Professional Architecture Exam

Study Guide

Education and Training Evaluation Commission (ETEC)
National Center for Assessment (NCA)

www.etec.gov.sa

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1. Aim:

The objective of this Instruction Manual is to provide guidelines for the NCA proposed Professional Architecture Exam. These guidelines cover the eligibility conditions, the grading and passing conditions, the structure of the exam and the distribution of exam questions among various areas. In essence, this Instruction Manual represents a "bridge" between the developed exam standards and the actual phrased questions. It is designed to help item writers prepare questions for the Architecture Discipline Exam as well as a study guide for examinees.

2. Exam Structure:

2.1 Exam Type

The exam is initially paper-based with questions being a combination of multiple- choice questions (MCQ) and essays.

2.2 Exam Organization

The exam will be conducted in two sessions during one day. The duration of the first session is 2.5 hours while the second section is 4 hours long. There is one-hour break between the two sessions.

2.2.1. Session #1

The first session is the common part to be taken by all the examinees from all disciplines. This part includes seven topics: (Ethics – Professionalism - Laws for Professional Practice, Professional Laws and Regulations - Environment and Natural Resources - Engineering Management - Engineering Economics - Health, Safety and Security (HSS)).

The total duration of this session is 2.5 hours and the total number of questions is 30 MCQ and 2 essays.

2.2.2. Session #2

The second session is the Discipline Part. The following Engineering disciplines along with Architecture are considered:

Code	Discipline
STE	Structural Engineering
GTE	Geotechnical Engineering
TRE	Transportation Engineering
WREE	Water Resources and Environmental Engineering
PE	Power Engineering
HVAC	Heating, Ventilation, and Air Conditioning (HVAC) and Refrigeration Engineering
TFSE	Thermal and Fluids Systems Engineering
CHE	Chemical Engineering
FPE	Fire Protection Engineering
ARCH	Architecture

The total duration of the Architectural Exam Session is 4 hours and the total number of questions is 30 MCQs and 4 essays. The examinee must answer all the MCQs and two essays out of four.

2.3 Eligibility for the Exam

The eligibility to register for the exam is according to the Saudi Council of Engineers (SCE) regulations.

2.4 Grades

Each part (common part and discipline part) carries a total grade of 100. The MCQs carry a total grade of 60% while the essays carry a total grade of 40%. Each MCQ has 4 choices for the answer. There is no negative marking for wrong answers.

2.5 Passing Rules

- The eligible candidate must take in his/her first sitting the two exam parts (common part and discipline part).
- In order to pass the exam, the candidate must obtain a grade of 60% or above in each part of the exam.
- If the candidate fails both parts of the exam (by receiving in each part a grade less than 60%), he/she can take the two parts of the exam but only when one full year has passed.
- If the candidate fails only one part of the exam (common part or discipline part), he/she must repeat only the part he/she failed, but he/she must pass this part within one year.
- If a year passed and the candidate did not succeed in passing the part he/she failed, then he/she has to take both parts of the exam.

2.6 Exam Rules

- No printed or electronic material is allowed during the exam. All necessary reference materials will be provided by NCA
- Calculators approved by NCA are allowed.
- Comprehensive exam rules will be provided by the examination authority, NCA, in a separate manual.

3. Table of Specifications for Professional Architecture Exam:

Standard Code	Area	Percentage of Exam (%)	Number of Questions (MCQ) Each MCQ is for 2 marks	Essay Questions
ARCH-T1	Programming	10	3	2
ARCH-T2	Site Analysis	3	1	
ARCH-T3	Schematic Design	10	3	
ARCH-T4	Engineering System Coordination	10	3	
ARCH-T5	Building Cost Analysis	10	3	
ARCH-T6	Code Research	7	2	
ARCH-T7	Design Development	13	4	
ARCH-T8	Construction Documents	3	1	
ARCH-T9	Specifications and Materials Research	7	2	
ARCH-T10	Document Checking and Coordination	3	1	
ARCH-T11	Bidding and Contracts	10	3	2
ARCH-T12	Construction Phase – Office	7	2	
ARCH-T13	Construction Phase – Site	7	2	
	Total	100	30	Answer Any 2 Out of 4

4. Standards for Architecture:

ARCH-T1	Programming.
ARCH-T2	Site Analysis.
ARCH-T3	Schematic Design.
ARCH-T4	Engineering System Coordination.
ARCH-T5	Building Cost Analysis.
ARCH-T6	Code Research.
ARCH-T7	Design Development.
ARCH-T8	Construction Documents.
ARCH-T9	Specifications and Materials Research.
ARCH-T10	Document Checking and Coordination.
ARCH-T11	Bidding and Contracts.
ARCH-T12	Construction Phase – Office.
ARCH-T13	Construction Phase – Site.

These topics are taught in Architecture schools worldwide and Architects rely on them in their practice. Each Topic is composed of a number of Indicators.

Architects are expected to possess and demonstrate command of the following Architectural Standards based on the core Topics of the discipline.

ARCH-T1: Programming

A professional architect should be able to develop an architectural program; analyze the requirements of the building type, the owner and the users using research methods; and analyze functional and spatial relationships.

Ultimately, a professional architect should be able to produce and present an architectural program or a brief for a given project.

ARCH-T1 Indicators

ARCH-T1-1	Apply architectural research methodology for collecting data/requirements from the clients and users including interviews/meetings, questionnaires, briefs, literature review, user participation techniques and analysis of case study and precedents.

ARCH-T1-2 Develop architectural program or brief for a project integrating all project requirements.

ARCH-T1-3 Assess project requirements considering the social, environmental, and economical aspects.

ARCH-T1-4 Appraise site-specific environmental opportunities.

ARCH-T1-5 Evaluate relevant quantitative and qualitative programmatic attributes of an existing or a new building.

ARCH-T1-6 Collect data for the program by evaluating analyses, assessments, reports, and documentation.

ARCH-T1-7 Analyze functional and spatial relationships of building components.

ARCH-T1-8 Propose a preliminary project schedule and assess a budget.

ARCH-T1-9 Analyze and present a building program graphically.

ARCH-T2 Site Analysis

A professional architect should be able to analyze a site for its suitability for a certain project, suggest a suitable land use strategy, understand site-specific constrains, understand the surrounding infrastructure, urban design, land planning and environmental assessment and develop an environmental impact study of the construction on the surrounding.

Ultimately, a professional architect should be able to integrate site and environmental analysis into other reports like the architectural program report.

ARCH-T2 Indicators

ARCH-T2-1 Analyze more than one site and choose the most appropriate one for a project based on criteria.

ARCH-T2-2 Analyze the suitability of a site for a certain project.

ARCH-T2-3 Formulate a suitable land use and zoning strategy based on criteria.

ARCH-T2-4 Analyze restrictions of a site including zoning, utilities, easements, etc.

ARCH-T2-5 Appraise site-specific constraints of the environment.

ARCH-T2-6 Conclude best possible use of onsite resources by consolidated sustainability principles.

ARCH-T2-7 Identify related code requirements for site and building types.

ARCH-T2-8 Identify related land use and zoning requirements.

ARCH-T2-9 Identify related site-specific and local requirements.

ARCH-T2-10 Assess site properties in quality and quantity for a certain program.

ARCH-T2-11 Integrate site analysis within other reports such as the program report.

ARCH-T2-12 Study graphical representations regarding site programming and site analysis.

ARCH-T3 Schematic Design

A professional architect should be able to develop an architectural concept and schematic designs for a project; consider the requirements of the building type, the owner and the users; and consider functional and spatial relationships.

Ultimately, a professional architect should be able to objectively choose from the design alternatives and produce and present an architectural schematic design in line with the program or brief for a given project.

ARCH-T3 Indicators

ARCH-T3-1 Develop concepts of preliminary designs to realize cultural, spatial and functional relationships in the program.

ARCH-T3-2 Develop program requirements with the input from consultants.

ARCH-T3-3 Prepare presentation models, animations and drawings.

ARCH-T3-4 Select engineering and construction systems based on criteria.

ARCH-T3-5 Assess design alternatives based on the criteria of the program.

ARCH-T3-6 Assess design alternatives according to the criteria of the environment, society, and the client.

ARCH-T3-7 Choose the appropriate material according to the regulations and the goals of the project.

ARCH-T3-8 Incorporate information and technical knowledge in the development of a design.

ARCH-T3-9 Decide where the building should be located on the site according to site analysis and decide on site modifications.

ARCH-T3-10 Plan sustainable measures that could be implemented into the proposed design.

ARCH-T3-11 Analyze the effect of the surrounding context on the design.

ARCH-T3-12 Design site and building according to zoning and environmental codes.

ARCH-T3-13 Integrate systems into project design.

ARCH-T3-14 Design according to program requirements.

ARCH-T3-15 Design according to contextual and environmental conditions.

ARCH-T4 Engineering System Coordination

A professional architect should be able to research and select engineering and building systems and revise their suitability and performance for a given project.

Ultimately, a professional architect should be able to coordinate between engineering and building systems and architectural designs for a given project taking into consideration the requirements of the program.

ARCH-T4 Indicators

ARCH-T4-1 Research and select electrical, plumbing, and mechanical systems for a project based on criteria.

ARCH-T4-2 Research and select structural systems for a project based on criteria.

ARCH-T4-3 Research and select special systems for a project based on criteria (this may include smart control systems, communications, acoustics, lighting, conveying, security, and fire control and suppression systems).

ARCH-T4-4 Research and select assemblies and materials for a project based on criteria like the budget, the program, and regulations.

ARCH-T4-5 Revise the performance of engineering and building systems.

ARCH-T4-6 Revise construction materials and methods.

ARCH-T4-7 Revise safety requirements.

ARCH-T4-8 Coordinate architectural construction documents with engineering systems documents.

ARCH-T4-9 Coordinate engineering systems documents with each other to detect conflicts.

ARCH-T4-10 Coordinate systems first operation and maintenance meetings for acceptance by the client and the start of usage.

ARCH-T4-11 Review catalogs of engineering systems to make sure they fit the requirements.

ARCH-T4-12 Check the contractor-submitted warranties for compliance with contract terms.

ARCH-T5 Building Cost Analysis

A professional architect should be able to prepare a schedule of volumes and areas of project components, estimate the quantities of a certain material and compare the cost of different materials options, all while considering the guidelines in the Saudi General Specifications for Building Construction.

Ultimately, a professional architect should be able to estimate, analyze and survey cost for project stages.

ARCH-T5 Indicators

ARCH-T5-1 Compose a schedule of volumes and areas of the project in preparation for cost estimation.

ARCH-T5-2 Estimate quantities of certain materials to compare cost of material options.

ARCH-T5-3 Estimate cost of project stages.

ARCH-T5-4 Review references such as the Saudi General Specifications for Building Construction for guidelines about quantities and cost estimation.

ARCH-T5-5 Prepare project cost analysis.

ARCH-T5-6 Survey current project cost.

ARCH-T5-7 Consider cost estimates through the design phase.

ARCH-T6 Code Research

A professional architect should be able to research, estimate requirements and comply with regulations and codes for a certain project.

Ultimately, a professional architect should be able to comply with policies and procedures for obtaining and maintaining permits for a project or variance.

ARCH-T6 Indicators

ARCH-T6-1 Research regulations and codes for a certain project.

ARCH-T6-2 Estimate code requirements for a project, e.g. stairs, exits, ramps, public toilets.

ARCH-T6-3 Calculate project footprint and maximum built up area based on zoning and regulations.

ARCH-T6-4 Apply different building codes in the design of a project.

ARCH-T6-5 Research and comply with procedures for obtaining permits of a project including alterations.

ARCH-T7 Design Development

A professional architect should be able to develop the schematic design into complete design solutions including the related specification outline and schedules of finishes, materials, fixtures and fixed equipment. This also includes sizing and coordination of engineering and building systems based on design decisions and assessing the constructability of construction documents.

Ultimately, a professional architect should be able to develop design development drawings from schematic designs of a project in line with its program or brief.

ARCH-T7 Indicators

ARCH-T7-1 Develop schematic designs into design development drawings.

ARCH-T7-2 Develop specification outline and schedules for finishes, materials, fixtures and fixed equipment.

ARCH-T7-3 Coordinate project proposed engineering and building systems.

ARCH-T7-4 Assess the constructability of project documents.

ARCH-T7-5 Enhance a design by integrating materials, technical knowledge and building systems.

ARCH-T7-6 Analyze architectural technologies and systems incorporation to satisfy project goals.

ARCH-T7-7 Consider proper sizing of structural and building systems e.g. plumbing, electrical, and mechanical, and their components in order to satisfy the project goals.

ARCH-T7-8 Develop designs that incorporate systems such as lighting, acoustics, conveying, fire suppression, communications and security.

ARCH-T7-9 Detail the integration of technologies and building systems.

ARCH-T7-10 Synchronize building systems and technologies.

ARCH-T8 Construction Documents

A professional architect should be able to develop construction documents including the related specification outline and schedules of finishes, materials, fixtures and fixed equipment. This also includes sizing and coordinating engineering and building systems; developing construction documents based on design decisions and assessing the constructability of construction documents.

Ultimately, a professional architect should be able to develop detailed, clear and complete set of drawings and construction documents from design development drawings for a project in line with its program or brief.

ARCH-T8 Indicators

ARCH-T8-1 Develop detailed, clear and complete set of drawings and construction documents.

ARCH-T8-2 Coordinate architectural documents with that produced by engineering consultants.

ARCH-T8-3 Understand the liabilities and responsibilities related with developing construction documents.

ARCH-T8-4 Manage construction documents development.

ARCH-T8-5 Decide on the appropriate building design documentation.

ARCH-T8-6 Decide on the appropriate site features documentation.

ARCH-T8-7 Decide on the appropriate detailed building drawings documentation.

ARCH-T8-8 Use standards in the development of construction documents.

ARCH-T8-9 Study documentation changes resulting from changes to the project.

ARCH-T8-10 Manage the communication of changes to the team and the owner.

ARCH-T9 Specifications and Materials Research

A professional architect should be able to research and assess the suitability of products and materials and determine the workmanship standards and methods of construction.

Ultimately, a professional architect should be able to write and maintain project specifications after deciding on necessary components.

ARCH-T9 Indicators

ARCH-T9-1 Review general and detailed construction specifications.

ARCH-T9-2 Research products and materials for consideration in a project.

ARCH-T9-3 Assess candidate products based on criteria like cost, availability, manufacturer reliability and code and specifications compliance.

ARCH-T9-4 Research a class of products for guidelines and standards.

ARCH-T9-5 Study workmanship standards and systems and methods of construction.

ARCH-T9-6 Assess the adoption of sections of standard forms of specifications (e.g. master specifications) in a project.

ARCH-T9-7 Write and maintain project specifications after deciding on necessary components.

ARCH-T10 Document Checking and Coordination

A professional architect should be able to cross check material and products with specifications; and drawings of different disciplines with each other.

Ultimately, a professional architect should be able to revise the completeness, accuracy and coordination of drawings and construction documents of a project.

ARCH-T10 Indicators

ARCH-T10-1 Cross-check specifications of a project with materials and products described in its working drawings.

ARCH-T10-2 Review the completeness and accuracy of drawings prepared by others.

ARCH-T10-3 Develop a coordination time schedule with other disciplines.

ARCH-T10-4 Cross-check drawings of different disciplines with architectural drawings and with each other to detect clashes and collisions.

ARCH-T10-5 Review a project documents for conformance with regulations and codes.

ARCH-T10-6 Assess constructions cost to check conformity with the design of the project.

ARCH-T11 Bidding and Contracts

A professional architect should be able to revise, interpret and assess the suitability of various agreements and abide to them; realize construction contract types, manage contract addenda; manage risk; manage bidding and procurement procedures; manage a project according to a given contract; assess payments and consequences of delays; manage resolution of disputes; and interpret contractual roles and responsibilities.

Ultimately, a professional architect should be able to manage bidding and contracts to deliver the project with minimal conflicts and best results.

ARCH-T11 Indicators

ARCH-T11-1 Interpret key owner and contractor agreement elements.

ARCH-T11-2 Interpret key owner and consultant (engineer) agreement elements.

ARCH-T11-3 Assess and revise contracts of professional services.

ARCH-T11-4 Assess and revise professional services compensation structure.

ARCH-T11-5 Assess professional relations with consultants based on contracts.

ARCH-T11-6 Assess contractual legal responsibilities, liabilities and restrictions.

ARCH-T11-7 Assess legislative, moral and contract related standards in the execution of architectural jobs and tasks.

ARCH-T11-8 Analyze suitability of contract forms and articulation methods.

ARCH-T11-9 Evaluate consequences of delayed works.

ARCH-T11-10 Manage bidding and procurement with standard governmental contracts.

ARCH-T11-11 Manage projects under standard consultancy contracts for design.

ARCH-T11-12 Manage projects under standard consultancy contracts for site supervision.

ARCH-T11-13 Manage projects under standard international contracts forms e.g. FIDIC, JCT and NEC.

ARCH-T11-14 Assess contractor insurance documents and procedures.

ARCH-T11-15 Assess nominated subcontractors' awards.

ARCH-T11-16 Assess "progress payments".

ARCH-T11-17 Assess conditions of certification.

ARCH-T11-18 Manage Architect's instruction and variations and its contractual consequences.

ARCH-T11-19 Assess Liquidated Ascertained Damages/Extension of Time.

ARCH-T11-20 Manage resolution of dispute: mediation, adjudication, arbitration, litigation.

ARCH-T11-21 Assess building procurement systems: traditional system, design and build, turnkey and construction management.

ARCH-T11-22 Understand risk management from problems encountered in previous projects, their reasons and how they were solved.

ARCH-T11-23 Manage bidders' prequalification.

ARCH-T11-24 Mange the bidding and awarding phases.

ARCH-T11-25 Assess and analyze bids (including discounted, alternative and unit price).

ARCH-T11-26 Research required submittals for the owner to issue "notice of proceed" (NOP) addressing the contractor and stating the date he can begin project work.

ARCH-T11-27 Evaluate supplemental data to be added to the contract as addenda.

ARCH-T11-28 Understand and research with suppliers and contractors their problems with contract documents and bid packages.

ARCH-T11-29 Interpret the role and responsibilities of the Architect during preconstruction process based on delivery method.

ARCH-T11-30 Analyze criteria to differentiate between contractors in order to choose the best.

ARCH-T11-31 Adjust project costs based on assessment of aspects of the design or contract.

ARCH-T11-32 Analyze and review bidding forms and conditions (special and supplementary).

ARCH-T12 Construction Phase – Office

A professional architect should be able to manage office tasks related to the construction phase, to manage change orders and payments, to review submitted material samples, to revise shop drawings, to settle conflicts and interpret contract documents.

Ultimately, a professional architect should be able to manage office tasks of the construction phase promptly and accurately to keep construction running smoothly.

ARCH-T12 Indicators

ARCH-T12-1 Review or prepare "applications for payments" and process "certificates for payment".

ARCH-T12-2 Assess submitted samples based on criteria of specifications and design.

ARCH-T12-3 Review shop drawings for compliance with designs.

ARCH-T12-4 Maintain records of construction phase.

ARCH-T12-5 Interpret construction documents, issue additional instructions and prepare or respond to "requests for information" (RFI or R.R.).

ARCH-T12-6 Evaluate "requests for changes" and prepare "change orders".

ARCH-T12-7 Interpret conflicts related to contract documents to resolve disputes.

ARCH-T12-8 Understand contractors, architects and clients' legal obligations.

ARCH-T12-9 Review "as-built-drawings" (record drawings) at the completion of the works.

ARCH-T12-10 Provide professional services during construction process of the project.

ARCH-T12-11 Interpret specifications and project documents to convey design goals.

ARCH-T12-12 Coordinate construction activities to satisfy design intent.

ARCH-T12-13 Appraise completed projects.

ARCH-T12-14 Evaluate the role of the architect during construction activities.

ARCH-T12-15 Assess construction compliance with codes, regulations, requirements for sustainability and contract documents.

ARCH-T12-16 Assess the progress of the project construction.

ARCH-T12-17 Examine extra information for suitability to supplement contract documents.

ARCH-T12-18 Assess submissions including samples, results of testing, product data, shop drawings, and mock-ups.

ARCH-T12-19 Assess an "application for payment" submitted by the contractor.

ARCH-T12-20 Assess responses to non - compliance with contract documents.

ARCH-T12-21 Perform "close-out activities" by applying procedural concepts.

ARCH-T12-22 Assess completed projects using "post-occupancy evaluation" techniques.

ARCH-T12-23 Assess building design and the associated performance.

ARCH-T12-24 Review shop drawings.

ARCH-T12-25 Evaluate samples according to specifications.

ARCH-T12-26 Document completed project for future use.

ARCH-T13 Construction Phase – Site

A professional architect should be able to observe the ongoing field work and manage site tasks of the construction phase according to contractual responsibilities. This involves monitoring ongoing works, managing change orders, payments, time schedules, stored materials, shop drawings, settling conflicts, interpreting contract documents and producing reports and documentation.

Ultimately, a professional architect should be able to manage site tasks of the construction phase promptly, accurately and in a well-documented manner to keep construction running and ending smoothly.

ARCH-T13 Indicators

ARCH-T13-1 Observe the ongoing work, stored materials and review progress schedule to compose relevant "construction reports" (field reports).

ARCH-T13-2 Review charts illustrating project progress through time (e.g. PERT schedule or Gantt chart).

ARCH-T13-3 Understand contractual responsibilities in connection with construction observation.

ARCH-T13-4 Document all agreed actions in job-site meetings.

ARCH-T13-5 Verify "deficiency list" (inspection or punch list) that result from a "substantial completion" review.

ARCH-T13-6 Review the work for "final acceptance" with the owner and stakeholders.

ARCH-T13-7 Issue "field orders" for clarifications and minor changes of the work.

ARCH-T13-8 Maintain project records including "daily construction reports", "record documents" and "as-built drawings".

ARCH-T13-9 Monitor the integration of engineering systems, details of construction and requirements of spaces.

ARCH-T13-10 Promote Health & Safety policy on site.

ARCH-T13-11 Manage Competing Interests of stakeholders including local Government officials.

ARCH-T13-12 Apply Dispute Resolution Methods, and Disputes Prevention.

ARCH-T13-13 Identify base line KPIs (scope, schedule and cost) to determine if the project is On Track.

ARCH-T13-14 Identify stakeholders of the project.

ARCH-T13-15 Establish Communication Protocol of stakeholders.

ARCH-T13-16 Establish roles and responsibilities matrix.

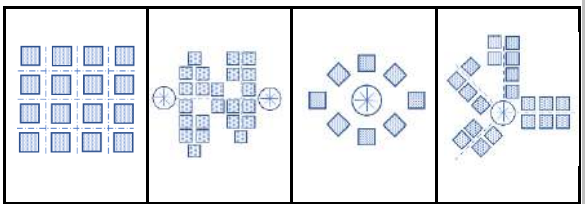
ARCH-T13-17 Define Scope briefly to team members.

ARCH-T13-18 Manage, organize and head meetings including ad hoc meetings for specific matters.

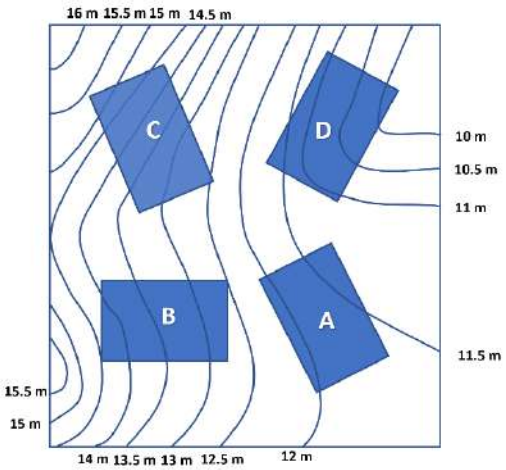
ARCH-T13-19 Maintain Close Out documentation of a Project.

ARCH-T13-20 Coordinate with various local authorities.

5. Sample Questions Table

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
1	Programming	ARCH-T1	If the area breakdown of an office building is as follows: Structural area = 1000m2 Building services area = 500m2 Circulation area = 2500m2 Mechanical area = 1000m2 Office spaces area = 5000m2 What is the Net Usable Area? (a) 9000m2 (b) 5000m2 (c) 7500m2 (d) 5500m2	a	5.0 - 6.0	None
2	Site Analysis	ARCH-T2	You have a project of a home for the elderly (a retirement home). The owner asked you to choose a suitable land from several available. The following land options were presented, which one should you choose? (a) A land beside a school, a nursery and a shopping mall. (b) A land beside a gas station, a car agency and a wholesale marketplace. (c) A land beside a mosque, a hospital and a park. (d) A land beside an airport, a business park and a parking garage.	c	5.0 - 6.0	None
3	Schematic Design	ARCH-T3	You have a project of a clinic which is comprised of numerous departments, each of which is predicted to grow yet at various paces. Which of the following organizational concept would be the least practical and cost-effective for such a building?  (a) Grid (b) Axial (c) Central (d) Radial (a) Grid (b) Axial (c) Central (d) Radial	a	5.0 - 6.0	None

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
4	Programming	ARCH-T1	Following is a summarized translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia: 1 Requirements for the establishment of private schools on vacant lands (not allocated for an educational facility) 1-1 The site should be on two streets, one commercial not less than 20 meters wide 1-2 The site should be away from the intersections of the main commercial streets with a distance not less than 50 m. 1-3 The distance between the site and the nearest gas station shall not be less than 20 m. 1-4 The distance between the site and liquefied petroleum gas shops shall not be less than 50 m. 1-5 Taking the approval of the educational authority and the planning authority of the municipality on the site of the project. 1-6 The land area of an educational establishment shall not be less than the following: 1-6-1 Kindergartens 900 m2. 1-6-2 Primary schools: 2500 m2. 1-6-3 Intermediate schools 3500 m2. 1-6-4 Secondary schools 5000 m2. 1-6-5 Complex schools (kindergartens - primary - intermediate - secondary) 7500 m2. 1-7 The distance between an existing educational facility and another at the same school stage should not be less than the following: 1-7-1 300 meters for kindergartens and nurseries. 1-7-2 500 meters for primary schools. 1-7-3 1000 meters for intermediate schools. 1-7-4 2000 meters for secondary schools. 1-8 Parking spaces shall be provided according to the following rates: 1-8-1 One parking space for each nursery class + kindergarten. 1-8-2 Two parking spaces for each primary school class. 1-8-3 Three parking spaces for each intermediate school class. 1-8-4 Five parking spaces for each secondary class.	b	5.0 – 6.0	a summarized translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia (quoted with the question)

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
			You are planning for a high standard private school complex with 12 primary school classes, 10 intermediate school classes and 8 secondary classes. The classes run simultaneously, and the car parking will be perpendicular to the curb with one way circulation and parking is on both sides of the circulation. What is a reasonable assessment of the total parking area required for the school complex according to the translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia, presented above? A) 6300 m^2 B) 3100 m^2 C) 1690 m^2 D) 1410 m^2			
5	Site Analysis	ARCH-T2	You have a project in which there is a one-story building on a contoured site. The figure shows different potential locations for the one-story building on the given site along with the site contours. Taking into consideration the amount of grading to provide suitable level pad for the building, and the grading required to establish good drainage away from the building, which of the following locations would offer the greatest construction cost saving? 	a	5.0 – 6.0	None

<table>
<tr><th>Q. No.</th><th>Major Area</th><th>Code</th><th>Question Statement
(Answer's Choices)</th><th>Key
Answer</th><th>Expected Time (min.)</th><th>Supplied Reference</th></tr>
<tr><td></td><td></td><td></td><td>A) Location A
B) Location B
C) Location C
D) Location D</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Code Research</td><td>ARCH-T6</td><td>In a project of a restaurant on a hotel's ground floor, it is required to calculate the total occupancy load, based on the table shown which includes the requirements for occupancy loads.
The project includes a dining area of 325 m^2, a kitchen of 93 m^2, and a lounge area of 112 m^2.
What is the total occupancy load?

<table><tr><th></th><th>Use</th><th>Occupant load factor (m^2/occupant)</th></tr><tr><td>1</td><td>Assembly areas, concentrated use (without fixed seats)
Dance floors
Lodge rooms
Auditoriums</td><td>0.65</td></tr><tr><td>2</td><td>Assembly areas, less-concentrated use
Conference rooms
Dining rooms
Exhibit rooms
Lounges
Stages</td><td>1.4</td></tr><tr><td>3</td><td>Hotels and apartments</td><td>18.6</td></tr><tr><td>4</td><td>Kitchens-commercial</td><td>18.6</td></tr><tr><td>5</td><td>Offices</td><td>9.3</td></tr><tr><td>6</td><td>Stores, ground floor</td><td>2.8</td></tr></table>
a) 282 occupants
b) 286 occupants
c) 305 occupants
d) 317 occupants</td><td>d</td><td>5.0 – 6.0</td><td>None</td></tr>
</table>

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
7	**Design Development**	ARCH-T7	Which of the following is the most effective approach that an architect could implement to the site of a health care facility to reduce noise from an adjacent highway? (a) Create a 30 m buffer zone planted with evergreen trees. (b) Construct a 1.2 m masonry wall next to the highway. (c) Plant deciduous trees 30 m deep between the building and the highway. (d) Locate the building 30 m away from the highway.	a	5.0 – 6.0	None
8	**Specifications and Materials Research**	ARCH-T9	A company is considering cutting operating expenses by replacing its air conditioning system. The cost of the new system is expected to be 60000 Saudi Riyals which will save the company 500 Saudi Riyals per month. What is the approximate simple payback period of their investment in years? A) 2 years B) 5 years C) 8 years D) 10 years	d	5.0 – 6.0	None
9	**Bidding and Contracts**	ARCH-T11	The effects of the Practical (Substantial) Completion Certificate do NOT include: (a) The contractor no longer possesses the site exclusively (b) Releasing all the retention due to the contractor (c) The contractor starts to rectify the issues in the Deficiency List (Inspection or Punch List) (d) Beginning of Defects Liability Period (1 year)	b	5.0 – 6.0	None
10	**Construction Phase – Office**	ARCH-T12	Following is a summarized translation of a part of the Public Works Contract Form of the Ministry of Finance, Kingdom of Saudi Arabia: Article 39: Delay Penalty If the Contractor fails to complete the work and deliver it in full on the specified dates and the Employer does not see a reason to withdraw the work from him, the Contractor shall commit to pay a fine for the period of	b	7.0 – 10.0	A translation of a part of the "Public Works Contract Form" of the

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
			delay in work completion after the predetermined date for delivery which shall be calculated on the basis of the average daily cost of the project by dividing the Contract value on its term as follows: A. A fine on the first part of the delay period, equivalent to one quarter of the average daily cost for each day of delay until the greatest of both the following periods is reached: fifteen days or 5% of the Contract term B. A fine on the second part of the delay period equivalent to half of the average daily cost for each day of delay until both parts exceed the greatest of both the following periods: 30 days or 10% of the Contract term. C. A fine on the third part of the delay period equivalent to the full amount of the average daily cost for each day of delay following the two periods stipulated for in Paragraph B The total fines imposed may not exceed 10% of the Contract value, provided that if the Employer considers that the delayed part does not preclude full utilization of work at the time specified for its completion, does not cause confusion in the use of any other benefit, and does not adversely affect the work accomplished, the total fine shall not exceed 10% of the value of the delayed work. A contracting company has a contract of 3 million SR stating that it should complete the works in 400 days. The Employer acknowledged the Practical (Substantial) completion of the work at the end of the Term and the Contractor submitted the completed works in 450 days. The value of the delayed works was SR 300000. What is the delay penalty on the Contractor according to the summarized translation of a part of the "Public Works Contract Form" of the "Ministry of Finance, Kingdom of Saudi Arabia" presented above? (a) SR 187500 (b) SR 30000 (c) SR 75000 (d) SR 37500			"Ministry of Finance, Kingdom of Saudi Arabia". (quoted with the question)

Q. No.	Major Area	Code	Question Statement (Answer's Choices)	Key Answer	Expected Time (min.)	Supplied Reference
Essay question (1)	**Schematic Design**	ARCH-T3	Draw and explain a detailed functional linkage diagram (bubble diagram) of a dining facility (an independent restaurant occupying the whole building) including all support spaces.	See Secti -on 6	35	None
Essay question (2)	**Document Checking and coordination**	ARCH-T10	Write and discuss a methodology for the revision of construction documents for discrepancies among various disciplines.	See Secti -on 6	35	None

6. Solutions of Sample Questions

Multiple Choice Questions (MCQs)

Question # 1

Indicator ARCH-T1-5: Evaluate relevant quantitative and qualitative programmatic attributes of existing or a new building.

Example:

If the area breakdown of an office building is as follows:

Structural area = 1000m^2

Building services area = 500m^2

Circulation area = 2500m^2

Mechanical area = 1000m^2

Office spaces area = 5000m^2

What is the Net Usable Area?

(a) 9000m^2

(b) 5000m^2

(c) 7500m^2

(d) 5500m^2

Solution:

Gross Area = Net Useable Area + Structural Area

Gross Area = 1000+500+2500+1000+5000 = 10000m^2

Net Useable Area = Gross Area - Structural Area

Net Useable Area = 10000-1000= 9000m^2

Answer: (a)

Question # 2

Indicator ARCH-T2-1: Analyze more than one site and choose the most appropriate one for a project based on criteria.

Example:

You have a project of a home for the elderly (a retirement home). The owner asked you to choose a suitable land from several available. The following land options were presented, which one should you choose?

(a) A land beside a school, a nursery and a shopping mall.

(b) A land beside a gas station, a car agency and a wholesale marketplace.

(c) A land beside a mosque, a hospital and a park.

(d) A land beside an airport, a business park and a parking garage.

Solution

The examinee should have good judgment and understanding of the nature and needs of the users to correctly answer this question.

The services expected to be most frequently used by the elderly are the mosque, the park and the hospital. Also, the existing beside a hospital generally means a quiet surrounding. Other lands may be too noisy for the project, have services of less importance or too pricey for the project.

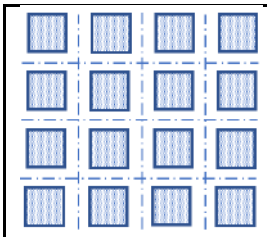
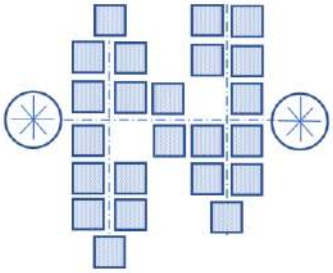
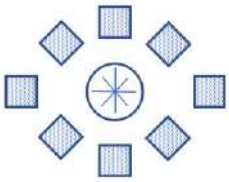
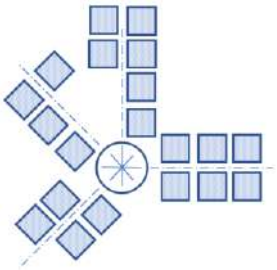
Answer: (c)

Question # 3

Indicator ARCH-T3-5: Assess design alternatives based on the criteria of the program.

Example:

You have a project of a clinic which is comprised of numerous departments, each of which is predicted to grow yet at various paces. Which of the following organizational concept would be the least practical and cost-effective for such a building?

			
(a) Grid	(b) Axial	(c) Central	(d) Radial

(a) Grid

(b) Axial

(c) Central

(d) Radial

Solution

On a plentiful and flat site, land probably would not restrict this type of organizational pattern. Because such facility may grow, but at different times, and because there are several distinct sections, a radial organization would work for each phase and allow for easy growth. Given that everyone enters in one place for directions and orientation in a medical facility, the central focus of a radial pattern probably would be desirable. The axial and central patterns also work, but they require special treatment of the entrance to make it clearly visible. The grid pattern is the least desirable organizational pattern in this case as it doesn't offer the advantage of having separate departments that can be expanded separately without disturbing the entire project.

Answer: (a)

Question # 4

Following is a summarized translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia:

1 Requirements for the establishment of private schools on vacant lands (not allocated for an educational facility)

1-1 The site should be on two streets, one commercial not less than 20 meters wide

1-2 The site should be away from the intersections of the main commercial streets with a distance not less than 50 m.

1-3 The distance between the site and the nearest gas station shall not be less than 20 m.

1-4 The distance between the site and liquefied petroleum gas shops shall not be less than 50 m.

1-5 Taking the approval of the educational authority and the planning authority of the municipality on the site of the project.

1-6 The land area of an educational establishment shall not be less than the following:

1-6-1 Kindergartens 900 m2.

1-6-2 Primary schools: 2500 m2.

1-6-3 Intermediate schools 3500 m2.

1-6-4 Secondary schools 5000 m2.

1-6-5 Complex schools (kindergartens - primary - intermediate - secondary) 7500 m2.

1-7 The distance between an existing educational facility and another at the same school stage should not be less than the following:

1-7-1 300 meters for kindergartens and nurseries.

1-7-2 500 meters for primary schools.

1-7-3 1000 meters for intermediate schools.

1-7-4 2000 meters for secondary schools.

1-8 Parking spaces shall be provided according to the following rates:

1-8-1 One parking space for each nursery class + kindergarten.

1-8-2 Two parking spaces for each primary school class.

1-8-3 Three parking spaces for each intermediate school class.

1-8-4 Five parking spaces for each secondary class.

Indicator ARCH-T1-2: Develop architectural program or brief for a project integrating all project requirements.

Example:

You are planning for a high standard private school complex with 12 primary school classes, 10 intermediate school classes and 8 secondary classes. The classes run simultaneously, and the car parking will be perpendicular to the curb with one way circulation and parking is on both sides of the circulation.

What is a reasonable assessment of the total parking area required for the school complex according to the translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia, presented above?

(a) 6300 m^2

(b) 3100 m^2

(c) 1690 m^2

(d) 1410 m^2

Required References: a summarized translation of a part of the "Municipal Requirements for Private Schools" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia (quoted above).

Solution

According to the summarized translation of a part of the "**Municipal Requirements for Private Schools**" of the "Ministry of Municipal and Rural Affairs", Kingdom of Saudi Arabia, the number of required parking spaces should be calculated as follows:
Two parking spaces for each primary school class x 12 classes = 24 parking spaces.
Three parking spaces for each intermediate school class x 10 classes = 30 parking spaces.
Five parking spaces for each secondary class x 8 classes = 40 parking spaces.
Therefore, the total number of parking spaces required is 94 parking space.
Next, the examinee must assess using his experience as a professional architect the reasonable area that should be allocated for each car parking space including circulation, which is around 33m^2 per car including circulation for 90 degrees parking angle and one-way double loaded circulation. If the examinee does not remember this number, he may make a simple sketch and deduce a number around it.
Therefore, a reasonable assessment of the parking area required for the school complex = 94 parking space x 33 m^2 per car including circulation = 3102 m^2 i.e. about 3100 m^2.

Answer: (b)

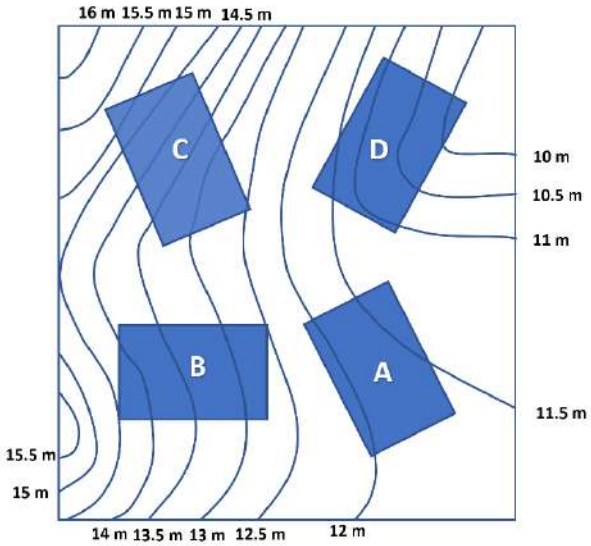
Question # 5

Indicator ARCH-T2-1: Analyze more than one site and choose the most appropriate one for a project based on criteria.

Example:

You have a project in which there is a one-story building on a contoured site. The figure shows different potential locations for the one-story building on the given site along with the site contours.

Taking into consideration the amount of grading to provide suitable level pad for the building, and the grading required to establish good drainage away from the building, which of the following locations would offer the greatest construction cost saving?



(a) Location A

(b) Location B

(c) Location C

(d) Location D

Solution

Based on two considerations which are: 1) the amount of grading, and 2) grading required to establish good drainage away from the building, location A will be the best choice since it would require the least cut-and-fill work to provide a level pad and drainage could be accomplished easily thus it will result in cost saving. While choosing Locations C and B would require severe cutting to level the site, Location D would result in difficult drainage problems.

Answer: (a)

Question # 6

Indicator ARCH-T6-2: Estimate code requirements for a project, e.g. stairs, exits, ramps, public toilets.

Example:

In a project of a restaurant on a hotel's ground floor, it is required to calculate the total occupancy load, based on the table shown which includes the requirements for occupancy loads.
The project includes a dining area of 325 m^2, a kitchen of 93 m^2, and a lounge area of 112 m^2. What is the total occupancy load?

	Use	Occupant load factor (m^2/occupant)
1	Assembly areas, concentrated use (without fixed seats) Dance floors Lodge rooms Auditoriums	0.65
2	Assembly areas, less-concentrated use Conference rooms Dining rooms Exhibit rooms Lounges Stages	1.4
3	Hotels and apartments	18.6
4	Kitchens-commercial	18.6
5	Offices	9.3
6	Stores, ground floor	2.8

(a) 286 occupants

(b) 317 occupants

(c) 282 occupants

(d) 305 occupants

Solution

Using the table, assembly areas have an occupancy load of 1.4 m^2/occupant, including restaurants and lounges. Commercial kitchens have 18.6 m^2/occupant occupancy load.

Therefore,

$$Dining\ occupancy = \frac{325\ m^2}{1.4\ m^2\ per\ occupant} = 232\ occupants$$

$$Kitchen\ occupancy = \frac{93\ m^2}{18.6\ m^2\ per\ occupant} = 5\ occupants$$

$$\text{Lounges occupancy} = \frac{112\ m^2}{1.4\ m^2\ per\ occupant} = 80\ occupants$$

$$Total\ occupancy\ load = 317\ occupants$$

Answer: (d)

Question # 7

Indicator ARCH-T7-5: Enhance a design by integrating materials, technical knowledge and building systems.

Example:

Which of the following is the most effective approach that an architect could implement to the site of a health care facility to reduce noise from an adjacent highway?

(a) Create a 30 m buffer zone planted with evergreen trees.

(b) Construct a 1.2 m masonry wall next to the highway.

(c) Plant deciduous trees 30 m deep between the building and the highway.

(d) Locate the building 30 m away from the highway.

Solution

While all the previously mentioned strategies would help mitigate the noise problem, creating a 30 m buffer zone planted with evergreen trees would be the most effective strategy. Maximizing the distance has limits and will not be effective in a small site. Planting deciduous have only a seasonal advantage. The use of short masonry walls will be less effective.

Answer: (a)

Question # 8

Indicator ARCH-T9-3 : Assess candidate products based on criteria like cost, availability, maker reliability and code and specifications compliance.

Example:

A company is considering cutting operating expenses by replacing its air conditioning system. The cost of the new system is expected to be 60000 Saudi Riyals which will save the company 600 Saudi Riyals per month. What is the approximate simple payback period of their investment in years?

(a) 2 years

(b) 5 years

(c) 11 years

(d) 8 years

Solution

The cost saving due to adoption of the new system per year is 500 Riyals/month x 12 months =6000 Riyals

The payback periods could be calculated as follows;

$$\text{Payback period in years} = \frac{\text{Initial cost for adapting the new system}}{\text{Yearly saving of cost due to the new system}}$$

Payback period in years =60000/6000=10 years

Answer: (d)

Question # 9

Indicator ARCH-T11-17: Assess conditions of certification.

Example:

The effects of the Practical (Substantial) Completion Certificate do not include:

(a) The contractor no longer possesses the site exclusively

(b) Releasing all the retention due to the contractor

(c) The contractor starts to rectify the issues in the Deficiency List (Inspection or Punch List)

(d) Beginning of Defects Liability Period (1 years)

Solution

The full release of retention happens after the Final Completion Certificate.

The contractor no longer possesses the site exclusively as the Employer is now using the building, and the contractor is rectifying the issues in the Deficiency List (Inspection or Punch List) also the Defects Liability Period (1 year) starts.

Answer: (b)

Question # 10

Indicator ARCH-T12-8: Understand contractors, architects and clients' legal obligations.

Following is a summarized translation of a part of the Public Works Contract Form of the Ministry of Finance, Kingdom of Saudi Arabia:

> Article 39: Delay Penalty
>
> If the Contractor fails to complete the work and deliver it in full on the specified dates and the Employer does not see a reason to withdraw the work from him, the Contractor shall commit to pay a fine for the period of delay in work completion after the predetermined date for delivery which shall be calculated on the basis of the average daily cost of the project by dividing the Contract value on its term as follows:
>
> A. A fine on the first part of the delay period, equivalent to one quarter of the average daily cost for each day of delay until the greatest of both the following periods is reached: fifteen days or 5% of the Contract term
>
> B. A fine on the second part of the delay period equivalent to half of the average daily cost for each day of delay until both parts exceed the greatest of both the following periods: 30 days or 10% of the Contract term.
>
> C. A fine on the third part of the delay period equivalent to the full amount of the average daily cost for each day of delay following the two periods stipulated for in Paragraph B
>
> The total fines imposed may not exceed 10% of the Contract value, provided that if the Employer considers that the delayed part does not preclude full utilization of work at the time specified for its completion, does not cause confusion in the use of any other benefit, and does not adversely affect the work accomplished, the total fine shall not exceed 10% of the value of the delayed work.

Example:

A contracting company has a contract of 3 million SR stating that it should complete the works in 400 days. The Employer acknowledged the Practical (Substantial) completion of the work at the end of the Term and the Contractor submitted the completed works in 450 days. The value of the delayed works was SR 300000.

What is the delay penalty on the Contractor according to the summarized translation of a part of the "Public Works Contract Form" of the "Ministry of Finance, Kingdom of Saudi Arabia" presented above?

(a) SR 187500

(b) SR 30000

(c) SR 75000

(d) SR 37500

Required References: Above, is a translation of a part of the "Public Works Contract Form" of the "Ministry of Finance, Kingdom of Saudi Arabia".

Solution

According to the summarized translation of a part of the "Public Works Contract Form" of the "Ministry of Finance, Kingdom of Saudi Arabia" presented above the following calculations should be done:

The average daily cost = SR 3000000 / 400 days = 7500 SR/day

The period of delay in work completion = 450 days – 400 days = 50 days

According to paragraph A:

5% of the Contract term = 400 days x 5% = 20 days, which is greater than the 15 days of Paragraph A, therefore the maximum period is 20 days.

The fine on the first part of the delay period = 20 days x 7500 SR/day / 4 = 37500 SR

According to paragraph B:

10% of the Contract term = 400 days x 10% = 40 days, which is greater than the 30 days in Paragraph B, therefore, the maximum period is 40 days, including 20 Day for the period in Paragraph A and 20 days after it.

The fine on the second part of the delay period = 20 days x 7500 SR/day / 2 = 75000 SR

According to paragraph C:

The Contractor had 50 days of delay of which 40 days were calculated above.

The remaining delay days = 50 – 40 = 10 days

The fine on the third part of the delay period = 10 days x 7500 SR/day = 75000 SR

The sum of the fines= SR 37500 + SR 75000 + SR 75000 = SR 187500

The maximum total fines = 10% of the value of the delayed work = SR 300000 x 10% = SR 30000.

The maximum total fines SR 30000 is less than the sum of the calculated fines: SR 187500. Therefore, the fine on the Contractor is SR 30000

Another Solution:

The maximum total fines may be first calculated based on the value of delayed works, then gradual fines may be calculated according to paragraphs A to C until the value of the maximum total fines is reached.

The maximum total fines = 10% of the delayed work = SR 300000 x 10% = SR 30000.

The average daily cost = SR 3000000 / 400 days = 7500 SR/day

The period of delay in work completion = 450 days – 400 days = 50 days

According to paragraph A:

5% of the Contract term = 400 days x 5% = 20 days, which is greater than the 15 days of Paragraph A, therefore the maximum period is 20 days.

The fine on the first part of the delay period = 20 days x 7500 SR/day / 4 = 37500 SR

Since the fine according to Paragraph A is greater than the maximum total fines, therefore, the maximum total fine will be applied i.e. SR 30000.

Answer: (b)

Essay Question

Essay Question # 1

Indicator ARCH-T3: Schematic Design.

Example:

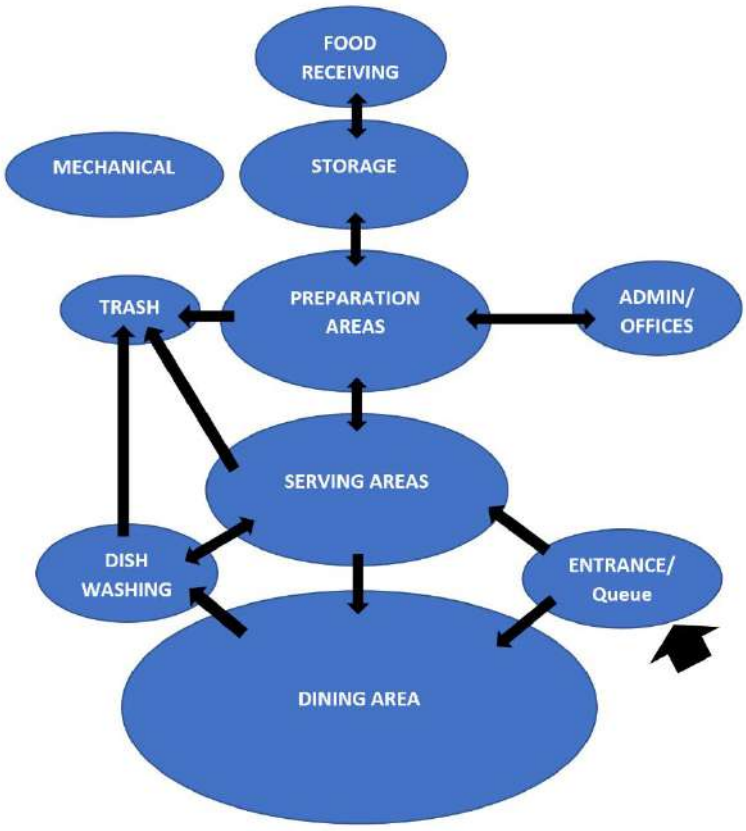
Draw and explain a detailed functional linkage diagram (bubble diagram) of a dining facility (an independent restaurant occupying the whole building) including all support spaces

Answer

The functional linkage diagram (bubble diagram) should include the following:

A- An area for the visitors (clients) which should include an entrance and queuing area (where clients may wait), a dining area, a serving area and toilets.

B- A staff area which should include a service entrance for receiving food components, a storage area, a preparation area for cold, hot and dessert food, this area should be in relation with the serving area. There should be special areas for administration, dish washing, mechanical, and trash exit.



Essay Question # 2

Indicator ARCH-T10: Document Checking and Coordination.

Example:

Write and discuss a methodology for the revision of construction documents for discrepancies among various disciplines.

Answer

The candidate may describe a contemporary method that relies on BIM and 4D software like Navisworks or a lengthy process that relies on traditional methods of revision and clash detection like first to revise the architectural drawings with each other, then revise the architectural drawings with structural drawings, then the mechanical with both the architectural and structural, then electrical with all the drawings, then to revise all the finishes and material and equipment and systems with their relevant specifications.

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