medium voltage switch-
- 5.4.2 Electricity Generation Plant (Standby equipment
- 5.4.3 General Lighting and LV Power installation
- 5.4.4 Uninterruptible Power Supply
- 5.4.5 Emergency Lighting installation

- 5.4.6 Street/Area/Floodlighting installation
- 5.4.7 Earthing system installation
- 5.4.8 Lightning Protection installation
- 5.4.9 Insulation, Fire stopping and Fire Protection systems
- 5.4.10 Conduits, Trunking and cable
- 5.4.11 Cables and wires
- 5.4.12 Builder's work associated with electrical installations, including excavating cable trenches, concrete plinths, etc.

## **5.5 SECTION D: MEASUREMENT OF COMMUNICATION, SECURITY & CONTROL SERVICES**

### **AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of control and technology services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carry out the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 5.5.1 Telecommunications, Public Address/Conference Audio facilities
- 5.5.2 Radio/TV/CCTV installation systems
- 5.5.3 Data Transmission installation systems
- 5.5.4 Control Systems
- 5.5.5 Security Detection & Alarm System installations
- 5.5.6 Fire Detection & Alarm System installations
- 5.5.7 Central Control/Building Management System installations including Car Parking Management system
- 5.5.8 Conduits, Trunking and cable trays
- 5.5.9 Cables and wires
- 5.5.10 Insulation, Fire Stopping and Fire Protection systems
- 5.5.11 Builder's work associated with control and technology installations, including excavating cable trenches, concrete plinths, etc.

## **5.6 SECTION E: MEASUREMENT OF TRANSPORTATION SYSTEMS**

### **AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of transportation system services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carry out the

pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 5.6.1 Lifts
- 5.6.2 Escalators
- 5.6.3 Moving Pavements
- 5.6.4 Powered Stair lifts
- 5.6.5 Hoists
- 5.6.6 Travelling Cradles
- 5.6.7 Conveyors
- 5.6.8 Builder's work associated with transportation systems installations

*Measurement shall be in accordance with latest BESMM4R for industrial engineering.*

## **5.7 MEASUREMENT OF CIVIL & HEAVY ENGINEERING WORKS (3 HOURS PAPER)**

### **AIM:**

To provide an **advanced** knowledge on the scope of measurement and detailed description of civil and heavy engineering construction components. To equip candidates with general civil engineering construction technology details to enable them measure and provide cost advice to clients.

- Civil works (scope of engineering works and method of measurement)
- Soil stabilization systems
- Tunneling and underpinning
- Marine works
- Road works, bridges, subways and airfield construction
- Railway track work

### **5.7.1 CIVIL WORKS**

#### **5.7.1.1 Scope of Engineering works and Method of Measurement**

- a) Site investigation, classification of rocks and soils, procedure of investigation, preliminary works, methods of site exploration, testing generally, Geophysical surveys and other techniques, special information and costs
- b) Site organization and temporary services, demolition, site offices and general accommodation, material storage and compounds, Temporary services, setting out and safety.

#### **5.7.2 Soil Stabilization systems**

Pilling, Diaphragm and Retaining wall systems. Sheet pilling, bearing piles, Bored piles, cast-in-place piles, preformed piles, vibrio-floatation and vibrio-replacement, diaphragm walling, retaining walls.

- a) General principles of Civil Engineering measurements, works classification, coding and numbering of items Preparation of Bills of Quantities.
- b) Principles of Method related charges
- c) Management of plant and Machinery

### **5.7.3 Tunneling and underpinning**

General considerations, methods of tunneling and underpinning, ventilation and lighting, safety aspects.

### **5.7.4 Marine works**

Cofferdams, caissons, underwater foundation construction, sea walls, Docks, jetties and other marine structures, Dredging and Reclamations, canal and River works, Reservoirs and liquid- retaining tanks.

5.7.5 Road works, Bridges, Subways and Airfield Construction

5.7.6 **Railway track Work**

## **5.7.2 HEAVY & INDUSTRIAL ENGINEERING**

- Scope of Heavy Engineering
- Measurement and Control of engineering projects

### **5.7.2.1 Scope of Heavy Engineering**

Definition of Heavy Engineering, Principles and constituents of heavy engineering equipment, facilities, structures and raw materials for: Pharmaceutical Chemicals, Nuclear Energy, Gas Exploration & Production.

Facilities for Oil exploration, production and petroleum refining, power generation, food and drinks, paper milling, steel and non-ferrous metal production, telecommunication, data communication etc.

### **5.7.2.2 Measurement and Control of engineering projects**

Taking off quantities, preparation of bid documents and negotiation of Work packages of all the followings;

- a) Construction site services
- b) Scaffolding
- c) Steelwork
- d) Plant
- e) Pipework
- f) Electrical Work
- g) Instrumentation
- h) Insulation
- i) Protective coverings
- j) Sundry items

***Measurement shall be in accordance with latest BESMM 4R for industrial engineering.***



# GRADUATESHIP

## GRADUATESHIP EXAMINATION

### 1.0 PROJECT COST MANAGEMENT AND CONTROL (3 HOUR PAPER)

#### AIM:

- i To enable the candidate to understand the techniques of preparing preliminary estimates
- ii To stress the importance of time value of money
- iii To establish the importance of prudent resource allocation

#### CONTENT

- Concept of Cost Control-need for Cost Control.
- Approximate estimating; Purpose and types of approximate estimates
- Cost Planning
- Cost -in-use
- Economics of Building Development
- Land use and value determinants

- 1.1 Concept of Cost Control-need for Cost Control.
- 1.2 Factors influencing cost-function, technical and aesthetic requirements, Cost implications of design variables. Sources and management of cost information.
- 1.3 Approximate estimating; Purpose and types of approximate estimates
- 1.4 Cost Planning

- 1.4.1 Cost Planning theories and techniques
- 1.4.2 Cost planning principles and the design process.
- 1.4.3 Preparation and presentation of Cost plans, cost limits, cost analyses, cost indices.
- 1.4.4 Cost control procedure
- 1.4.5 Application of computer to cost control work
- 1.5 Cost -in-use
  - 1.5.1 Concept of cost -in-use
  - 1.5.2 present and future payments-concept and time value of money
  - 1.5.3 Maintenance and running cost; Life of building and component effects of errors in prediction
- 1.6 Economics of Building Development
  - 1.6.1 Land acquisition problems
  - 1.6.2 Financial Considerations and sources of development Finance
  - 1.6.3 Developer's Budget
  - 1.6.4 Choice between building, lease or purchase
- 1.7 Land use and value determinants
  - 1.7.1 Factors determining land use and value
  - 1.7.2 Town planning Control and Development
  - 1.7.3 Legal interest in property
  - 1.7.4 Land use planning

## **Section B (30%)**

### **Content**

#### **Pricing Techniques and Estimating**

- Constituents of all-in-rates: analysis and synthesis of rates in all trades.
- Pricing of Preliminaries P.C. Sums including attendances and Day work items and Overheads
- Know tender analysis and reports.

#### **1.1.1 Pricing Techniques and Estimating**

- 1.1.2 Principles and methods for estimating based on user requirements, designs and approximate measurements and quantities.
- 1.1.3 An overview of the applications and limitations of preliminary estimating methods: Unit, superficial or floor area, storey enclosure and cubic methods, elemental cost model, approximate quantities, etc.
- 1.1.4 **Constituents of all-in-rates: analysis and synthesis of rates in all trades.**
  - 1.1.4.1 Understand the concept of pricing and costing.
  - 1.1.4.2 Pricing of bill: pre-pricing activities (collection of materials, role of consultants, market surveys/research, measure of profitability, risk analysis, cash flow consideration and gearing).
- 1.1.5 Explain economic considerations and factors relating to use of mechanical plants.
- 1.1.6 All-in rates: Detailed analysis showing the basis upon which prices of bills of

quantities items are compiled.

1.1.6.1 Building-up of rates for certain works items: Excavations and earthwork, concrete works (including ancillaries), block work, plastering, carpentry work and roofing, plumbing, electrical works, etc.

### **1.2.5 Pricing of Preliminaries P.C. Sums including attendances and Day work items and Overheads**

1.2.5.1 Price preliminaries, Prime cost sums including attendances, overheads, day works and plant items.

1.2.5.2 Calculate cost of variation from day work sheet.

1.2.5.3 Explain the expenditure of P.C sums and contingency sum allocated in the Bill of Quantities.

1.2.5.4 Preparation of construction resources schedules using SMRS 1 of the NIQS.

### **1.2.6 Know tender analysis and reports.**

1.2.6.1 Understand pricing methods.

1.2.6.2 Know how to analyze tenders.

1.2.6.3 Know how to write tender reports for selected projects such as duplex, high rise building, etc.

## **2.0 CONSTRUCTION TECHNOLOGY (3-HOUR PAPER)**

### **AIM:**

To equip candidates with more advanced Construction Technology to enable them to have adequate knowledge of technology of building, civil engineering and understanding of Engineering Services required for measurement and cost advice to clients.

### **LINKAGES**

This subject form the core of Measurement, Project Management and Project Cost Control

### **CONTENTS**

- **Building works (30%)**
- **Civil works (40%)**
- **Engineering services (30%)**
  - Mechanical Installations
  - Electrical Installation
  - Communications and Security Systems

## **2.1 BUILDING WORKS (30%)**

2.1.1 Basements, multi-storey construction, associated problems of design, construction, excavation and support. Advanced Foundation Types.

2.1.2 Sequence of erection, accuracy, fit, safety and mechanical plant requirements.

2.1.3 High rise buildings, design and construction in steel and concrete, construction



joints and curtain walling.

2.1.4 Roofing of buildings particularly those with large floor areas.

2.1.5 Safety requirements on building sites.

2.1.6 Spot item demolitions, alterations, maintenance, repairs, conversion, extensions etc.

2.1.7 Defects in buildings.

## **2.2 CIVIL WORKS (40%)**

Site investigation and Exploration, Earthwork design and Groundwater control, External works, Reads and paving, swimming pools, fountains, Water features, sculptural works, Horticultural and landscaping works.

## **2.3 ENGINEERING SERVICES (30%)**

### **2.3.1 Mechanical Installations**

- i Rainwater installation, Sanitary Installation, Cold water installation identifying treated water, boosted water, cooling water, chilled water or domestic cold water.
- ii Firefighting installations Hose reel system, Dry riser system, Sprinkler system, Co2 system, foam inlets or hand appliances, heated water installation, identifying steam and condensate (high pressure) or domestic hot water.
- iii Fuel oil installation, Fuel gas installation, Refrigeration installation which shall be deemed to include Medical and Laboratory installations, (Pneumatic tube installation, Vacuum installation).
- iv Refuse disposal installation; Special equipment identifying whether incinerator and flues, Air handling installation identifying whether ventilation supply. Ventilation extract or ventilation with heating (air heated locally or centrally) or foul air extract, air conditioning (air cooling), Automatic control installation Kitchen equipment, laundry equipment etc. Any other installation. Metal work, supports and the like associated with more than one installation.
- v Drains Manholes/Inspection chambers, septic tanks and cesspits, soak away pits, sewage systems and treatment plant, drainage pipework and associated builders work.

### **2.3.2 Electrical Installation**

Incoming services up to but excluding main medium voltage switchgear Standby equipment, Mains installation, excluding final sub circuits. Power installation, lighting installation, electric heating installation, Electrical appliances, electrical work associated with plumbing and mechanical engineering installations. Earthing system installation, Lightning protection installation.

### **2.3.3 Communications and Security Systems**

Telephone, intercom Fax, Internet, Email, Close Circuit TV etc.

## **3.0 CONSTRUCTION LAW (3-HOUR PAPER)**

**NOTES FOR GUIDANCE:** Candidates will be expected to show proficiency in the interpretation and understanding of the general principles of law including:

Content

**SECTION A** -outline of the law relating to development primarily, town and Country Planning, Public Health, Housing and Highways.

**SECTION B -**

- Law of Property:
- Insolvency, Bankruptcy and Liquidation.
- Insurance law relating to Buildings

**3.1 SECTION A (40%)**

An outline of the law relating to development primarily, town and Country Planning, Public Health, Housing and Highways.

3.1.1 Nigeria Land-use Act

3.1.2 Litigation, Arbitration and Alternative dispute resolution methods

3.1.3 General principles of Contracts; Formation of contracts, Contracts that are not binding Discharge of contracts and International cases. Special contracts including sales of goods, Agency, Employment, Insurance, etc.

**SECTION B (60%)**

3.2 Law of Property: Rights of the owner and occupier of Land Rights over Land and others. Planning Law. Infringements of patent and copyrights, **trespass** etc. Breach of statutory duty; Rayland vs.

Fletcher, liability for spread of fire; Easements, Restrictive covenants.

3.3 Tort.

Negligence, Nuisance, Vicarious Liability, Remedies and Limitation.

3.4 Company Law.

3.5 Limited liability Companies, Partnership, Corporate Bodies and Trade Unions. Law of sale of Goods; Hire-purchase law.

3.6 Insolvency, Bankruptcy and Liquidation.

3.7 Insurance law relating to Buildings

**PROJECT MANAGEMENT AND INFORMATION TECHNOLOGY (3-HOUR PAPER)**

Content

**SECTION A -**

- Definitions and principles of Project Management

- Project Planning and Scheduling techniques

## **SECTION B -**

- Financial Management
- Finance
- Management Theory

## **SECTION C -**

- Information Technology
- Computer processing Technology
- Components of a Computer
- Packages and application software
- Development Economics
- Value Engineering

## **SECTION A (30%)**

### **3.8 Definitions and principles of Project Management**

- 3.8.1 Project definition.
- 3.8.2 The role of the Project Manager from inception to completion.
- 3.8.3 Project leadership
- 3.8.4 Project/organizational structures
- 3.8.5 Project reporting and control
- 3.8.6 Project risk management
- 3.8.7 Criteria for success and failure in projects.

### **3.9 Project Planning and Scheduling techniques**

Bar chart, CPM, PERT, line of balance, linear programming and transportation problems, Queuing theory and Simulation

## **SECTION B (30%)**

### **3.10 Financial Management**

Categorization of assets, liabilities and capital, Trading, Profit and loss Accounts, Balance sheet and Interpretation of Published Accounts, Liquidity, Solvency, Convertibility, Security, Cash Flow, Debt Coverage, Financial Ratios, Determinant analysis and prediction of corporate Bankruptcy. Total, Fixed, Variable and Marginal Cost Analysis.

### **3.11 Finance**

Commercial and Merchant Banking, role of the Central Bank of Nigeria, Non-Bank. Financial Institutions. Trustees Investment Act. Companies and Allied Decree 1990. Banking Act. 1969, Money and capital Market, Treasury Bills. Common stock, Raising of Loan and Equity using private placement and the public offer through the Nigerian Stock Exchange.

### **3.12 Management Theory**

3.12.1 General understanding of Management principles and theories.

3.12.2 Project Planning and programming - Bar chart, Critical Path Analysis and other project planning methods.

### **SECTION C (40%)**

#### **3.13 Information Technology**

3.13.1 Introduction to information systems and management.

3.13.2 Technological changes in the information systems to date.

3.13.3 Relationship between data and information.

3.13.4 Social and organization impacts of new information systems.

#### **3.14 Computer processing Technology**

3.14.1 Introduction to Computer Systems. Analogue, Digital Hybrid I Electronic Computers

3.14.2 The different types of computers; microcomputers minicomputers, super micros, super minis, mainframes, super main frames.

3.14.3 The differences between clone systems and major manufacturers systems (IBM PC Gateway, Packard bell, Apple Macintosh, etc.

3.14.4 The standard computers accessories (digital camera and camcorders, memory sticks and Zip drives etc.)

#### **3.15 Components of a Computer**

Hardware, Software, Input, Output and Back-up devices, Systems and application software, Graphic User Interfaces, etc.

#### **3.16 Packages and application software**

Principles and introduction to the following applications:

3.16.1 i Word-processing: Microsoft word, WordPerfect.

ii Database: dBase Language, Oracle, dBase IV, Quickens,

iii Spreadsheets: Lotus 123, SuperCalc. 5, Excel, etc.

3.16.2 Graphics: Harvard Graphics, Lotus Freelance

3.16.3 Desktop publishing: Aldus Page Maker, Xerox Ventura

3.16.4 Integrated Packages: Enable, Ability Lotus 1-2-3, MS-Works, MS office (pro).

3.16.5 Computer Aided Design: Auto CAD, Generic CADD, Design -CAD, Con Draw, Auto Sketch.

3.16.6 OS Software: Master Bill, MB3, MB Lite, QS Cad, Estimator, Cost Planner CATO, Wessex system, OS scrip, OS Editor, Os Web.

3.16.7 Project: MS Project.

3.16.8 Management: Contract administration form for CAF GEN windows, M Project.

3.16.9 Current Development in Micro-Computing, current trends in hardware and software Technologies

#### **3.17 Development Economics**

Application and use of cost analyses and cost checking during design and construction stages.

3.17.1 Introduction to Commercial Economics

- 3.17.2 (a) Cost control and information technology.
- (b) Computer technology as a tool in cost management process.
- 3.17.3 Life cycle costing — Concept and time value of money. Taxation and life cycle costing. Cost capital allowances.
- 3.17.4 Sources of Finance, Investment Appraisal, Developers Budget. Cost Benefit Analyses.
- 3.17.5 Land use and value determinants — Town Planning Control and Development, Legal interest in property. Mortgages and Negotiable instruments and their implications to development costs and values.
- 3.17.6 Present and future payment concept and time value of money derived from first principles.
- 3.17.7 Maintenance and running cost; Life of building and components including errors of prediction.
- 3.17.8 Economics of Building Development
- 3.17.9 Land acquisition problems
- 3.17.10 Financial Considerations and Sources of development Finance.
- 3.17.11 Developer's Budget
- 3.17.12 Choice between building lease or purchase
- 3.17.13 Land use and value determinants
- 3.17.14 Factors determining land use and value
- 3.17.15 Town Planning Control and Development
- 3.17.16 Legal interest in property.
- 3.17.17 Land use planning

### **3.18 Value Engineering**

- 3.18.1 Definition
- 3.18.2 Basic requirements
- 3.18.3 Structure of a typical value Engineering team
- 3.18.4 Procedure or phases of Value Engineering Management - advantages and disadvantage
- 3.18.5 Value Management – advantages and disadvantages
- 3.18.6 Earned Value Management
- 3.18.7 Time Value Management

## **4.0 MEASUREMENT OF BUILDING WORKS (3HOUR PAPER)**

### **AIM:**

To broaden the scope of measurement and detailed description of construction components

### **LINKAGES:**

Construction Technology, Construction Management and Estimating

## **CONTENTS**

### **SECTION A -**

- The application of measurement principles
- The preparation of Bills of Quantities
- The purpose and uses of
- Preparation, editing and presentation of tendering and control information.
- Specification writing, details of items under preliminaries section of Bills of Quantities.

### **SECTION B -**

- Measurement of Building Works

### **SERVICES -**

- Application of engineering services works
- measurement of mechanical services
- measurement of electrical services
- measurement of communication, security & control services
- measurement of transportation systems

### **SECTION A (25%)**

- 1.1 The application of measurement principles to all forms of construction works in accordance with the latest edition of the Nigerian Standard Method of Measurement
- 1.2 The preparation of Bills of Quantities from dimension including an understanding of abstracting methods and the application of computer for data processing and production of documentation.
- 1.3 The purpose and uses of Trade bills, elemental bills, Operational bills and Approximate Bills of Quantities, Schedule of rate, Writing of preliminary and preamble items, the significance of standard phraseology in Bills of Quantities.
- 1.4 An understanding of the terms Prime Cost and Provisional Sums, Nominated Suppliers and Nominated Sub-contractors including the assessment of allowances for associated general items and profit.
- 1.5 Preparation, editing and presentation of tendering and control information.
- 1.6 Specification writing, details of items under preliminaries section of Bills of Quantities.

### **SECTION B (35%)**

#### **• Measurement of Building Works**

- 1.1 Site preparation and temporary works, underpinning, basements, foundations and substructures in level and uneven sites.
- 1.2 External and internal walling in concrete. Sandcrete blocks. Curtain walling or other similar systems, brick, blocks, face work in brick slips, stone and glass blocks.

- 1.3 Floors in steel, concrete or Timber.
- 1.4 Stairs and ramps in Timber, concrete and steel
- 1.5 Roofs in Timber, concrete and metal construction. Roof's coverings, roof linings and roof lighting.
- 1.6 Framed and unframed steel work and casings
- 1.7 In -situ concrete frames, pre-cast concrete components, pre-stressed concrete.
- 1.8 Proprietary cladding
- 1.9 Windows and doors in timbers and metal, associated openings including frames and accessories.
- 1.10 Fittings and Fixtures; Wardrobes, shelving, pelmets, Dado railings,
- 1.11 skirting, architraves, Linings, kitchen cabinets and workshops
- 1.12 Metal work generally; Burglary proofing Hand-railing, Embellishments, etc.
- 1.13 Internal and external finishes and decoration
- 1.14 Glazing work
- 1.15 External works, Roads and paving, swimming pools, Fountains, water features, sculptural works. Horticultural and landscaping works.
- 1.16 Spot items
- 1.17 Renovation, alteration, and demolition works.
- 1.18 Measurement and principles of rehabilitation works.

- **SERVICES (40%)**

**AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of mechanical and electrical services in Construction works. Importance should be attached to a systematic and logical approach of measurements and suitability descriptive statements. Candidates should be able to measure a prepare bills of quantities as well as carry out the pricing of works accordance with the Nigerian Standard Method of measurement Building works and services in the following areas.

- a) Water supply generally, hot and cold-water production a distribution pipe work and storage design.
- b) Planning sanitary accommodation, sanitary, plumbing CIJ appliances.
- c) Drainage and sewerage systems disposal and treatment plant.
- d) Heating and Ventilation systems, equipment, heat sources, fuel distribution and transmission media, heat emission fuels, thermal insulation, Natural and mechanical Ventilation, fans and equipment Choice of systems.
- e) Gas supply installation and distribution Equipment.
- f) Electrical services including installation, wiring in single phase installation, earthing and sub-circuits.
- g) Electrical fittings, equipment and control gear (H) Artificial lighting layouts.

## **SECTION A:**

### **1..1 APPLICATION OF ENGINEERING SERVICES WORKS**

- 1..1.1 The application of measurement principles to all forms of Engineering Services works in accordance with the current latest edition of the Building & Engineering Standard Method of Measurement (BESMM).
- 1..1.2 The purpose and uses of: Trade bills, Elemental bills, Operational bills and Approximate Bills of Quantities, Schedule of Rates, Development and application of Preliminaries/General Items (Conditions), the significance/application of standard phraseology in Bills of Quantities.
- 1..1.3 An understanding of the terms Prime Cost and Provisional Sums, Nominated Suppliers and Nominated Sub-contractors including the assessment of allowances for associated general attendance items and profit.
- 1..1.4 The preparation of Bills of Quantities from dimensions and the application of standard phraseologies and developing a phraseology library for the production of documentation.
- 1..1.5 Preparation, editing and presentation of tendering and control information,
- 1..1.6 Specification writing, understanding details of items under the preliminaries section of the Bills of Quantities. Computer aided measurements and tender
- 1..1.7 Understanding and use of different software and packages available for pre- contract documentations

*Measurement shall be in accordance with latest BESMM 4R for industrial engineering.*

## **SECTIONB:**

### **1.2 MEASUREMENT OF MECHANICAL SERVICES**

#### **AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of mechanical services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of pipelines/duct lines, pipeline/duct line ancillaries and pipeline/duct line control equipment across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carryout the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 1..2.1 Furniture, Fittings, Equipment and Appliances, Kitchen/Catering equipment,



- sanitary fittings and appliances.
- 1..2.2 Rainwater installations, Drainage and sewerage systems disposal and treatment plant, sanitary installation, industrial waste drainage, etc.
- 1..2.3 Hot and cold water supply and distribution pipe work and storage, Boreholes and water treatment systems, Gas supply installation and distribution, fuel oil storage/ distribution installation.
- 1..2.4 Fire-fighting equipment, inlets and appliances, fire hose reel system, dry/wet riser systems, sprinkler system, fire hydrant installations, CO<sub>2</sub> system, foam fire-fighting installations.
- 1..2.5 Chilled water systems, central refrigeration plant.
- 1..2.6 Ventilation Systems: Air handling installations–Ventilation supply and extract equipment, supply and extract duct lines and pipelines with associated fittings, general ventilation installation, toilet ventilation installation, kitchen ventilation installation.
- 1..2.7 Air-Conditioning Systems: Air-conditioning systems–VAV air-conditioning, Dual-duct air-conditioning, Multi-zone air-conditioning, Fan-coil air-conditioning, and air-conditioning units (room/window/split units and central packaged systems) including duct works and associated pipe works and fittings.
- 1..2.8 Insulation, Fire Stopping and Fire Protection systems
- 1..2.9 Builder’s work associated with mechanical services installations

### 1.3 SECTION C: MEASUREMENT OF ELECTRICAL SERVICES

#### AIM:

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of electrical services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carryout the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 1..3.1 HV/LV Supply/Public Utility/Distribution. Incoming services up to but excluding main medium voltage switch-gear
- 1..3.2 Electricity Generation Plant (Stand by equipment)
- 1..3.3 General Lighting and LV Power installation
- 1..3.4 Uninterruptible Power Supply
- 1..3.5 Emergency Lighting installation
- 1..3.6 Street/Area/Flood lighting installation
- 1..3.7 Earthing system installation
- 1..3.8 Lightning Protection installation
- 1..3.9 Insulation, Fire stopping and Fire Protection systems
- 1..3.10 Conduits, Trunking and cable trays

- 1..3.11 Cables and wires
- 1..3.12 Builder's work associated with electrical installations, including excavating cable trenches, concrete plinths, etc.

#### 1..4 **SECTION D: MEASUREMENT OF COMMUNICATION, SECURITY & CONTROL SERVICES**

**AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of control and technology services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carry out the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 1..4.1 Telecommunications, Public Address/Conference Audio facilities
- 1..4.2 Radio/TV/CCTV installation systems
- 1..4.3 Data Transmission installation systems
- 1..4.4 Access Control Systems
- 1..4.5 Security Detection & Alarm System installations
- 1..4.6 Fire Detection & Alarm System installations
- 1..4.7 Central Control/Building Management System installations
- 1..4.8 Conduits, Trunking and cable trays
- 1..4.9 Cables and wires
- 1..4.10 Insulation, Fire Stopping and Fire Protection systems
- 1..4.11 Builder's work associated with control and technology installations, including excavating cable trenches, concrete plinths, etc.

#### 1..5 **SECTION E: MEASUREMENT OF TRANSPORTATION SYSTEMS**

**AIM:**

Candidates are required to demonstrate a clear understanding of the basic principles of planning, design and installation of transportation system services in construction works. Importance should be attached to a systematic and logical approach of measurement and suitability of descriptive statements. Candidates are expected to understand the application of control equipment and conduit/cables/trunking across the following installations. Candidates should be able to measure and prepare bills of quantities as well as carry out the pricing of works in accordance with the current edition of the Building & Engineering Standard Method of Measurement (BESMM) in the following areas:

- 1..5.1 Lifts
- 1..5.2 Escalators

- 1..5.3 Moving Pavements
- 1..5.4 Powered Stair lifts
- 1..5.5 Hoists
- 1..5.6 Travelling Cradles
- 1..5.7 Conveyors
- 1..5.8 Builder's work associated with transportation systems installations

*Measurement shall be in accordance with latest BESMM 4R for industrial engineering.*

## **5.0 MEASUREMENT OF CIVIL AND HEAVY ENGINEERING WORKS (3 HOUR PAPER)**

### **AIM:**

To provide a **general** knowledge on the scope of measurement and detailed description of civil and heavy engineering construction components. To equip candidates with general civil engineering construction technology details to enable them measure and provide cost advice to clients.

### **CONTENT**

#### **CIVIL WORKS**

#### **HEAVY & INDUSTRIAL ENGINEERING**

- Scope of Heavy Engineering
- Measurement and Control of engineering projects

#### **5.1.1 CIVIL WORKS (30%)**

##### **5.1.1.1 Scope of Engineering works and Method of Measurement**

- a) Site investigation, classification of rocks and soils, procedure of investigation, preliminary works, methods of site exploration, testing generally, Geophysical surveys and other techniques, special information and costs
- b) Site organization and temporary services, demolition, site offices and general accommodation, material storage and compounds, Temporary services, setting out and safety.

##### **5.1.1.2 Soil Stabilization systems: Pilling, Diaphragm and Retaining wall systems. Sheet pilling, bearing piles, Bored piles, cast-in-place piles, preformed piles, vibrio-floatation and vibrio-replacement, diaphragm walling, retaining walls.**

- a) General principles of Civil Engineering measurements, works classification, coding and numbering of items Preparation of Bills of Quantities.
- b) Principles of Method related charges
- c) Management of plant and Machinery

- 5.1.1.3 Tunneling and underpinning: General considerations, methods of tunneling and underpinning, ventilation and lighting, safety aspects.
- 5.1.1.4 Marine works
- 5.1.1.5 Cofferdams, caissons, underwater foundation construction, sea walls, Docks, jetties and other marine structures, Dredging and Reclamations, canal and River works, Reservoirs and liquid-retaining tanks.
- 5.1.1.6 Road works, Bridges, Subways and Airfield Construction
- 5.1.1.7 Railway track Work

## **5.1.2 HEAVY & INDUSTRIAL ENGINEERING**

### **5.1.2.1 Scope of Heavy Engineering**

Definition of Heavy Engineering, Principles and constituents of heavy engineering equipment, facilities, structures and raw materials for: Pharmaceutical Chemicals, Nuclear Energy, Gas Exploration & Production.

Facilities for Oil exploration, production and petroleum refining, power generation, food and drinks, paper milling, steel and non-ferrous metal production, telecommunication, data communication etc.

### **5.1.2.2 Measurement and Control of engineering projects**

Taking off quantities, preparation of bid documents and negotiation of Work packages of all the followings;

- a) Construction site services
- b) Scaffolding
- c) Steelwork
- d) Plant
- e) Pipework
- f) Electrical Work
- g) Instrumentation
- h) Insulation
- i) Protective coverings
- j) Sundry items

***Measurement shall be in accordance with latest BESMM 4R for industrial engineering.***