

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2018

BUILDING MAINTENANCE AND SERVICES

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List the two factors effect durability of buildings.
2. What is understood by cracks in walls ?
3. What is routine maintenance ?
4. Name two methods adopted for cleaning small sewers.
5. Define Shoring.

(5 × 2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. What are the Role of maintenance in durability and serviceability of buildings ?
2. State the defects in foundations.
3. State two methods for preventing leakage in RCC roof slab.
4. Explain two reasons in drainage defective system and its preventive measures.
5. Write the names of water supply fittings.
6. What are the Challenges in retrofitting in existing building ?
7. What is under pinning and list different methods of Shoring ?

(5 × 6 = 30)

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

- III (a) Explain the factors effect of pollution on buildings. 9
 (b) Explain the Environmental factors affecting durability of building. 6

OR

- IV (a) Explain the economic aspect of maintenance. 6
 (b) Identify the planning aspect of maintenance. 9

UNIT — II

- V (a) Identify corrosion in Steel structures and reinforcement. 9
 (b) Explain the structural damages due to fire. 6

OR

- VI (a) What are the causes of cracks in concrete ? 9
 (b) Identify the types of cracks in building. 6

UNIT — III

- VII (a) Identify the common defects in water supply and drainage system. 6
 (b) List out the common defects in building services. 9

OR

- VIII (a) Explain the rectification measures in Building service for common defects. 8
 (b) List the components used in lift. 7

UNIT — IV

- IX (a) Explain retrofitting, restoration and conservation. 7
 (b) State the need for retrofitting, restoration and conservation. 8

OR

- X (a) What are the common causes in deterioration of historical building ? 6
 (b) Explain different methods of retrofitting and restoration. 9

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BUILDING MAINTENANCE AND SERVICES

Qt No.	Scoring Indicators	Split Score	Total Score
I. 1)	PART- A		
	Buildings can be vulnerable to climate change, also vulnerable to environmental impacts of air pollution.	2	
2)	Lack of foundation. Temperature influence. Damage due to damp.	2	
3)	Routine Maintenance, also known as preventive, preventative or cyclical maintenance, is an essential part of the on-going care and upkeep of any building.	2	
4)	The sewage can be treated: in a septic tank at each building or in a lagoon itself just before the lagoon in a large septic tank or macerator system	2	
5)	The arrangement employed to prevent a damaged structure, due to either foundation settlement or other reasons form collapse, is called shoring.	2	10
II 1)	PART- B		
	The avoidance of accidents, which may harm people. The continued operation of facility. The protection of the capital investment in the asset. It improves the life of structure. Improved life period gives better return on investment. Better appearance and aesthetically appearing. Leads to quicker detection of defects and hence remedial measures. Prevents major deterioration that leads to collapse. Ensure safety occupants.	1x6	6
2)	Unequal settlement of sub-soil. Unequal settlement of masonry. Sub-soil moisture movement. Lateral pressure on the walls. Lateral Movement of sub-soil		

3)	<p>Weathering of sub-soil due to trees and shrubs. Atmospheric action Cracks in concrete must be repaired as soon as possible.</p>	1x6	6
	a) Waterproofing		
	<p>Epoxy Grouting: Grouting can be performed in a similar manner as the injection of an epoxy. However the use of an epoxy is the better solution except where considerations for the resistance of cold weather prevent such use in which case grouting is the comparable alternative. The method includes:</p>	1	
	<p>Cleaning of the crack surface and removing any type of oily dirt or contaminants.</p>		
	<p>Widen the crack just a little to allow the grouting to occur at a faster pace.</p>		
	<p>Fill the epoxy grouting (from Epoxy Injection) and seal the surfaces immediately to prevent epoxy gel from falling off. If Epoxy grouting cannot be done, you can do the same using Plaster of Paris with water, ONLY if the crack is shallow and not widening. When the gel dries up properly, paint the roof to give it a proper finish and to protect it from dust and water.</p>	3	
	<p>Stitching Method: Holes are drilled at both the ends of the crack and 'stapled' using short-legged u-shaped reinforcement unit. The holes are then filled by epoxy gel or non-shrink grout.</p>	2	6
4)	<p>Defective drainage systems occur in various forms and to different extents in all types of buildings, irrespective of age. Leaking or broken drainage pipes at external wall Rusty internal drainage pipes Unauthorized alteration of drainage system</p>		
	<p>Preventive measures: Regular Inspection</p>	4	
	<p>Building owners, owners' corporations and building management and maintenance personnel are encouraged to conduct regular inspection on the drainage systems and sanitary fitments of their buildings to ensure that they are properly maintained and in working condition.</p>	2	6
5)	<p>A fitting is used in pipe systems to connect straight pipe or tubing sections, adapt to different sizes or shapes and for other purposes, such as regulating (or measuring) fluid flow.</p>		
	<ul style="list-style-type: none"> • Elbow • Coupling 		

	<ul style="list-style-type: none"> • Union • Nipple • Reducer • Double-tapped bushing • Tee • Diverter tee • Cross • Cap • Plug • Barb • Valve 	1/2x12	6
6)	<p>-Expensive and inconvenient.</p> <p>-Internal spaces may reduce upon installation of internal wall insulation.</p> <p>-Might cause negative impact to heritage and archaeological assets caused by usage of unproven methods, technologies or instruments. Further research is needed especially on insulation mechanism on walls and the effect on retrofit on buildings fabrics.</p> <p>-More education, training and activities on maintaining and preserving the buildings need to be taught to address issues and to create awareness.</p> <p>-The risk of retrofitting needs to be highlighted, not just focusing on the benefits of retrofitting and discussion between retrofit and refurbishment.</p>	1x6	6
7)	<p>A solid foundation laid below ground level to support or strengthen a building.</p> <p>Soldier Pile and Lagging.</p> <p>Pressure / Chemical Grouting.</p> <p>Soil Nails and Shot-Crete.</p> <p>Hydraulic Shoring.</p> <p>Pneumatic Shoring.</p> <p>A choice of Timber or Aluminium materials.</p>	1x6	6

PART- C UNIT- I			
III. (a)	<p>Smog, coal dust and other chemicals in the air have deleterious effects on people, plants and animals, and these chemical pollutants also have effects on our buildings and structures as well. Whether it was during the Industrial Revolution or during the latest round of manufacturing on the lakeshore, pollution effects everything.</p> <p>Dust</p> <p>Air pollution most noticeably affects buildings by depositing dust and filth on them. During the Industrial Revolution in England, the air contained so much smoke and coal dust that it actually caused butterflies to alter their color as an evolutionary adaptation so they could hide against the soot-covered buildings.</p> <p>Acid Rain</p> <p>While it may sound more dangerous than it is, acid rain is a serious matter. It refers to rain that has been affected by pollution so that it is more acidic than it should be. While you may not notice it when the rain hits your skin, the acidic nature of this rain can cause major damage to buildings and structures over time. This is especially true of limestone buildings, which are particularly sensitive to the effects of acid rain.</p> <p>Protective Coatings</p> <p>While acid rain is one way that structures can be damaged, there are other ways that buildings can be hurt by air pollution. Many contemporary air pollutants, according to the Imperial College Press, have the potential to degrade and damage organic coatings and polymers on structures. Air pollution can eat away the finishes on walls and stairs, the coatings on hand rails, and even the settings that hold in windows. Once those coatings are gone, the materials beneath are exposed to both the air and the pollution in the air and will be oxidized and damaged.</p>	2	
b)	<p>Deterioration due to corrosion</p> <p>Environmental effects</p> <p>Poor quality material used</p> <p>Quality of supervision</p> <p>Design and construction flaws</p>	3	9
		6	6

IV (a)	<p style="text-align: center;">OR</p> <p>So far we have only concentrated on the uncertainty relative to component and system lifetime. In practice, the cost of inspection and maintenance decisions are often of paramount importance. These too are of course not known with certainty, but it is conventional to use expected costs and compute expected present worth or expected future worth, the impact of depreciation and other income tax considerations relative to replacement decisions are not included as they should be in a realistic comprehensive analysis. Also, the revenues that might be generated by the machines considered are omitted.</p>	6	6
(b)	<p>To Identify the planning aspect of maintenance :</p> <ul style="list-style-type: none"> • Consider total cost • Do repair job in time • If defects are few & isolated repair on an individual basis. Otherwise do in generalized manner • Ensure the repair prevents further development of defects • In case of lost strength, repairs should restore the strength • If appearance is a problem, the number of applicable types of repairs become limited & the repairs must be covered • Repair works should not interface with facilities of the structure • Take care in addition of section to a member and in retributing live loads and other live load moments. After selecting a suitable method of repairs, and after considering all the ramifications of its application, the last step is to prepare plans & specification and proceed with the work. 	9	9
V (a)	<p style="text-align: center;">UNIT-II</p> <ul style="list-style-type: none"> • Spalling of concrete cover • Cracks parallel to the reinforcement • Spalling at edges • Swelling of concrete • Dislocation • Internal cracking and reduction in area of steel reinforcement. <p>To prevent corrosion:</p> <ul style="list-style-type: none"> • Corrosion inhibitors • Corrosion resisting steels • coatings for steel • Cathodic protection 	9	9
(b)	<p>Spalling Strength reduction in concrete</p>		

VI (a)	<p>Loss of anchorage of reinforcement Excessive deflection of beams and slabs distortion of the whole structural framing.</p>	1 ½ x4	6
	OR		
(b)	<ul style="list-style-type: none"> • Use of unsound material • Poor & bad workmanship • Use of high water-cement ratio • Freezing & thawing • Thermal effects • Shrinkage stresses 	1 ½ x6	9
	<p>Cracks leading to structural failure Cracks causing corrosion Cracks affecting function Cracks affecting appearance</p>	1 1/2x4	6
VII	UNIT-III		
(a)	<p>Rusting, Leakage, Dents and Buckles, Blockage, Cracks, Tree root entry,</p>	1x6	6
(b)	<p>Erosion of Mortar Joints basically, the principle capacity of a mortar joint is to try and out abnormalities of individual squares, regardless of whether they are of stones or blocks.</p>	2	
	<p>Peeling Paint</p>		
	<p>Peeling paint for the most part happens on building veneers, principally on put dividers, segments and different regions which are presented to unnecessary rain and suddenness. A few structures situated close to the ocean may confront a substantially more serious hazard once the indications of peeling paint are obvious on the outside dividers.</p>	1	
	<p>Cracking of Walls / Leaning Walls</p>		
	<p>Aside from conveying loads from rooftops and floors to establishments, outer dividers might be unsafe to a building on the off chance that they are fundamentally unsound. Splits in divider, either vertical or corner to corner, are regular indications of basic</p>	2	

VIII (a)	<p>unsteadiness</p> <p>Unstable Foundations</p> <p>Establishments are a piece of a building which disseminates loads from rooftops, dividers and floors on to the earth beneath. They are fundamentally vital to the lasting of a building and if this is missing there is no point of spending substantial wholes of cash on other shallow reclamation work</p> <p>Roof Defects</p> <p>Other than being one of the principle structures in a building, rooftop may go about as a climate shield, offering assurance to clients or tenants from rain and sun. Subsequently, it is critical to treat any maturing rooftop tiles.</p> <p>Honey combing and Dampness</p>	2	
	<p style="text-align: center;">OR</p> <p>Concrete can be restricted from frost action, damage of the structure by the entrainment of air. This entrainment of air is distributed through the cement paste with spacing between bubbles of no more than about 0.4mm.</p> <p>Control cracks in a structure</p> <ul style="list-style-type: none"> • Use of good coarse aggregates free from clay lumps • Use of fine aggregate free from silt, mud & organic constituent. • Use of sound cement. • Provision of expansion & contraction joint. • Provide less water-cement ratio. <p>coating for reinforcement to prevent corrosion</p> <ul style="list-style-type: none"> • Organic coating • Epoxy coating • Metallic coating • Zinc coating <p>Methods of corrosion protection</p> <ul style="list-style-type: none"> • Corrosion inhibitors • corrosion resisting steels <ul style="list-style-type: none"> • coatings for steel • Cathodic protection 	2	9
(b)	<p>A lift is a system permanently installed that serves for vertical (or in the direction smaller than 15% from perpendicular) transport of persons or goods in lift cars or on platforms.</p> <p>Cabin: a lift unit designed for transportation of persons and/or goods.</p>	8	8

	<p>Shaft: a space in which the lift cabin moves. The space is as a rule housed with pit bottom, walls and ceiling.</p> <p>Machine room: a room in which the drive unit (or units) and the connected equipment are situated, e.g. control elements.</p> <p>Drive unit: a unit that contains motor that drives a lift. In traction lifts it is so called traction machine and in hydraulic ones it is a set with a motor, pump and valve block.</p> <p>T-guides: rigid elements that secure guiding of a car frame and a cabin.</p> <p>Car frame: a rigid construction that holds the car and travels in the guides.</p> <p>Counterweight: a separately guided mass that partly counterbalances the cabin and secures ropes pressure to a driving pulley.</p> <p>Controller: a unit that controls the lift travel.</p> <p>Piston: a lift component that uses a working medium for a plane motion. The piston is composed of a cylinder and a ram. There are also single or multistage pistons so called telescopic.</p>		
IX (a)	<p style="text-align: center;">UNIT-IV</p> <p>Retrofit involves modifications to existing commercial buildings that may improve energy efficiency or decrease energy demand. In addition, retrofits are often used as opportune time to install distributed generation to a building.</p> <p>Restoration is said as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period.</p> <p>Architectural conservation describes the process through which the material, historical, and design integrity of any <u>built heritage</u> are prolonged through carefully planned interventions</p>	7	7
(b)	<p>Retrofitting of these structures was aimed at preservation of initial geometry and appearance by creating composite structures. As far as preservation is concerned, it can be done in three different modes of construction techniques, namely: Maintenance, Conservation, and Restoration. Maintenance refers mostly to utilization of buildings. It implies a large variety of checkouts and repair works carried out periodically and based on a detailed program. The major purpose of maintenance is to prevent malfunctioning of engineering systems.</p> <p>Conservation is aimed at preventing damage by maintaining and improving loading capacity to fit a required level. Thus, conservation is based on proper structural design in each individual case. One</p>	2	7
		3	

	<p>should distinguish between Temporary and Permanent conservation. Temporary conservation is used when a building is threatened with rapid destruction, such as earthquake aftershock.</p> <p>Restoration is primarily aimed at architectural aspects, such as external and internal appearance, and functional roles of internal spaces, courtyards, etc. Restoration is most important also in historical aspects. Restoration is the most complicated of all the works done on the historical building. It usually includes elements of both conservation and repairs. Conservation often includes certain elements of restoration.</p>	2	
	OR		
X (a)	<p>Deterioration due to corrosion Environmental effects Poor quality material used Quality of supervision Design and construction flaws</p>	3	8
(b)	<p>Retrofitting techniques: Global: Adding shear wall, infill wall, bracing, wing wall, thickening, mass reduction, supplemental damping and base isolation. Local: Jacketing of beams Jacketing of Column Jacketing of beam-column joints Strengthening of individual footings Stitching of cracks, Grouting with epoxy or cement Use of CFRP</p>	6	6
	<p>Restoration is drastically different from just repairs. It entails a complete restitution of the strength of the architectural structure before the damage occurred. Restoration will usually be the main course of action if a building has deteriorated beyond building regulations, and needs to be restored to its former glory.</p>	6	
		3	9