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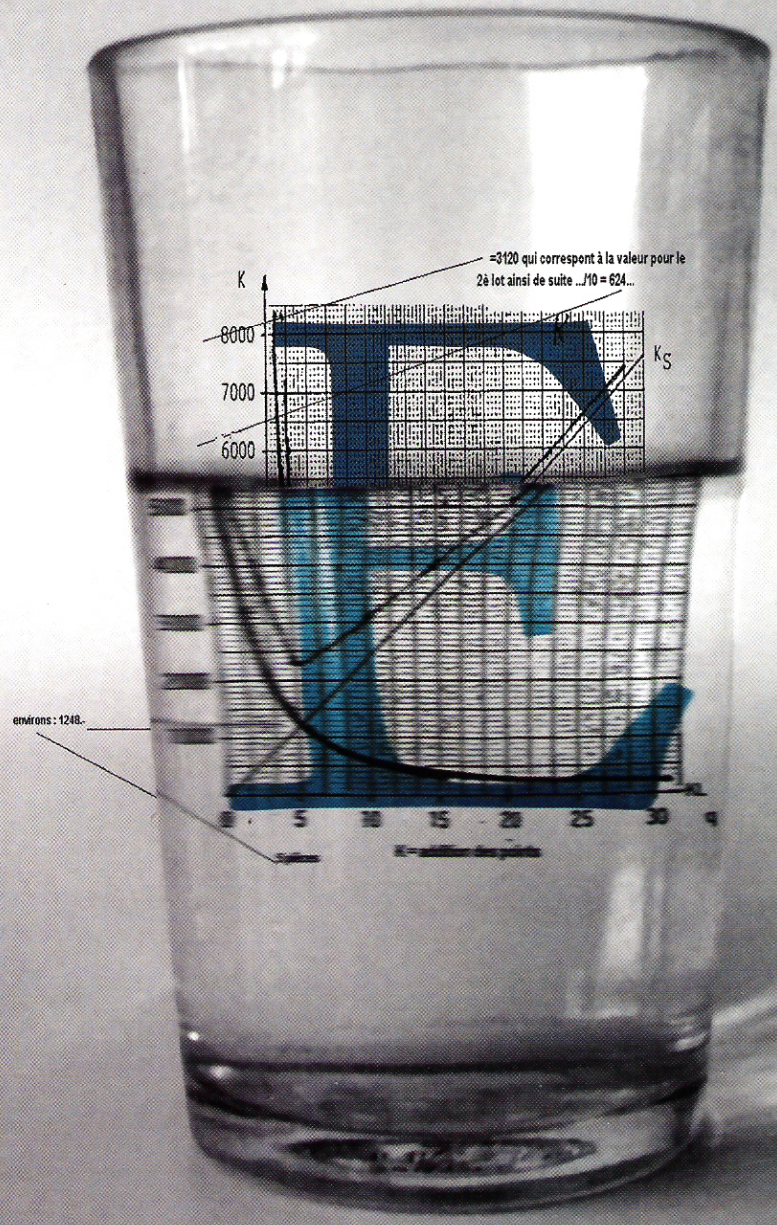
زبان تخصصی

مهندسی عمران | تالیف: دکتر شاهرخ قاضی مرادی



پارسه

SECTION 1 READING SKILLS

Part A: General Rules

WHAT IS A PARAGRAPH?

A paragraph is a basic unit of organization in writing in which a group of related sentences develops one main idea. A paragraph can be as short as one sentence or as long ten sentences. The number of sentences is unimportant; however, the paragraph should be long enough to develop the main idea clearly.

The following model contains all of the elements of a good paragraph. Read it carefully two or three times and try to analyze its structure.

Model 1: Paragraph structure

Gold

Gold, a precious metal, is prized for two important characteristics. First of all, gold has a lustrous beauty that is esistant to corrosion. Therefore, it is suitable for jewelry, coins, and ornamental purposes. Gold never needs to be polished and will remain beautiful forever. For example, a Macedonian coin remains as untarnished today as the day it was minted twenty-three centuries ago. Another important characteristics of gold is its usefulness to industry and science. For many years, it has been used in hundreds of industrial applications. The most recent use of gold is in astronauts' suits. Astronauts wear gold-plated heat shields for protection outside the spaceship. In conclusion, gold is treasured not only for its beauty, but also for its utility.

THE THREE PARTS OF A PARAGRAPH

A paragraph has three major structural parts: a topic sentence, supporting sentences, and a controlling sentence.

The **topic sentence** states the main idea of the paragraph. It not only names the topic of the paragraph, but it also limits the topic to one or two areas that can be discussed completely in the space of a single paragraph. The specific area is called the controlling idea. Notice how the topic sentence of the model states both the topic and the controlling idea:

	(Topic)	*(Controlling Idea)*
Topic Sentence	Gold, a precious metal, is prized for	two important characteristics.

Supporting sentences develop the topic sentence. That is, they explain the topic sentence by giving reasons, examples, facts, statistics, and quotations. Some of the supporting sentences that explain the topic sentence about gold are:

Supporting Sentences

First of all, gold has a lustrous beauty that is resistant to corrosion. For example, a Macedonian coin remains as untarnished today as the day it was inted twenty-three centuries ago.

Another important characteristics of gold is its usefulness to industry and science.

The most recent application of gold is in astronauts' suits.

The concluding sentence signals the end of the paragraph and leaves the reader with important points to remember:

Concluding Sentence *In conclusion, gold is treasured not only for its beauty, but also for its utility.*

THE TOPIC SENTENCE

Every good paragraph has a topic sentence, which clearly states the topic and the controlling idea of the paragraph. It names the topic and then limits the topic to a specific area to be discussed in the space of a single paragraph. It is a complete sentence; that is, it contains a subject, a verb, and (usually) a complement. It is usually (but not always) the first sentence in the paragraph.

A topic sentence is the most important sentence in a paragraph. It briefly indicates what the paragraph is going to discuss. For this reason, the topic sentence is a helpful guide to both the writer and the reader. The writer can see what information to include (and what information to exclude). The reader can see what the paragraph is going to be about and is therefore better prepared to understand it.

The following examples show how a topic sentence states both the topic and the controlling idea in a complete sentence.

Driving on freeways requires skill and alertness.
Gold, a precious metal is prized for two important characteristics.
Registering for college classes can be a frustrating experience for new students.

POSITION OF TOPIC SENTENCES

The topic sentence may be the first or last sentence in a paragraph. The topic sentence may also be the first *and* last sentence of the paragraph--"sandwich-style." A "sandwich-style" paragraph is especially helpful to your reader if the paragraph is very long. The second topic sentence in the "sandwich-style" paragraph also serves as a concluding sentence.

Study the following three paragraphs. Notice the different positions for the topic sentence in each. the topic sentences are Underlined.

Model 2: Position of topic sentences

Hurricanes

Topic sentence

Hurricanes, which are also called cyclones, exert tremendous power. These violent storms are often a hundred miles in diameter, and their winds can reach velocities of seventy-five miles per hour or more. Furthermore, the strong winds and heavy rainfall that accompany them can completely destroy a small town in a couple of hours. The energy that is released by a hurricane in one day exceeds the total energy consumed by humankind throughout the world in one year.

Famous School "Failures"

Albert Einstein, one of the world's geniuses, failed his university entrance examinations on his first attempt. William Faulkner, one of America's noted writers, never finished college because he could not pass his English courses. Sir Winston Churchill, who is considered one of the masters of English language, had to have special tutoring in English during elementary school. These few examples show that failure in school does not always predict failure in life.

Topic Sentence

Synonyms

Topic Sentence

Synonyms, words that have the same basic meaning, do not always have the same emotional meaning. For example, the words "stingy" and "frugal" both mean "careful with money." However, to call a person stingy is an insult, while the word frugal has a much more positive connotation. Similarly, a person wants to be slender but not skinny, and aggressive, but not pushy. Therefore, you should be careful in choosing words because many so-called synonyms are not really synonymous at all.

Topic Sentence (conclusion)

The Concluding Sentence

A concluding sentence is not absolutely necessary, but it is very often helpful to the reader because it signals the end of the paragraph and because it reminds him/her of your important points.

A concluding sentence serves three purposes:

1. It signals the end of the Paragraph. (Use an end-of-paragraph signal such as "In conclusion," "In summary," "Finally," etc.)
2. It summarizes the main points of the paragraph.
3. It gives a final comment on your topic and leaves the reader with the most important ideas to think about.

The examples below demonstrates two different types of concluding sentences. The first one paraphrases the topic sentence; i.e., the concluding sentence repeats the main idea of the topic sentence in different words. The second example summarizes the two main points of the paragraph, which were not specifically stated in the topic sentence.

Model 3: Concluding sentences

Synonyms

Synonyms, words that have the same basic meaning, do not always have the same emotional meaning. For example, the words "stingy" and "frugal" both mean "careful with money." However, to call a person stingy is an insult, while the word frugal has a much more positive connotation. Similarly, a person wants to be slender but not skinny, and aggressive, but not pushy. Therefore, you should be careful in choosing words because many so-called synonyms are not really synonymous at all.

Gold

Gold, a precious metal, is prized for two important characteristics. First of all, gold has a lustrous beauty that is resistant to corrosion. Therefore, it is suitable for jewelry, coins, and ornamental purposes. Gold never needs to be polished and will remain beautiful forever. For example, a Macedonian coin remains as untarnished today as the day it was minted twenty-three centuries ago. Another important characteristics of gold is its usefulness to industry and science. For many years, it has been used in hundreds of industrial applications. The most recent use of gold is in astronauts' suits. Astronauts wear gold-plated heat shields for protection outside the spaceship. In conclusion, gold is treasured not only for its beauty, but also for its utility.

Review: What Is a Paragraph?

These are the important points you should have learned from this section:

1. A good topic sentence:
   a. is a complete sentence with a subject, a verb, and generally a complement.
   b. states both the topic and the controlling idea of the paragraph.
   c. is neither too general nor too specific. It states the main idea clearly, but it does not give the specific details.
2. A good concluding sentence:
   a. signals the end of the paragraph.
   b. summarizes the important points briefly.

Part B: Strategies for the Reading Comprehension Questions

In this part of the test you will be given reading passages, and you will be asked two types of questions about the reading passages:

1. **Reading Comprehension** questions ask you to answer questions about the information given in the reading passages, including main idea questions, directly answered detail questions, and implied detail questions.
2. **Vocabulary** questions ask you to identify the meanings of vocabulary words in the reading passages. To answer these questions , you may have to know the meanings of the words. You can also identify the meanings of some of the words by understanding the context surrounding the words, by using structural clues to identify the meanings of the words, or by breaking down the unknown words into known word parts in order to identify them.

GENERAL STRATEGIES

1. **Be familiar with the directions.** The directions on every test are the same, so it is not necessary to spend time reading the directions carefully when you take the test. You should be completely familiar with the directions before the day of the test.
2. **Do not spend too much time reading the passage!** You do not have time to read each reading passage in depth, and it is quite possible to answer the questions correctly without first reading the passages in depth. You do not need to understand every detail in each passage to answer the questions correctly, It is therefore a waste of time to read the passage with the intent of understanding every single detail before you try to answer the questions.
3. **Do not worry if a reading passage is on a topic that you are unfamiliar with.** All of the information that you need to answer the questions is included in the passages, You do not need any background knowledge to answer the questions.
4. **Find the section of the passage that deals with each question.** The question-type tells you exactly where to look in the passage to find correct answers.
   - For *main idea questions*, look at the first line of each paragraph.
   - For *directly* and *indirectly answered detail questions*, choose a key word in the question, and skim for that key word (or a related idea) in order in the passage.
   - For *vocabulary questions*, the question will tell you where the word is located in the passage.
   - For *overall review questions*, the answers are found anywhere in the passage.
5. **Carefully read the part of the passage that contains the answer.** The answer will probably be in the same sentence (or one sentence before or after) the key word or idea.
6. **Choose the best answer to each question from the four answer choices listed in your test booklet.** You can choose the best answer according to what is given in the appropriate section of the passage, eliminate definitely wrong answers, and mark your best guess on the answer sheet.

Part C: Eight Keys to Vocabulary Building

1. Read as much as you can

By reading as many related texts (books, journals, reports, etc.) as you can, you will encounter new words and technical terms. You can guess the meanings of many of these words by their context - that

is, you will get a clue to the meaning from the words that surround the new word. If you are still not sure, you can look up the word in an appropriate dictionary to check if you were right.

2. Use a dictionary

Buy a good comprehensive dictionary, preferably a university-level dictionary along with a dictionary of scientific and technical terms. The dictionary should be all in English, not a bilingual one. A good dictionary should include the following information about a word:

- its pronunciation
- its part of speech (noun, adjective, verb)
- a clear, simple definition
- an example of the word used in a sentence or phrase (if necessary)
- its origin (roots, prefix)

You can also use a pocket dictionary if you travel back and forth to classes.

3. Learn roots, prefixes, and suffixes

Roots and prefixes from Latin and Greek make up many English words. It has been estimated that more than half of all English words come from Latin and Greek. Prefixes are added to the beginning of a root and suffixes are added to the end to modify the meaning of words. Learning these will help you increase your vocabulary.

4. Learn from listening

Listening to good programs on the radio and television as well as to people who speak English well is another way of improving your vocabulary. Since you cannot always ask the speaker to tell you what a particular word means, write down the words and look them up later.

5. Use a dictionary of synonyms and antonyms

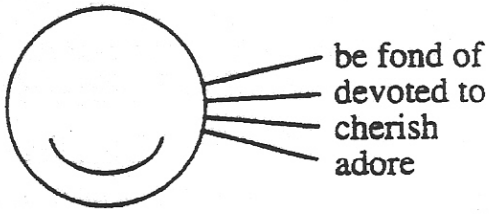
Synonyms are words that have almost the same meaning; antonyms are words that have almost the opposite meaning. Knowing the synonyms and antonyms of a word will expand your vocabulary. Some dictionaries of synonyms and antonyms explain each synonym and how it differs in meaning for other synonyms. Since no two words have the exact same meaning, this is very useful for you.

6. Make your own word list

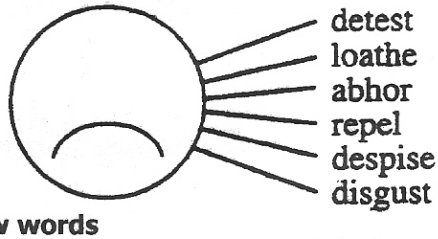
Get a notebook for your vocabulary study and use it to create your own word list. Whenever you read and come across a word you don't know, write it down in your notebook together with the sentence in which you found it. Try to work out the meaning of the word from its context. Then look the word up in a dictionary and write the definition in your notebook. Also, write down any other information such as the root of the word, and see how it is connected to the meaning. Lastly, write your own sentence using the word. Writing will help you remember the word and its meaning. Try to add a new word to your list every day.

7. Create your own theme groups

Words are easier to remember and learn when you group words with similar meanings under a theme. For example,



Then you can make another theme with the opposite.



8. Use your new words

Using your new words whether it be in speaking or writing is an important step in learning them.

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SECTION 2 M.Sc. EXAM's QUESTIONS

Part A: Vocabulary & Technical Terms

Choose the correct choice.

1 . Light weight aggregate for concrete can be obtained from ..... .
1) sand and gravel 2) volcanic material
3) granite 4) crushed granite

2 . To slow down the rate of setting of concrete, we add ..... .
1) a retarder 2) a plasticizer 3) an accelerator 4) an inhibitor

3 . Portland cement is foremost among construction ..... used in civil engineering projects.
1) goods 2) substances 3) stuffs 4) materials

4 . A state in which the properties of a system do not change with time, unless the system is influenced by the surroundings is called ..... .
1) buoyancy 2) equilibrium 3) balance 4) stability

5 . An applied science which deals with the properties and principles of liquids and gases is called ..... .
1) soil mechanics 2) hydraulics 3) fluid mechanics 4) thermodynamics

6 . A mass formed by coalescence or concentration of particles of matter such as artificial stonelike material used for foundation called ..... .
1) aggregate 2) concrete 3) foundation basin 4) sandstone

7 . If the load on a layer of saturated clay is increased, the excess water drains out of the soil. This process is known as ..... .
1) consolidation 2) cavitation 3) swelling 4) uplift

8 . The cement has to be ..... under very dry conditions as otherwise it deteriorates rapidly.
1) used 2) packed 3) stored 4) mixed

9 . In the case of air entrained concrete, a mixing time of less than 2 or 3 minutes may cause ..... entrainment of air.
1) harmless 2) prolonged 3) desired 4) inadequate

10 . Generally, the higher the temperature of the concrete at placement, the greater the ..... rate of strength development, but the lower the long term strength.
1) initial 2) heat 3) first 4) economic

11 . Members and their connections in a highway bridge truss may be ..... loaded and unloaded millions of times during the life of the bridge.
1) simultaneously 2) directly 3) repeatedly 4) commonly

12 . A force applied to a member before it carries its working load is called ..... .
1) wind force 2) prestressing force 3) impact force 4) earthquake force

13 . A paved strip on which aircrafts land or take off at an airport is called ..... .
1) a sleeper 2) a runway 3) an overpass 4) a retaining wall

14 . A bridge supported by cables usually hung from towers is called ..... .
1) a masonry arch bridge 2) a concrete arch bridge
3) a multi-arch bridge 4) a suspension bridge

15 . Quicksand is produced when the intergranular pressure of sand is ..... by u[illegible]d drag of water.
1) neutralized 2) decreased 3) doubled 4) prevented

16 . Block shear rupture is a ..... failure mode that can occur along the perimeter of welds.

1) exploding 2) ongoing 3) extending 4) tearing

17 . The word "fluctuation" means ..... .

1) burn with a bright flame 2) drifting movement
3) up and down movement 4) process of casting

18 . Slow movement of water or another fluid through porous material like earth or some types of rock such as limestone is called ..... .

1) upstream 2) seepage 3) effluent 4) sewage

19 . supporting a building with temporary timber or steel elements during repair or construction is called ..... .

1) sludge 2) shoring 3) shift 4) slurry

20 . The stresses that are caused by cold bending and straightening, cooling after rolling, or by welding are:

1) Residual Stresses 2) Ultimate Stresses 3) Working load Stresses 4) Yield Stresses

21 . A fracture phenomenon associated with a cyclic stress condition is known as:

1) strain-hardening 2) plastic hinge 3) ductile failure 4) fatigue

22 . The construction material which is most likely to be abundantly present in a masonry structure is ..... .

1) aluminum 2) bricks 3) reinforced concrete 4) steel

23 . Creep is the property of concrete by which it continues to deform with time under.....loads.

1) substantial 2) suitable 3) sustained 4)suspended

24 . A duct or pipe carrying off the waste material or excess water is called ..... .

1) drainage 2) spillway 3) sewage 4) sewer

25 . Lateral deflection of a building due to wind is called:

1) foundation settlement 2) drift
3) buckling shape 4) allowable deflection

26 . After compaction using one of the three standard methods, the bulk density and water content of the soil are determined and the dry density calculated. For a given, soil the..... is repeated at least five times, the water content of the sample is increased each time.

1) condition 2) limit 3) method 4) process

27 . A (n) ..... sees a glass half full, and a (n) ..... sees a glass half empty.

a. Hydrologist b. pessimist c. businessman d. optimist

1) c, d 2) d, b 3) a, c 4) b, d

28 . The basic distinction between the linked professions of science and engineering lies in their goals. The scientist aims to discover new knowledge whether useful or not, while the engineer strives to put knowledge, old or new, to work efficiently for the needs of mankind.

You can guess from the context that " ..... " .

1) puts forward 2) concludes 3) makes great efforts 4) co[illegible]rates

29 . During strong earthquakes, buildings may be damaged to some extent.

1) somewhat
2) sometimes
3) otherwise
4) investment

30 . For certain structure, the results of earthquake damage may be very serious.

1) consequences
2) failures
3) requirements
4) strong

31 . Some buildings are designed to withstand very strong earthquakes.

1) produce
2) resist
3) shift
4) support

32 . Different type of soil failure can be caused by earthquakes.

1) specified
2) required
3) produced
4) expected

33 . It is now <u>usual</u> for large dams to be built of earth.

1) common
2) event
3) ordinary
4) sustain

34 . In B.S. 882: 1965 the division into zones is based primarily on the percentage passing the 600 μm (No. 25) B.S. sieve, as shown by the values in Table 3.23. The main reason for this is that a large ..... of sands divide themselves naturally at just that size, the grading above and below being approximately uniform. Furthermore, the content of particles finer than the 600μm (No. 25) sieve has a considerable influence on the workability of the mix, and provides a fairly reliable index of the overall specific surface of the sand.

1) value
2) particle
3) specimen
4) number

35 . A property of a soil which decides the angle at which its free slope will stand in cut-and-fill and which therefore decides its stability is called:

1) internal friction
2) irrigation
3) insulation
4) infiltration

36 . A block to which a tension member is tied and is of any size, from a few cm square in a prestressed concrete beam to several meters for the cables of a suspension bridge is called:

1) Aggregates
2) An anchorage
3) An articulated dumper
4) an abrasion

37 . Acceleration is <u>lessened</u> as the distance from epicenter increases.

1) attenuated
2) injured
3) evaluated
4) originated

38 . Because a knowledge of how the ground moves in an earthquake is important for engineers, a network of about 200 instrument has been set up in earthquake areas. These instruments are designed to record the true acceleration of the ground and operate on a ..... from one to one hundred percent of the acceleration of gravity. The instruments are located not only at ground level but also at mid-height and at the top of buildings.

1) epicentre
2) range
3) scale
4) amplitude

39 . By ..... a member, its load carrying capacity increases.

1) stiffing
2) stiffinering
3) stiffinessing
4) stiffening

40 . A structure with redundant members is ..... .

1) stable
2) stable and indeterminate
3) indeterminate
4) determinate

41 . ..... of concrete is obtained using a slump test.

1) Durability 2) Humidity 3) Workability 4) Rigidity

42 . For what purpose does a topographical surveyor use a tacheometer?

1) To find out estimated slope between the instrument and a point.
2) To find the distance from the instrument to particular point.
3) To save the cost of buying and using a theodolite.
4) To save multiplying a measured distance by 100.

43 . A slab is a structural member which can be defined as a ..... .

1) horizontal plate under vertical loads
2) vertical member under compressive loads
3) slender diagonal member under tensile loads
4) long narrow horizontal member under axial loads

44 . For a homogenous anisotropically elastic solid, which one of the following statement is true?

1) The material properties are the same at every point, but different in each direction at a point.
2) The material properties are the same at every point and in every direction at a point.
3) The material properties are different at every point, but the same in every direction at a point.
4) The material properties are different at every point and in every direction at a point.

45 . If a rectangular plate is simply supported on all edges, which one of the following descriptions most closely depicts the condition of the edges of the plate.

1) The edges of the plate are built into walls.
2) The edges of the plate are sitting on four columns.
3) The edges of the plate are sitting on walls.
4) The edges of the plate are not supported in a complicated way.

(1383 M.Sc. Exam)

46 . A material is said to be *ductile* if it can undergo large, ... deformations before fracture.

1) residual 2) temporary
3) dynamical 4) permanent

47 . Properly done for a long period, ... produces stronger, more watertight concrete.

1) curing 2) vibration
3) admixture 4) reinforcement

48 . For concrete without ..... air, the duration of protection against freezing should be twice as long for maximum durability.

1) enclosed 2) entrained 3) entranced 4) entertained

49 . An aggregate is physically ..... if it retains dimensional stability under temperature or moisture change and resists weathering without decomposition.

1) hard 2) sound 3) strong 4) resistant

50 . The soil for foundations can be altered to conform to desired characteristics by ....., consolidation and or its replacement with select material.

1) vibration 2) mixtures 3) saturation 4) compaction

(1384 M.Sc. Exam)

51 . Local waves within the harbor make ..... difficult, if not possible.

1) sailing 2) anchoring 3) berthing 4) anchorage

52 . The rate of ..... of pavements is a function of the traffic using the road.

1) corrosion 2) deterioration 3) wear and tear 4) displacements

53 . The increase in carbon content of steel ..... .

1) reduces its ductility 2) reduces its strength
3) increases its density 4) increases its weldability

54 . By ..... the plate-girder web, its resistance to bulking will be increased.

1) stiffening 2) widening 3) hardening 4) stiffenering

(1386 M.SC. Exam)

55 . Earthquakes provide architects and engineers with a number of important design ..... foreign to the normal design process.

1) chart 2) criteria 3) factor 4) crucial

56 . In some countries the greater importance to the community of some types of structure is recognized by ..... requirements, such as in IRAN where all public buildings are designed for higher earthquake forces than other buildings.

1) hospital 2) structure 3) earthquake 4) statutory

57 . As some reference to seismological data may be necessary, some basic definitions are given prior to discussing the ..... studies themselves.

1) manual 2) seismic 3) seismicity 4) insufficiently

58 . By indicating the type of fault movement prevalent on a given fault, some of the characteristics of the ground motions in the fault ..... may be anticipated.

1) slightly 2) vicinity 3) distance 4) activity

59 . The basic assumptions used in analytical models are themselves models of the behaviour and should not attempt ..... without a good appreciation of them.

1) good representation 2) structural analysis 3) design requirements 4) mathematical ability

60 . The Winkler model may be more suitable for cohesionless soils but gives a poor representation of the ..... with cohesive soils.

1) rigid base 2) shear force
3) edges of the foundation 4) pressure distribution

61 . The traditional method of calculating the plastic collapse load of a steel structure is the limit analysis approach where possible collapse modes are searched to find the one that gives the ..... collapse load.

1) minimum 2) maximum 3) vertical 4) horizontal

62 . A parallel chord truss has a structural action analogous to that of a beam and the top and bottom chords are equivalents to the ..... While the posts and diagonals are equivalent to the web.

1) depth 2) flanges 3) centroid 4) neutral

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Part B: Reading Comprehension

Read the following passages carefully; then choose the correct choices.

Reading A: The Measurement of Earthquakes

Earthquakes are natural vibrations within the Earth's crust. They show that crustal movements are still taking place today. When rocks move or fracture, great pressures are produced and shock waves are transmitted through the Earth.

The waves are recorded on a seismograph and the intensity can be determined by using a scale which ranges from 1 to 10.

Three kinds of waves can be identified on a seismograph; P, or primary waves; S, or secondary waves and L, or long waves; P and S waves arrive at the seismograph station first because they travel directly through the Earth. The L waves travel along the surface of the Earth and make the biggest impression.

63 . The long waves produce the most outstanding ..... .

1) intensity
2) pressure
3) vibration
4) impression

64 . A seismograph is an instrument concerned with ..... .

1) transmission
2) great pressures
3) earthquakes
4) station

65 . The word "crust" means ..... .

1) a liquid layer
2) a solid layer
3) a non-solid layer
4) a gaseous layer

66 . The synonym of word "fracture" is ..... .

1) cleavage
2) splash
3) sprinkle
4) misplacement

67 . The ..... arrive at the seismograph station first.

1) primary waves
2) secondary waves
3) long waves
4) both 1 and 2

Reading B

68 . The observation of earthquake motion by instruments has provided basic data for studies of the natural phenomena of earthquakes as well as for earthquake-resistant design of structures and has contributed much to the progress of earth science and earthquake engineering. In particular, the development of the strong motion seismograph and the accumulation of strong motion seismograms have played a very important part in the rational design of structures.

1) Rational design of structures are indebted to the accumulation of strong motion records.
2) Strong motion seismograms do not play role in the studies of earthquake resistant design of structures.
3) Studies of the phenomena of earthquake provide data for instruments.
4) all the above.

Reading C: Road Surfacing

The choice of type and thickness of the road surface is an important part of design. The type chosen depends on the maximum loads expected, the frequency of these loads, and other factors. On some routes, because the traffic flow is very low, no surfacing is necessary; and soil serves as the finished roadway. As traffic increases, a surface of sandy clay, crushed slag, crushed stone, or a mixture of these is applied. When correctly applied, this provides a satisfactory surface for a small traffic flow. Gravel, if used for these surfaces, usually contains sufficient clay or fine material to stabilize the surface. When further stabilized by the application of calcium chloride, a gravel surface also creates less dust. Another surface is composed of Portland cement and water. When mixed into the upper few inches of the subgrade and compacted with a roller, this forms a soil/cement base which can be surfaced with bituminous materials. On the other hand, highways which have to carry large volumes of heavy vehicles must be carefully designed and must have considerable thickness.

Pavements are either flexible or rigid. Flexible pavements have less resistance to bending than rigid pavements, but both types can be designed to withstand heavy traffic. Flexible paving mixtures are composed of aggregate and bituminous materials. The latter, though sometimes obtained from petroleum products, are more usually obtained from asphalt products.

69 . Flexible paving mixtures are composed of ..... .

1) aggregate materials only
2) bituminous and clay materials
3) aggregate and bituminous materials
4) bituminous materials only

70 . Both flexible and rigid pavements can be designed to withstand ..... .

1) light traffic
2) heavy traffic
3) delicate cars
4) unheavy vehicles

71 . Flexible pavements have ..... to bending than rigid pavements.

1) more strength
2) more withstanding
3) more resistance
4) less resistance

72 . Gravel helps in ..... if it is used for surface construction.

1) stabilization
2) standardization
3) incapability
4) fragileness

73 . The important part of a road design is the choice of type and thickness of the ..... .

1) subgrade
2) road surface
3) road aggregate
4) traffic flow

74 . When some Portland cement and water are mixed together and compacted with a roller, they form a ..... .

1) finished roadway
2) gravel surface
3) bituminous material
4) soil/cement base

75 . Highways with large volumes of heavy vehicles must have ..... .

1) considerable thickness
2) a maximum load
3) sufficient crushed clay
4) a mixture of clay and crushed stone

76 . As traffic increases, a surface of sandy clay, crushed stone, and crushed slag is ..... .

1) appraised
2) applauded
3) applied
4) apprehended

77 . On some roads, no surface is necessary because ..... .

1) the traffic flow is very low
2) soil cannot serve as the finished roadway
3) there is no traffic flow at all
4) the traffic flow is very high

78 . Bituminous materials are more usually obtained from ..... .

1) paving mixtures
2) sufficient clay
3) composed aggregates
4) asphaltic products

Reading D

The movement of water in a cycle, from the oceans to the atmosphere, to the land, and then back to the sea, is called the hydrologic cycle. They interact with the atmosphere to maintain an almost constant average value of water vapor in the atmosphere. Without the balancing effect of the oceans, whole continents could be totally dry at some times and completely flooded at others.

79 . The atmosphere maintains an almost constant average value of water vapor because of .... .

1) the winter and summer temperature difference
2) the heat it receives from the oceans
3) its interaction with the oceans
4) its balancing effect

80 . In line 2, "they" refers to ..... .

1) cycles
2) oceans
3) balancing
4) atmosphere and oceans

81 . The hydrologic cycle is basically the movement of ..... .

1) atmosphere from the sea to the land
2) atmosphere from the continents to the oceans
3) water from the continents to the sea
4) water from the sea to the atmosphere, to the land, and back to the sea

82 . In line 3, "value" means ..... .

1) cost
2) amount
3) worth
4) weight

83 . In line 4, "others" refers to:

1) times
2) continents
3) oceans
4) effects

Reading E: Airport Design

Passenger Terminal Building Concept. The passenger terminal building is a focal point in the terminal area. It has a key function around which all the other supporting functions must be planned. Terminal buildings vary in size and arrangement, depending principally on the volume of traffic to be handled. The following text describes briefly the different arrangements and the factors to be considered in making a choice.

Centralized and Unit Terminals. Basically, there are two possible approaches to the arrangement of the terminal buildings. In a centralized terminal, all passengers and baggage are processed in one building. Where traffic volumes are very high (as at Tokyo International Airport), each airline may have its own separate terminal building. This is referred to as the unit terminal concept. These two concepts can be combined in various degrees. Thus, at Tokyo International Airport, there is a centralized terminal combining the activities of all foreign carriers, but the domestic carriers have their own terminal building.

A single centralized terminal building has many advantages. It represents a reasonably compact operation without the problems of transferring passengers and baggage from one terminal building to another. Thus, it is important to plan a terminal building so that it can be readily expanded as traffic grows.

Number of Levels of Operation in a Terminal Building. The decision as to whether the design of the terminal building should incorporate one, two or three levels (floors) for processing passengers and baggage is influenced primarily by the volume of traffic.

for small volumes of traffic, the one-level operation is normally much more economical than the other. The processing of passengers and baggage takes place at the level of the apron, and the entire layout is quite simple.

A two-level operation can be economically justified only at a high-traffic-volume airport. In this type of operation, arriving and departing passengers are separated. The departing passengers are usually processed on the upper level, and the arriving passengers, on the lower level. The fingers leading to the aircraft are also above the level of the apron. The principal advantage of this system is that congestion in the flow of passengers and baggage can be reduced considerably. The disadvantage is the high cost.

If an airport is to handle large volumes of international and domestic passengers, a three-level operation might be justified. One level could be used solely for international passengers, one level for domestic passengers, and the ground level for baggage and service facilities. Regardless of the scheme selected, the importance of complete flexibility in planning to permit expansion, both horizontally and vertically, causing as little interference with the original facilities cannot be overemphasized.

In the 5 following questions, choose the item in each question which, according to the reading, is not true.

84 .

1)The design of the passenger terminal building is the most important factor in planning the terminal area.
2) Airport design depends on the fact that the passenger terminal has a key function.
3) Support functions cannot be planned without taking the passenger terminal into account.
4) The number of passengers affects the type of terminal building chosen.

85 .

1) Centralized and unit terminals are basically incompatible.
2) With a low volume of traffic, more than one terminal is necessary.
3) It is not essential for each airline to have its own terminal.
4)The reading does not state that all international flights at Tokyo Airport are processed at the same terminal building.

86 . Two-level operations

1) are more expensive to run than one-level operations
2) have access "fingers" at ground level
3) ensure a smooth flow of passengers and baggage
4) are important for airports with a high volume of traffic

87 .

1) Centralized terminals do not spread their activities over a wide area.
2) Unit terminals may involve moving passengers from one terminal to another.
3) The reading does give many of the advantages of centralized terminals.
4) Terminal buildings must be designed to a fixed plan.

88 . The design of terminal buildings

1) is influenced only by the number of passengers.
2) may include up to three floors.
3) is determined partly by economic considerations.
4) takes the volume of traffic and cost factors into consideration.

Reading F

The profession of engineering takes the knowledge of mathematics and natural sciences gained through study, experience, and practice and applies this knowledge with judgement to develop ways to utilize the materials and forces of nature for the benefit of all humans.

An engineer is a person who possesses this knowledge of mathematics and natural sciences, and through the principles of analysis and design, applies this knowledge to the solution of problems and the development of devices, processes, structures, and systems for the benefit of all humans.

The end result of an engineering effort, generally referred to as design, is a device, structure, system, or process which satisfies a need. A successful design is achieved when a logical procedure is followed to meet a specific need. The procedure, called the design process, is similar to the scientific method with respect to a step-by-step routine, but it differs in goals and end results. The design process encompasses the following activities, all of which must be completed.

1) Identification of a need
2) Problem definition
3) Search
4) Constraints
5) Criteria
6) Alternative solutions
7) Analysis
8) Decision
9) Specification
10) Communication

In the majority of cases, designs are not accomplished by an engineer simply completing the 10 steps shown in the order given. As the designer proceeds through each step, new information may be discovered and new objectives may be specified for the design. If so, the designer must backtrack and repeat steps. For example, if none of the alternatives appear to be economically feasible when the final solution is to be selected, the designer must redefine the problem or possibly relax some of the criteria to admit less expensive alternatives. Thus, because decisions must frequently be made at each step as a result of new developments or unexpected outcomes, the design process becomes iterative.

89 . What does "possess" mean in the 2nd paragraph?

1) Have 2) Play 3) Postpone 4) Practice

90 . What does "encompass" mean in the 3rd paragraph?

1) Remind 2) Protect 3) Explain 4) Cover

91 . The ..... of an engineering effort of design is usually a device, or a structure which satisfies a need.

1) Application 2) Object 3) Process 4) Routine

92 . Under what circumstances the designer should possibly modify and reduce some aspects of the problem.

1) When it is difficult to justify within the budget limits.
2) When it is difficult to define the problem.
3) When it is difficult to analyze the problem.
4) When it is difficult to communicate with other designers.

Reading G: Quantity of Domestic Wastewater

In accordance with accepted engineering practice, separate domestic sewers should be designed for conveying the spent water supply from a community, the industrial wastewaters and the unavoidable amounts of groundwater and storm water infiltration to a wastewater treatment plant and disposal to a point of ultimate discharge. All waters that do not contain objectionable or potentially objectionable impurities

should be excluded from the domestic sewer system. In addition to storm water runoff and commercial and industrial cooling waters, this would include building roof, yard and foundation drains which should be excluded from the domestic sewer system by--rigidly enforced--local ordinances.

Since the domestic water supply is also used for watering lawns and washing cars and streets, the quantity of domestic wastewater is less than the water consumed by the community. Conversely under conditions reflecting excessive infiltration into the sewer system owing to high groundwater levels and poor sewer construction, the quantity of wastewater may be greater than the amount of water consumed. Owing to these influences, the quantity of wastewater flow may vary in different communities from 70 to 130 percent of the water consumed. If more exacting data are not available, it is frequently assumed that the average rate of domestic wastewater flow, including some allowance for infiltration, is equivalent to the average rate of water utilization.

The quantity of community wastewater flow will be significantly influenced by seasonal conditions, daily times and days of the week. A typical pattern of hourly flow variation would begin at midnight with a gradual decrease in flow to a minimum between 5 A.M. and 7 A.M., followed by a marked increase in flow as the daily activities of the community begin to a maximum flow between noon and 1 P.M. This is followed by a gradual decrease in flowrate through the remaining portion of the day. Positioned approximately halfway between the maximum and minimum hourly levels are the average rates of wastewater flow. This characteristic wastewater flow variation is very similar to that for community water consumption, but the peaks are commonly flatter than and lag in time over those for water usage. This is mainly due to the storage capacity available in the sewers.

93 . The origin of domestic sewage running in sewers is ..... .

1) used water only
2) used water and rain water
3) used water and infiltration from all sources
4) used water and groundwater

94 . The variation of sewage flow in sewers depends on ..... .

1) cost of water and water consumption
2) climatic effects and days of the year
3) population density
4) temperature and humidity

95 . The quantity of wastewater is usually ..... .

1) equal to quantity of water used
2) less than 70 percent of water consumption
3) more than 130 percent of water consumption
4) more than 70 and less than 130 percent of water consumption

96 . Infiltration of groundwater to sewer system depends on ..... .

1) high groundwater and poor sewer construction
2) high groundwater level
3) type and diameter of sewer
4) poor sewer construction

97 . Variations in wastewater flowrates may differ somewhat from those for consumed water owing to ..... .

1) the size of the Domestic sewage collection system
2) Wastewater characteristics
3) quantity of wastewater compared to that of water usage.
4) both 2 & 3

Reading H

The sloping face and graceful parabolic arch of the Espirito Santo Plaza--a mixed-use high-rise--are likely to make it a well-known feature of the local skyline. But the building is also notable for the strategy its designers employed to cope with floods.

The 35-story tower stands close to the edge of Biscayne Bay. The 70,000 m^2 post-tensioned concrete structure is divided into office, hotel, and residential levels, respectively, from bottom to top, each with a different column layout, says Elias Matar, the project manager for structural engineers L.E.R. Associates.

Many high-rises in similar locations are built so that the walls of the ground floor will break away during a flood. The Espirito Santo Plaza, however, is designed to keep floodwaters out, even during a 100-year flood, when the water would be 4.3 m above sea level, or 2.3 m above the building's ground floor elevation. The curtain wall is reinforced to withstand water pressure on the exterior, much like an aquarium in reverse, says Jae Chang, an architect with K.P.F.
Associates, which designed the building. The window assembly is 50 mm thick, or about twice the typical thickness, including a nearly 25 mm inner layer comprising two glass panels joined by a clear polycarbonate interlayer for added strength. In addition, the window mullions are reinforced with carbon steel.

The ground floor slab is reinforced and attached to the pile caps to resist upward hydrostatic pressures of up to 25,000 Pa, says Matar. In addition, a concrete wave trip wall about 450 mm high will be constructed on the eastern edge of the property to dissipate wave energy during a flood. In this way, Matar says, the owners obtained a flood classification for the building that allowed them to use the ground floor for habitable space.

Flat-plate construction was used for the hotel and residential floors, but slab-and-beam construction was used on the office level to achieve spans of up to 15 m. Column transfers occur at the 16th and 25th floors. On the 23rd and 24th floors, two concrete outrigger walls about 9 m high and 700 mm thick extend from the building core to the perimeter to provide additional stiffness. Now under construction, the $ 160-million project is scheduled for completion in the summer of 2003.

98 . A major difference between this building and others built in flood-prone areas is:

1) other high-rises employ break-away walls on the ground floors.
2) high-rises are not usually built near bays because of the high risk of flooding.
3) post-tensioned concrete structures have not previously been considered suitable for flood areas.
4) most such high rises designate the ground floor as living space because it can be more easily repaired after a flood.

99 . Uplift forces on the building due to flooding are resisted by ..... .

1) two concrete outrigger walls
2) a curtain wall reinforced with carbon steel
3) alternating flat-plate with slab-and-beam construction
4) a reinforced ground floor slab attached to the pile caps

100 . The article states:

1) more stiffness is obtained through the use of concrete outrigger walls.
2) the ground floor of such buildings are not usually considered habitable spaces.
3) column transfer is an effective means of improving the flood resistance of buildings.
4) that the building enjoys sufficient rigidity since it has employed flat-plate construction for upper floors.

101 . The first line of defense against flooding is ..... .

1) break-away walls on the ground floor
2) a concrete wall at the edge of the property
3) flat-plate construction on the hotel and residential floors
4) windows made of extra glass reinforced with a polycarbonate interlayer

Reading I

As noteworthy as the stadium is from a structural point of view, it might not have been built without the benefit of comprehensive water supply and reuse system. From the beginning, it was clear that meeting the new facility's increased demand for water would be a formidable task. The town of Foxborough's existing water supply system was capable of providing the stadium with approximately 380 m^3/min; the new facility would require 13,250 m^3/min. Obtaining that water required close cooperation between Foxborough and the project team. The town designed and built an on-site booster station to create a high-pressure water district that would serve not only the stadium but also other areas of the town, says Frank Dougherty, who was Rizzo Associates' lead technical manager for the water and wastewater components of the project. An elevated 3,800 m^3 on-site storage tank reinforces the water district by providing enough additional potable water to meet the stadium's needs without disrupting the town's supply. To further reduce the strain on the town's supply system, an abandoned on-site well was reactivated to satisfy all the irrigation needs of the site.

Increasing the supply of potable water to the site was an important step, but to further reduce demands on the town's resources--and again to reduce any harmful effects to the environment--the stadium designers included and innovative water reuse system that is projected to converse 42,000 m^3 per year.

During a stadium event, wastewater will be directed to underground holding tanks, from which it will then be pumped into an on-site wastewater treatment plant. Designed by Applied Water Management of Bellmead, New Jersey, the 950 m^3/day plant will treat the effluent to a high standard of quality using a membrane bioreactor filtration system with ozone treatment and ultraviolet light disinfection.

After the water is treated, it will be pumped off-site to a 1,900 m^3 reuse tank financed and built by the town of Foxborough. Treated water from the reuse tank will then go back into the stadium through a separate piping system to be used for toilet flushing. Excess reclaimed water will be directed to a 1 ha leach field for groundwater recharge. About 60 percent of all water the stadium uses during an event will come from the reuse tank, says Boiteaue. Because of the potential for future growth in the region, the wastewater treatment plant was designed to accommodate expansion to 4,900 m^3/day.

Making the public/private partnership work was essential to the success of the water system improvements. Because the town's share of the system was subject to a public bidding process, says Dougherty, it needed a longer procurement schedule. Yet the components for which the town was responsible were critical to the completion of the rest of the project.

Commissioning the interconnected water system on time in coordination with the town and the various contractors has been one of the most challenging and rewarding parts of the project, Dougherty says. Another example of a successful public/private partnership on the project was the cooperation between the

consulting engineers and the Massachusetts Highway Department (MassHighway) on the design and construction of related transportation improvements, says Chris Calnan, a senior project manager for Rizzo Associates who led the transportation infrastructure design. On the site itself, the transportation plan mitigated the conflicts between vehicular and pedestrian traffic by creating large pedestrian walkways, including four underpasses below roadways, to separate the two traffic types. Off-site, the major transportation improvements, funded by MassHighway, consisted of two grade-separated interchanges on Route 1, ramp improvements at the interchanges between Route 1 and the interstate system; and reconstruction of Route 1 in the vicinity of the stadium. The two main paths into the stadium grounds--Route 1 southbound and northbound--were separated at grade so that southbound traffic crosses under a bridge carrying the northbound traffic, eliminating the potential left-turn conflict. To provide access to the back entrance of the stadium, a concrete arch bridge having two 11 m spans crosses the Neponest River.

Rising above the north entrance to the stadium, which is scheduled for substantial completion this spring, a pair of architectural features reminds visitors that they are indeed in New England: a 24 m steel arch bridge and a steel-framed beacon, reminiscent of a coastal lighthouse. With its unique combination of structural and environmental components, including the water reuse system and the daylighting of the Neponset River, CMGI Field itself serves as a reminder that a major stadium can be designed not only to function effectively but also to be environmentally friendly.

(1383 M.Sc. Exam)

102 . A major issue affecting the success of the stadium project was:

1) How to provide the huge amount of water that the facility would use.
2) The number of people from the surrounding community who would actually use the facility.
3) How to discharge sewage from the facility into Boston Harbor without adverse environment impact.
4) How to provide adequate public transportation to the facility so that the volume of automobile traffic would be minimized.

103 . What two features of the facility does the author feel reminds people of the New England area?

1) A bridge and a beacon.
2) Steel spans and a lighthouse.
3) A water reuse system and the daylighting of the river.
4) A major stadium and an environmentally friendly design.

104 . Changes made in the transportation infrastructure off-site primarily ..... .

1) were made on the nearby interstate freeway system
2) are funded by the corporation that is constructing the stadium itself
3) provided safe pedestrian walkways that did not cross vehicular traffic
4) improved access to the stadium site while minimizing delays to through traffic

105 . From this portion of the article we can understand that ..... .

1) the stadium facility will put a major strain on the water supply for the area
2) the city of Foxborough is responsible for treating all wastewater coming from the facility
3) the major portion of the water used by the stadium during an event is used for flushing toilets
4) competition between the public and private sector with regard to the method of treating wastewater significantly slowed construction

106 . Which of the following is not a way that the stadium will use to meet its water needs:

1) Recycling treated wastewater.
2) The use of on-site well water to water the grounds.
3) Building a large water storage tank specifically for stadium use.
4) Expansion of the area's storage reservoir to increase its capacity.

107 . MassHighway funded ..... .

1) reconstruction of the interstate and pedestrian bridges on the stadium site
2) a bridge crossing the Neponset River and pedestrian bridges on the stadium site
3) reconstruction of a portion of Route 1 and a bridge crossing the Neponset River
4) an overpass for northbound Route 1 traffic and an exit ramp the interstate to the stadium grounds

Reading J: Seismic Behaviour of Soil-Structure Systems

The importance of the nature of the sub-soil for the seismic response of structures has been demonstrated in many earthquakes, but a reasonable understanding of the factors involved has only recently begun to emerge. For example, it seems clear from studies of recent earthquakes that the relationship between the periods of vibration of structures and the period of the supporting soil is profoundly important regarding the seismic response of the structure.

In the case of the 1970 earthquake at Gediz, Turkey, part of a factory was demolished in a town 135 km from the epicentre while no other buildings in the town were damaged. Subsequent investigations revealed that the fundamental period of vibration of the factory was approximately equal to that of the underlying soil. Further evidence of the importance of periods of vibration was derived from the medium sized earthquake of Caracas in 1967 which completely destroyed four buildings and caused extensive damage to many others. The pattern of structural damage has been directly related to the depth of soft alluvium overlying the bedrock. Extensive damage to medium-rise buildings (5-9 storeys) was reported in areas where depth to bedrock was less than 100 m while in areas where the alluvium thickness exceeded 150 m the damage was greater in taller buildings (over 14 storeys). The depth of alluvium is of course directly related to the periods of vibration of the soil. Considering shear waves travelling vertically through a soil layer of depth *H*, the periods of horizontal vibration of the soil are given by:

$$T_n = \frac{4H}{(2n-1)\upsilon_s}$$

where *n* is an integer, 1,2,3..., and υ_s is the velocity of the shear wave.

In order to evaluate the seismic response of a structure at a given site, the dynamic properties of the combined soil-structure system must be understood. The nature of the sub-soil may influence the response of the structure in three ways.

(i) The phenomenon of soil *amplification* may occur, in which the seismic excitation at bedrock is modified during transmission through the overlying soils to the foundation. This may cause attenuation or amplification effects.

(ii) The fixed base dynamic properties of the structure may be significantly modified by the presence of soils overlying bedrock. This will include changes in the mode shapes and periods of vibration.

(iii) A significant part of the vibrational energy of the flexibly supported structure may be dissipated by material damping and radiation damping in the supporting medium.

Items (ii) and (iii) above are investigated under the general title of *soil-structure interaction* which may be defined as the interdependent response relationship between a structure and its supporting soil. The behaviour of the structure is dependent in part upon the nature of the supporting soil and similarly the behaviour of the stratum is modified by the presence of the structure.

It follows that *soil amplification* (item (i) above) will also be influenced by the presence of the structure, as the effect of soil-structure interaction is to produce a difference between the motion at the base of the structure and the free-field motion which would have occurred at the same point in the absence of the structure. In practice however, this refinement in determining the soil amplification is seldom taken into account, the free-field motion generally being that which is applied to the soil-structure model as discussed in the following section. Because of the difficulties involved in making dynamic analytical models of soil systems, it has been common practice to ignore soil-structure interaction effects simply treating structures as if rigidly based regardless of the soil conditions. However intensive study in recent years has produced considerable advances in our knowledge of soil-structure interaction effects and also in the analytical techniques available, as discussed below.

(1384 M.Sc. Exam)

108 . During the Gediz earthquake, part of a factory was demolished because of ..... .

1) soft alluvium
2) vertical vibration
3) horizontal vibration
4) resonance phenomenon

109 . What is the predominate period (in second) of a clay soil layer at 20 m depth with a velocity of the shear wave equal 200 m/s?

1) 0.1 2) 0.2 3) 0.4 4) 0.6

110 . What is the opposite of amplification?

1) vibration 2) excitation 3) attenuation 4) signification

111 . The word refinement means the act of ..... .

1) beating 2) washing 3) purifying 4) amplifying

According to the passage J, in the 2 following sentences, choose the appropriate word for the blanks.

112 . Ideally the earthquake motion should be applied at ..... to the complete soil-structure system.

1) bedrock 2) surface 3) top of building 4) soil layer

113 . There are great uncertainties in defining a design ground motion which not only represents the nature of ..... shaking appropriate for the site, but also represents a suitable level of risk.

1) soil 2) building 3) vibration 4) earthquake

Reading K : Reaching for the Sky

The world's tallest building is scheduled to open soon and has a profile unlike that of any previous skyscraper - a tapered base topped by a series of flared segments. The great height - 508 m - and unique shape of the building posed a series of challenges for the engineers who developed its structural scheme

and had to devise a way to found the skyscraper on weak geologic formations in an area known for extreme typhoons and earthquakes.

The height of the structure presented one of the greatest challenges for engineers. Each level added to a skyscraper comes at an ever-increasing cost; in effect, the new story is added at the bottom of the building since it must include sufficient structure to carry the floors above it and include enough space to house elevator and stair extensions, plus utility risers for mechanical, electrical, plumbing and fire protection systems. An economic limit on the height of a building occurs when the cost of adding a level exceeds the revenue it will generate.

The tower was conceived as a structure encompassing 200,000 m^2 and surrounded at the base by an area called "the podium" - an additional 200,000 m^2 of retail space and basement parking. With the floor plate sizes following general office building standards, the office space requirement led to 101 levels.

Soft bedrock beneath the site is located about 40 to 60 m below clay and stiff colluvial soil layers. Building such a tall structure on this soil required extensive geotechnical sampling and investigation. The groundwater level is normally 2 m below the surface, but engineers designed the building substructure, which is five levels deep, as if the water table were at grade.

Shallow foundations could have led to excessive settlement or soil bearing failure, so the engineers designed a deep foundation to transfer the building's weight directly to bedrock. Greater loads require larger or more numerous deep foundation elements, so the engineers sought to minimize the building's dead load. A steel frame design helped to achieve this goal.

While based on concepts of culture and beauty, the design of the building also reflects the practical requirements of high-rise construction. Below the repetitive modules that flare upward, the tower has a 25-story base shaped as a truncated pyramid that offers structural benefits. A wide base provides better overturning resistance and lateral stiffness than a straight shaft, if the structural system engages the perimeter columns. The transition between the pyramidal base and its inverted pyramidal modules above gives the building a waistline of sorts.

(1384 M.Sc. Exam)

114 . From the article it can be understood that ..... .

1) the profile of the building is straight from bottom to top.
2) the profile of the building grows narrower at one point and then widen again
3) the profile of the building grows narrower at one point and then rises straight up
4) the sides of the building are straight up to the 62^{nd} level and then taper toward the center

115 . The cost of adding levels to a skyscraper ..... .

1) decreases as the number of levels increases
2) may be more than the revenue than an additional level would earn
3) includes jacking up the base of the building to add levels form the bottom
4) includes adequate structures to support the building, but not the cost of utility risers

116 . The podium of the structure ..... .

1) extends above the base of the building
2) is equal in area to that of the skyscraper itself
3) includes shopping areas but not parking facilities
4) consists of parking areas and the bedrock foundation

117 . The main reason that a steel frame design was chosen is that ..... .

1) it would minimize the dead load of the skyscraper
2) it offers the most resistance to typhoon damage
3) it would allow the designers to use a shallow foundation
4) it would decrease the overall cost and time of construction

118 . A challenge for engineers was to design the building ..... .

1) based on concepts of culture and beauty
2) taking into consideration the extremely deep water table of the area
3) to stand in an area with no bedrock and withstand earthquake and typhoons
4) to withstand earthquakes and typhoons despite the weak geology of the area

119 . The structural benefits of the shape of the building's base ..... .

1) are only realized if the building has a waistline
2) include resistance to overturning and lateral stiffness
3) were lessened because it does not engage the perimeter columns
4) were a major consideration when the shape of the building was chosen

120 . The foundation of the skyscraper is ..... .

1) a shallow mat foundation
2) steel piles driven deep into the ground
3) a series of cast-in-place concrete piles
4) a deep one that transfers the load to the bedrock

121 . The building was designed as if the water table were ..... .

1) at ground level
2) two meters below the surface
3) 40 to 60 meters below the surface
4) level with the bottom of the five-story substructure

Reading L: Effect of Design on Behavior

A structure which is designed for very much larger horizontal earthquake forces than are ordinary will have a shorter period of vibration because of its greater stiffness. The shorter period results in higher spectral accelerations, so that the stiffer structure may attract more horizontal force. Thus, a structure designed for too large force will not necessarily be safer than a similar structure based on smaller forces. On the other hand, a design, based on too small force makes the structure more flexible and will increase the relative deflections of the floor.

In general, yielding occurs first in the story that is weakest compared with the magnitudes of the shearing forces to be transmitted. In many cases this will be near the base of the structure. If the system is essentially elastoplastic, the forces transmitted through the yielded story cannot exceed the yield shear of that story. Thus, the shears, accelerations, and relative deflections of the portion of the structure above the yield floor are reduced compared with those of an elastic structure subject to the same base motion. Consequently, if a structure is designed for a base shear which is less than the maximum value computed for an elastic system, the lower story will yield and the shears in the upper stories will be reduced. This means that, with proper provision of energy absorption in the lower stories, a structure will, in general, have adequate strength provided the design shearing forces for the upper stories are consistent with the design base shear.

A significant inelastic deformation in a structure *inhibits* the higher modes of oscillation. Therefore, the major deformation is in the mode in which the inelastic deformation predominates, which is usually the fundamental mode.

(1385 M.Sc. Exam)

122 . The main message of above passage is .....

1) to design the structure for small horizontal force
2) to design the structure for greater horizontal force
3) to design for consistent shearing forces and ductility
4) to design the structure for small horizontal force

123 . The structure failure against earthquake will primarily occur in the .....

1) first floor 2) foundation 3) lowest floor 4) weakest floor

124 . The fundamental mode of vibration.....

1) governs the primary behavior of structure
2) posses greater period than higher modes
3) is most representative of major deformation of structure
4) all above

125 . What is the synonym for the word "inhibit" in above passage .....

1) exhibit 2) restrain 3) increase 4) represent

Reading M: Semi-Rigid Connections in Steel

Semi rigid connections in steel structures have been in various phases of development for over 50 years and appear to be at the genesis of utilization as the twentieth century has drawn to an end. It is believed that within 10 years there will be an international explosion of new uses and innovative applications of the semi-rigid approach.

After a century of utilization of structural steel as a practical framing material, designers are finally looking at the role of connections in frameworks with a more critical eye. In buildings, connections were expected to act as either pinned or rigid joints. In between, semi-rigid performance was too unpredictable and also not worth unraveling the additional analyses, despite obvious benefits of some weight or size reduction in the connected member. Today the onrush of technological development is removing those historical barriers and more versatility in connection design appears imminent. The reason is the pervasive development of information on a global basis which continues to shed light and provide behavior models that offer predictability, reliability, and economical options.

Perhaps the most important need today in the field of steel connection technology is a better way of classifying and labelling the different connection types in terms of the range of their practical performance. There still remains some confusion as to what is meant by "partially restrained", "flexible", or "semi-rigid" connections. It would seem that before structural designers begin utilizing such connections as part of the steel design process, they need to be reassured that they understand the effect the connection has on the structure's performance as a whole. This includes readily understood design models that provide reliability, economy of use, as well as some economical tradeoff from a value engineering point of view.

(1385 M.Sc. Exam)

126 . Design of semi-rigid connections .....

1) requires additional modeling and analysis
2) is the only reliable and economical option
3) Will be allowed within next 10 years
4) is still not practical

127 . If frameworks, connections .....

1) contribute to global performance and member sizing
2) are classified to be flexible or semi-rigid
3) are selected based on value engineering
4) are either pinned or rigid

128 . What is the best equivalent to the word "imminent".

1) Safe 2) enforcing 3) impossible 4) about to happen

129 . The most desirable perception in the framework connections is .....

1) to achieve economical solution
2) to advance the analytical techniques
3) to incorporate various choices with assurance
4) to elaborate further modeling and classification aspects

Reading N: Robot Will Stabilize Steep Slopes

A large remote controlled robot may soon be able to stabilize slopes that are prone to landslides, thereby sparing construction employees the need to expose themselves to danger on steep or unstable terrain.

Robotic technologies that were first developed to move satellites into their correct orbits are being adapted by engineers interested in preventing even small landslides, which threaten thousands of homes and lives each year. The 2m tall robot can perform a common slope – stabilizing function – drilling rods into soil.

The robot features an adjustable, rotating tool that can drill 20 m deep holes in the earth from any angle and has a separate arm with the ability to insert a series of steel rods 1,500 mm long and 73 mm in diameter into the holes. The contraption's four legs can rotate up to 110 degrees, enabling the robot to "walk", and remain stable, on very steep slopes.

Every leg has a Cartesian architecture so that one limb may extend parallel to the surface, while a second limb my go back and forth over the surface. The hydraulically powered legs can withstand vertical and lateral forces of up to 20 kN, enabling them to sustain the 3,000 kg weight of the contraption at nearly any angle.

Current plans call for the use of stability analysis software so that the robot can monitor the locations of its legs and its overall equilibrium and, if necessary, take corrective action. It will spare people the need to rappel down steep slopes or work on scaffolds at great heights. By eliminating or at least reducing the need for people to work under such conditions, the robot will contribute to increasing safety of the workers.

The designers expect to test the robot's hole – drilling capabilities this spring, with a test of its ability to make its way along unstable slopes to follow soon after.

(1386 M.SC. Exam)

130 . From this article, it can be understood .....

1) that this robot is still in the development stage.
2) that this robot is currently in use in some places.
3) that this robot is being produced in significant numbers.
4) that this robot will not be ready for testing for several years.

131 . The main purpose in the creation of such a robot is to .....

1) reduce construction time on roads in unstable areas.
2) save money in the construction of roads in unstable areas.
3) reduce the need for workers to work in dangerous positions.
4) increase understanding of satellites in stabilizing roads.

132 . The legs are designed to .....

1) inset 1,500 mm rods into the soil
2) position the robot parallel to the surface.
3) support and balance the robot while it drills into the soil.
4) carry up to 3,000 kg of weight in addition to the weight of the robot.

133 . Stabilizing the soil by inserting rods into it .....

1) helps prevent landslides.
2) prepares the soil to support a road.
3) eliminates the need for construction workers.
4) is a technique use mainly on the walls of stream beds.

134 . In this article, what is "the contraption"?

1) The robot itself.
2) the legs of the robot.
3) the drilling tool of the robot.
4) the Cartesian architecture of the robot

135 . In can be inferred from the article that .....

1) the robot will require scaffolding for support.
2) the robot must be heavy in order to be stable.
3) the robot will be satellite controlled.
4) the robot is computer operated.

Reading O:

Every year millions of cubic meters of contaminated materials are dredged from bays and ports to maintain the water's depth. This hazardous material generally ends up in landfills. In an effort to decontaminate and reuse the material, as well as conserve landfill space, experts are testing turning dredged matter into an ingredient of Portland cement.

The test uses a process called cement lock, which treats contamination in two ways. First the dredged material is inserted into a rotary kiln that reaches temperatures of 1,315°C to 1,426°C. the heat breaks down such contaminants as polychlorinated biphenyls (PCBs) into their benign constituent parts. The resulting material is then passed through a carbon filter to remove such toxins as mercury and allowed to cool. The process creates a glasslike product called Ecomelt, which is then ground into a fine powdered and added to cement to give it weight and volume. When it is blended into cement, it takes part in the curing of concrete. It is similar to granulated glass furnace slag and is very uniform and consistent.

In November and December last year, some 305 m^3 of material dredged from a harbor was treated this way and the resulting 136 Mg of Ecomelt was destined to replace shale in a concrete roadway. Sh[illegible]as to be mined, and that creates its own environmental problems. Using Ecomelt not only saves landfill sp[illegible]e, but also prevents the creation of more waste by using an already existing material as a component of ce[illegible]t.

The kiln used in the pilot test captured the contaminants from the treatment process rather than releasing them into the air. The emissions control aspects and the monitoring protocols all led to a good environmental outcome.

Ecomelt has also been tested against ASTM International's standards for compressive strength with a favorable result, and, although no long term tests have been conducted on its life cycle, the material is expected to be as durable and reliable an ingredient as furnace slag.

A commercial–scale rotary kiln that can treat up to 382, 400 m^3 of dredged material a year is being developed. Other ways of treating and reusing contaminated dredged material are also being investigated. The goal is to establish a self–sustaining new industry that regularly uses dredged material as building material.

(1386 M.SC. Exam)

136 . The main reason that material is dredged from waterways is:

1) to be used in landfills
2) to reduce contamination
3) to be used as an ingredient in Portland cement
4) to keep the water from becoming too shallow.

137 . In the cement lock process:

1) PCBs are produced.
2) the contaminated material is first heated and then filtered.
3) the dredged material is "locked" into the concrete as it dries.
4) the contaminated material is ground into powder and then filtered.

138 . Ecomelt:

1) is also a name for furnace slag.
2) has been tested for long term durability.
3) is the scientific term used for the product created by cement lock.
4) is the commercial name for the product of the cement lock process.

139 . Ecomelt is better than shale because:

1) it doesn't have to be mined.
2) it can be used in concrete roadways.
3) it does not require the use of furnace slag.
4) shale's contaminants are released into the air.

140 . It is clear from the article that the rotary kiln being developed:

1) will also filter the material.
2) will not meet the demand of the industry Ecomelt.
3) will meet environmental standards similar to those of the test kiln.
4) will also be used for other ways of disposing of contaminated material.

141 . The overall goal of the designers developing Ecomelt is:

1) to reduce environmental contamination created in the production of Portland cement.
2) to dispose of dredged material in a profitable and environmentally friendly way.
3) to find a cheaper way of producing Portland cement.
4) to find a better substitute for furnace slag and shale.

✪ ✪ ✪ ✪

APPENDIX A

"Practice Tests"

PRACTICE TEST 1
Required Time: 5 Minutes

Read the following passage and choose the correct choice.

Many chemical industries require large amounts of low-cost electrical power for their operations. Hydro power, developed in times when capital and interest costs were low, is frequently very inexpensive, but most large sources in the developed countries have been exploited, and small units produce electricity at higher cost. Hydroelectric plants must be situated where a head of water is available from a waterfall or a dam. This water is used to drive a turbine attached directly to a generator. The initial cost of a hydroelectric plant is much greater than that of a steam plant of identical size, but the operating cost is far lower.

1. What is the main topic of this passage?

1) Electrical power in developed countries
2) Hydroelectric power
3) Low-cost electrical power
4) Initial and operating costs of a hydroelectric power

2. The word "exploited" (underlined) is closest in meaning to which of the following?

1) To use or develop fully
2) To misuse
3) To misapply
4) To abuse

3. The operating cost of a hydroelectric plant is .....

1) much higher than that of a steam plant
2) almost the same as that of a steam plant
3) much lower than that of a steam plant
4) fairly lower than that of a steam plant

4. The word "identical" (underlined) is closest in meaning to which of the following?

1) The same
2) Unlike
3) Unified
4) Not like

✪ ✪ ✪ ✪✪ ✪ ✪ ✪✪ ✪ ✪ ✪

PRACTICE TEST 2
Required Time: 12 Minutes

Read the following passage and choose the correct answer.

The texture of the soil depends on the relative amounts of different-sized particles that combine to make up the soil. These particles can be as large as stone and gravel or as small as clay.

A typical clay soil is composed of approximately 60 percent actual clay, 20 percent silt, and 20 percent sand. The particles in a clay soil are so fine that it tends to be compact and interferes with the oxygen supply for plant roots. Water has trouble entering this impervious soil, and runoff is very common during rainfalls.

A typical light sandy soil is composed of approximately 70 percent sand, 20 percent silt, and 10 percent clay. The particles in a sandy soil are comparatively large, permitting water to enter the soil and to pass through it so quickly that it often carries nutrients with it and dries out very rapidly. The texture of sandy soils is generally very difficult to modify because huge amounts of organic material must be added.

A typical loam soil is composed of approximately 40 percent sand, 40 percent silt, and 20 percent clay, making and ideal garden soil. It is easily worked and retains water and nutrients, which are slowly absorbed by plant roots.

A typical adobe soil is a clay soil present in hot, dry areas of the country and is often very hard and cracked. It has all the disadvantages of a heavy clay soil and, being much drier, is more difficult to correct.

1. What is the author's main purpose in the passage?

1) To tell gardeners how to modify their soil
2) To classify soil types on the basis of their composition
3) To illustrate the effects of soil type on plant growth
4) To show how water is absorbed by different soil particles

2. In the second paragraph, the author describes the particles in clay soil as "fine" to indicate that they are ..... .

1) small in size 2) high in quality 3) free from impurity 4) delicate in shape

3. What is most likely to happen to rainwater when it falls on sandy soil?

1) It sinks in slowly; days later the soil is still saturated.
2) It sinks in quickly; a few hours later the soil is almost dry.
3) It runs off the surface and does not enter the soil.
4) It cracks the surface of the soil.

4. According to the passage, the texture of sandy soil can be improved by mixing in ..... .

1) water 2) gravel 3) chemical nutrients 4) organic material

5. According to the passage, how does the percent of clay in a sandy soil compare with the percent of clay in a loam soil?

1) There is less clay in a sandy soil.
2) There is about the same amount in both types.
3) There is more clay in a sandy soil.
4) The amount of clay varies, depending on the region.

6. In line 8 "comparatively" means ..... .

1) fairly 2) extremely 3) relatively 4) both 1&3

7. In line 10 "modify" means ..... .

1) make partial change in
2) make easier
3) both 1&2
4)make modern

8. Adobe soil differs from other clay soils in that

1) other clay soils retain less water
2) other clay soils have smaller particles
3) adobe soil has had organic material added to it
4) adobe soil is found mostly in dry climates

9. According to the passage, which type of soil has an even balance between its two principal components?

1) Clay
2) Sandy
3) Loam
4) Gravel

10. It can be inferred from the passage that the most distinguishing characteristics of adobe soil is ..... .

1) its color
2) the texture of its surface
3) the size of the soil particles
4) the number of nutrients present

✪ ✪ ✪ ✪✪ ✪ ✪ ✪✪ ✪ ✪ ✪

PRACTICE TEST 3

Required Time: 20 Minutes

Choose the best choice which completes each item.

1. For ..... reasons, timber supports may be used instead of steel supports.

1) safety 2) design 3) economical 4) several

2. Large cities require tunnels to convey ..... to treatment plants.

1) sewer 2) sewage 3) sewerage 4) water

3. There are so many regulations which ..... the design of wastewater treatment and disposal facilities.

1) affect 2) effective 3) effect 4) effecting

4. Building construction is an ancient human activity. The word "Ancient" (underlined) means ..... .

1) vital 2) ongoing 3) contemporary 4) old

5. In general, very dry ..... soils are difficult to compact.

1) cohesion 2) adhesion 3) clay 4) cohesive

6. In order to develop a new type of fire-fighting nozzle, experiments would be made at ..... .

1) Los Angeles 2) the time 3) full scale 4) the hour

7. The results of hydraulic models may have only a faint qualitative resemblance to the physical phenomena ..... in the prototype.

1) appearance 2) to appear 3) appears 4) appearing

Read the following passage and choose the correct answer.

In a few cases, the required life of a pavement is determined by external circumstances; for example, a temporary road to serve a major construction site may be designed to last for the duration of the construction works and no more. Generally, however, the matter is less than clear-cut.

The life of a pavement may be extended almost indefinitely by judiciously applied maintenance works - particularly by the provision of overlays. Techniques are available by which the condition of a pavement may be assessed and from which deductions may be made regarding the timing and nature of necessary repairs. An aim of the maintenance engineer is to identify the onset of critical conditions in the pavement - those beyond which rapid structural deterioration is likely, so that major works are necessary to restore the road to a sound condition and increase pavement life. Once this critical stage has been passed, an overlay can no longer be relied upon to provide a substantial increase in pavement life; expensive reconstruction is likely to become necessary.

A survey has been carried out of the correlation between the structural condition of a flexible pavement and defects apparent at the surface which indicated that the critical stage described above is generally ..... with a 10 mm rutting in the wheel paths or the beginning of cracking in the wheel paths. Current UK practice is to provide an overlay when these conditions, or others consistent with them, arise.

In designing a new pavement, we , therefore, define the design life as being that period of time likely to elapse before this critical condition will arise. Current UK design are based on this definition.

If such a definition of design life is to be of practical value, the designer should be aware of the implications of different choices of design life. It is possible to design a pavement with a design life of say 5,

40 or any other number of years but, in the situation where the need for a pavement is expected to remain for ever, there are arguments for and against any particular choice of pavement life.

8. What is the main topic of this passage?

1) Road surfacing
2) Design life of the pavement
3) Maintenance of the pavement
4) Roadbuilding

9. The best synonym for "circumstances" in the first paragraph is ..... .

1) situations 2) deeds 3) achievements 4) documents

10. Choose the best word for the blank in the third paragraph.

1) inconsistent 2) consistent 3) incompatible 4) frequent

11. The best synonym for "correlation" in the third paragraph is ..... .

1) connection 2) correction 3) proportion 4) disconnection

12. An aim of the maintenance engineer is to identify the ..... of critical conditions in the pavement.

1) cause 2) effect 3) rate 4) beginning

13. In line 9 "those" refers to ..... .

1) critical conditions
2) maintenance engineers
3) pavements
4) necessary repairs

14. The results of the survey to find a correlation between the structural condition and the defects apparent on the surface of pavements indicated that ..... .

1) the critical stage occurs once every five years
2) the critical stage is agreeing with a 10 mm rutting in the wheel paths
3) both (2&4)
4) the critical stage is agreeing with the beginning of cracking in the wheel paths

15. The ..... of a pavement is the period of time to elapse before critical conditions arise.

1) maintenance 2) repair time 3) design life 4) design period

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

PRACTICE TEST 4

Required Time: 15 Minutes

Choose the word or phrase that is closest in meaning to the underlined word or phrase.

1. The lack of water has been a major factor in industrial growth.

1) use
2) abuse
3) shortage
4) distribution

2. At the end of the last ice age, the Earth's climate began to change.

1) biological balance
2) rotation
3) weather condition
4) geography

3. The primary function of a ..... dam is to raise the water level.

1) diversion
2) flood detention
3) flood retention
4) coffer

Read the following passages and choose the correct answer.

Reading A

Concrete is produced by mixing together cement, water, and mineral aggregates. This mixture is placed into a suitable mold, compacted, and allowed to harden. It is somewhat similar to building stone, but has the advantage that can be easily molded into any suitable shape and also that it can be conveniently reinforced with steel rods to improve its structural properties.

4. According to the text, ...

1) concrete is superior to building stone
2) building stone is a more suitable building material than concrete
3) neither concrete nor building stone is a suitable construction material
4) the structural properties of building stone can be improved

5. In line 2, The word "somewhat" (underlined) is closet in meaning to which of the following?

1) Value
2) To some extent
3) More or less
4) both(2&3)

Reading B

The effect of earthquake ground shaking is to make buildings vibrate. Low, stiff buildings vibrate with relatively high frequencies of 5 to 10 cycles per second and tall buildings vibrate with low frequencies. The earthquake-induced forces, that a building experiences, depend especially upon the mass of the building and upon the frequency of vibration. Although a 20-story building may have twice the mass of a 10-story building, its natural frequency will be smaller and, hence, the earthquake forces will be less than twice of those of a 10-story building. This is quite different from the forces by wind storms which will be twice as great for the 20-story building as for a 10-story building of the same width. In other words, for sufficiently tall buildings the wind forces will be greater than the earthquake forces. This leads to the interesting consequence that very tall buildings which have been designed to resist wind forces will also be able to

withstand a strong earthquake. Although New York City does not have earthquake design requirements, its skyscrapers will be relatively safe in the event of an earthquake because they have been designed to resist wind forces; however, buildings of 10 stories or less will not be safe.

The most hazardous buildings during an earthquake are those constructed of brittle materials such as brick or stone masonry. These brittle materials are weak in tension and when overstressed during an earthquake will break and collapse. Such brittle materials of construction were the cause of the high death toll in Agadir, Morocco. In California such buildings are not permitted, but are made of steel beams and columns, or reinforced concrete. Such properly-designed buildings, even when overstressed during a strong earthquake, will not fail and will not be hazardous to the occupants.

6. What does the passage mainly discuss?

1) The earthquake-induced and wind-induced forces that different buildings experience.
2) Behavior of buildings during earthquakes.
3) The effect of earthquakes on low and stiff buildings.
4) The safety of skyscrapers during earthquakes and wind storms.

7. The most dangerous structures during an earthquake are those made of ..... .

1) brick or stone masonry
2) reinforced concrete
3) steel beams and columns
4) stone and concrete

8. The skyscrapers of New York City are relatively safe in the event of an earthquake since they ..... .

1) have earthquake design requirements
2) have been designed to resist vibration
3) fail to withstand wind storms
4) have been designed to resist wind forces

9. The effect of earthquake ground shaking makes tall buildings vibrate with ..... .

1) frequencies less than 5 cycles per second
2) high frequencies of 10 to 15 cycles per second
3) high frequencies of 5 to 10 cycles per second
4) the same frequencies as that of low, stiff buildings

10. The second paragraph mainly discusses ..... .

1) safety of buildings in relation to the design and material of construction
2) hazardous buildings made in Agadir, Morocco.
3) destiny of occupants when buildings are overstressed during an earthquake.
4) buildings in California which are made of steel beams or reinforced concrete

11. The best synonym for "hazard" is ..... .

1) toll
2) weak
3) venture
4) brittle

12. The word "toll" is closest in meaning to which of the following?

1) Cost in life
2) Grievous price
3) Charge for health
4) Death of the bishop

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

PRACTICE TEST 5
Required Time: 20 Minutes

Reading A

In seismic zone, buildings are designed to resist the earthquake forces that are specified by the building code. The magnitudes of these forces depend on the mass of the building, upon the proportions of the building, upon the type of construction, and upon the functions of the building. These specified forces are intended to provide a strength commensurate with the vibrational forces the building will experience during a moderately strong earthquake. In the event of very strong earthquake, it is expected that the building will be overstressed and will be somewhat damaged, but there should be no injury or loss of life. To design a building so as to sustain damage in the event of strong ground shaking is justified by economic considerations. The very strong ground shaking occurs so infrequently that the cost of repairing damage is less than the investment required to provide more earthquake resistance.

For very important structures, the consequences of severe damage or failure may be so great that special precautions are required. Nuclear reactor power plants, large dams, long suspension bridges, and exceptionally tall buildings are examples of such special structures. Such structures are not designed according to ordinary building code requirements but are given special consideration. Their potential earthquake vibrations are analyzed, and the maximum stress and displacements produced by earthquake ground motions are determined by means of digital computers. They accordingly are given more earthquake resistance than ordinary buildings. For example, in the world, nuclear reactor power plants are designed to resist the strongest expected ground shaking without being overstressed.

Buildings are sometimes damaged during earthquakes because of failure of the ground upon which the building is founded. The passage of seismic waves causes the ground to vibrate, and the associated stresses and strains may produce a failure of the ground itself. In Alaska in 1964, this took the form of large landslides that destroyed many buildings.

In the city of Niigata in Japan, a different type of soil failure was produced by the earthquake of June, 1964. This seacoast city was built on an alluvial plane of saturated sandy soil. During the earthquake, the stresses produced by the seismic waves caused the sand grains to shift slightly relative to each other and to become more closely packed. When this happened, the weight of the superposed soil and buildings was temporarily supported by the water that filled the spaces between the sand grains and, in effect, for a few minutes the ground became like quicksand. In this condition, it no longer had the strength to support the buildings, and they settled into the ground. Some of the buildings sank as much as one meter, and many buildings tilted like the leaning Tower of Pisa, and one six-storey building rolled over completely without being otherwise damaged.

In I.R. of IRAN, it is now common to build large dams of earth; for example, in Khuzestan, the new KARKHEH Dam has a height of 127 meters. An earth structure such as this must be analyzed with great care and must be designed to withstand the vibratory stresses and strains produced by earthquakes. At present, there is a great interest in the world, in studying the earthquake behavior of soils and earth structures.

According to the reading A, determine the best choice in the following sentences.

1. What is the main topic of this passage?

1) Design of buildings to resist earthquakes.
2) Landslides during the Niigata earthquake of June, 1964.
3) Different types of soil failure caused by earthquakes.
4) Consequences of severe damage or failure during earthquakes.

2. In seismic zone, buildings are designed to ..... .

1) have mass and proportions which will not be affected by earthquakes.
2) meet certain economic criteria only.
3) provide a strength commensurate with any forces they will experience.
4) suffer damage during a very strong earthquake.

3. Certain special structures are ..... .

1) analyzed during earthquakes to discover their vibrations.
2) built to higher specifications than those of the normal building codes.
3) determined by the use of digital computers.
4) designed to resist all possible ground shaking.

4. In the Niigata earthquake of 1964, damage was caused by ..... .

1) failure of construction techniques.
2) changes in the soil: water ratio.
3) buildings rolling over.
4) the weight of superposed soil and buildings.

5. Soil failure may take the form of ..... .

1) underground collapse
2) landslides
3) both of these (1&2)
4) neither of these (1&2)

6. In designing structures like the Karkheh Dam, the most important factor is ..... .

1) height
2) mass
3) seismic influences on soil structures
4) vibratory stresses produced by earthquakes.

7. In line 5, "moderately" (underlined) means ..... .

1) comparatively
2) both (1&3)
3) relatively
4) extremely

Reading B: Storage Dams

The dams discussed here are normally used to store water for supplementary irrigation, domestic water supply, recreational purposes, stock ponds, or auxiliary flood control in tributaries of main streams. Their operation will rarely require continuous attention, except at seasonal intervals. If warranted, there should be an operator's house with telephone service, at or near the control works of dams.

The stimulation and protection of growth of vegetative cover to retard erosion on the slopes of the reservoir, on the borrow pits used in construction, and on the slopes of earthfill dams not otherwise protected is an important item of maintenance to which careful attention should be given. This cover is an essential item of protection against erosion and sloughing of banks, as well as beautification of the structure, and may have an important influence on the cost of repairs.

Expert advice on suppression of algae growth in reservoirs should be obtained and followed, and no chemicals should be introduced into a reservoir without competent advice.

Based on Reading B, choose the one which best completes each sentence in the three following questions:

8. Chemicals ..... used in a reservoir ..... the algae growth.

1) can be, to stop
2) can be, to speed up
3) should not be, except for
4) should not be, as it damages

9. The stimulation and protection of growth of vegetative cover ..... .

1) needs careful attention
2) may increase the cost of repairs
3) is an important item of maintenance and cost reduction
4) is only desired on the slopes of earthfill dams not otherwise protected

10- What is meant by recreational in the Reading?

1) Artificial 2) Agricultural 3) Entertainment 4) To create again

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

PRACTICE TEST 6

Required Time: 15 Minutes

Reading A: Soil Stabilization

Motorways are usually made of reinforced concrete about 20 to 25 cm thick, placed on a granular sub-base or base course, which in turn is placed on a well-compacted earth sub-grade. Sometimes rock which has been excavated can be crushed and used for the base-course; at other times, a lean concrete base-course is used. The base course can be created by soil stabilization, i.e. increasing the bearing strength of the existing subsoil, rather than by replacing it with another material. This process consists of mixing a percentage of stabilizing agent-which may be cement, bitumen or other substances into the soil.

The engineer has classified soils into four principal groups according to particle size: gravel, comprising particles from 60 mm down to 2 mm; sand, comprising particles from 2 mm to 0.06 mm; silt , comprising particles from 0.06 mm to 0.002 mm in size; and clay, having particles less than 0.002 mm in size. Soils rarely consist of just one of these groups; usually there is a mixture resulting in compound soils, such as sandy silt or sandy clay. The engineer is more concerned with the grading. A soil may be well-graded, uniformly graded or poorly graded. A well-graded soil has a particle size distribution which includes a wide range of sizes without an excess or deficiency of any size, A uniformly graded soil is one having a high percentage of one certain size of particle and a low percentage of other sizes. A poorly graded soil is one containing an excess of some sizes and a deficiency in others. It is a poorly graded soil that exhibits weakness. This is because the voids between the particles existing in excess are not filled by the next smaller size particles. The result is a soil containing more water and air than is desirable and which will not compact. The stabilizing agent has little effect on a poorly graded soil unless material having the missing particle sizes is added and the whole mixture thoroughly compacted.

1. According to the reading A and with reference to the table below, which soil is well graded?

Particle size in millimeters

	60-2	2-0.06	0.06-0.002	less than 0.002
Soil A	6%	7%	8%	79%
Soil B	25%	28%	23%	24%
Soil C	10%	45%	5%	40%

1) soil A 2) soil B 3) soil C 4) soil A, B

2. According to the reading A, the four following statements are all true, but choose the one which you consider to be most important?

1) Crushed rock can be used for the base course.
2) Cement and bitumen can act as stabilizing agents.
3) A well-graded soil does not have an excess of any particular particle size.
4) Stabilizing agents have little effect on poorly graded soil unless material having the missing particle sizes is added.

3. According to the reading A, which expression is true?

1) Soils usually consist of one principal soil group.
2) Stabilizing agents have considerable effect on a poorly graded soil.
3) Base courses can be created by increasing the bearing strength of the existing subsoil.
4) The engineer is less concerned with the grading than the soil group.

4. According to the reading A, which expression is false?

1) Soils rarely consist of only one size group.
2) The base course can be created by soil stabilization.
3) The grading of a soil is more important to an engineer than particle size.
4) A poorly graded soil includes a wide range of particle sizes without an excess or deficiency of any one size.

Reading B: Surge Tanks

It is uneconomical to design long pipelines for pressures created by water hammer or to operate a valve slowly enough to reduce these pressures. Usually a surge tank is installed close to valves at the end of long conduits. A surge tank is a tank containing water connected to the conduit; the water column, in effect, floats on the line.

When a valve is suddenly closed, the water column in the line rushes into the surge tank. The water level in the tank rises until the increased pressure in the surge tank overcomes the momentum of the water. When a valve is suddenly opened, the surge tank supplies water to the line when the pressure drops. The section of the pipe between the surge tank and the valve must still be designed for water hammer; however, the closure time to reduce the pressures for this section will be only a fraction of the time required without the surge tank.

Although a surge tank is one of the most commonly used devices to prevent water hammer, it is by no means the only device. Various types of relief valves and air chambers are widely used on small diameter lines, where the pressure of water hammer may be relieved by the release of a relatively small quantity of water.

Based on reading B, choose the one which best completes each sentence in the 3 following questions:

5. The objective for usage of surge tank is ..... .

1) to optimize the cost and design of pipelines
2) to increase the water pressure in the pipelines
3) to reduce the pressure quickly in long pipelines
4) to supply water when the water pressure is not enough

6. To prohibit water hammer ..... .

1) small quantity of water has to be released
2) the surge tank is the only recommended device.
3) besides surge tanks, special types of valves and air chambers are used
4) depending on pipeline diameter, various types of relief valves and air chambers are introduced

7. Water hammer ..... .

1) needs strong pipelines
2) may hit the surge tank and damage it
3) helps to increase pressure and supply water easily
4) is the result of momentum of water and should be considered in the long pipeline design

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

PRACTICE TEST 7

Required Time: 15 Minutes

Read the following passages and answer the questions.

Reading A

Arrangements should be made, immediately following the ...1... of a dam, for periodic ...2.... of the structure and all of the operating ....3.... . Adequate measures to accomplish this are usually taken on the more important structures but frequently are neglected on small dams.

1. 1) completion 2) maintenance 3) repair 4) restore

2. 1) inspect 2) inspector 3) inspecting 4) inspection

3. 1) processes 2) methods 3) equipment 4) procedures

Reading B

Because so few real flows can be solved exactly by analytical methods alone, the development of fluid mechanics has depended heavily on experimental results. Solutions of real problems usually involve a combination of analysis and experimental information. First, the real physical flow situation is approximated with a mathematical model that is simple enough to yield a solution. Then experimental measurements are made to check the analytical results. Based on the measurements, refinements in the analysis are made. The experimental results are an essential link in this iterative process. Empirical designs, developed without analysis or careful review of available experimental data, are often high in cost and poor or inadequate in performance.

4. According to the text, ...

1) experimental results are available for all fluid flows.
2) many fluid flows can be solved by analytical methods only.
3) analytical methods are available for most real fluid flows.
4) only a small number of real fluid flows can be solved by mathematical techniques alone.

5. According to the author, ...

1) designs made based merely on empirical concepts are not recommended.
2) experimental results are as essential as empirical concepts in a design.
3) empirical designs are as useful as designs based on experimental results.
4) empirical concept designs are always invalid and must be avoided due to poor performance.

6. The author believes that ..... .

1) experiments are used to verify the analytical results.
2) mathematical models justify experimental measurements.
3) the experimental results are necessary to obtain the analytical results.
4) the analytical results and mathematical models must be obtained to verify the experimental results.

Reading C

In essence, construction is combination of organizations, engineering science, studied guesses, and calculated risks. From their very nature, construction operations must be performed at the site of the project. Construction is a dynamic, restless, compelling business.

Two basic factors, however, help to stabilize the construction business. In prosperous tim[illegible]here is immediate and widespread increase in demand for contractor's services from both government a[illegible] private

industry; during periods of recession, Federal and state governments tend to accelerate public-works programs to "offset" economic downswings. Another inherent element of stability is the industry's mobility, making it less subject to regional economic slumps.

Construction is essentially a service industry. The construction of a project involves thousands of details and complex, interwoven relationships among owners, architects, engineers, general governmental bodies and agencies, labor, and others.

Technological advances are resulting in more complex facilities. Hence, there is increasing necessity for skilful coordination of all construction operations to attain maximum efficiency, speed, and economy. Thus, the professional function of managing and coordinating construction operations and performing the work with his own experienced organization makes the contractor a key figure in the economy.

7. The best title for above passage is:

1) Stability of Industry
2) Role of Contractors
3) Construction Management
4) Construction and Economy

8. Complex facilities ..... .

1) are more efficient, economical and speedy
2) require skilled project operation management
3) are resulting in more technological advances
4) stabilize the regional economy and Federal governments

9. The word "offset" in above passage means ..... .

1) offend 2) grow up 3) demolish 4) counterbalance

10. During periods of recession, ...

1) industry's mobility is more effective
2) the contractors are key figures in the economy
3) government should stabilize construction projects
4) public-works programs should be further supported by governments

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

PRACTICE TEST 8
Required Time: 12 Minutes

Read the following passage and choose the correct answer.

Prestressed concrete, when properly designed and fabricated, can be virtually crack-free under normal service loads as well as under moderate overload. This is believed to be an advantage in structures exposed to corrosive atmospheres in service. Prestressed concrete efficiently utilizes high-strength concretes and steels and is economical even with long spans. Reinforced concrete flexural members cannot be designed to be crack-free, cannot efficiently utilize high strength concrete (except in compression members), and are not economical for long-span flexural members.

A number of other statements can be made in favor of prestressed concrete, but there are bona fide objections to the use of this material under specific conditions. Among the more significant advantages of this material are that in many structural applications, prestressed concrete is lower in first cost than other types of construction, and, in many cases, if the reduced maintenance cost inherent in concrete construction is taken into account, prestressed concrete offers the most economical solution. Its benefits have been well confirmed by the very rapid increase in the use of linear prestressed concrete that has taken place in the United States since its introduction in the late 1940s. It is well known that the advantages of low first cost and maintenance (real economy) outweigh intangible advantages that may be claimed except for very special conditions.

It is generally considered impractical to use post-tensioning on very short members because the elongation of a short tendon (during stressing) is small and requires very precise measurement. In addition, some post-tensioning systems do not function well with very short tendons. A number of short members can be made in series on a pretensioning bench without difficulty and with no need for precise measurement of the tendon elongation during stressing; relatively long tendon lengths result from making a number of short members in series.

Because post-tensioning tendons can be installed in holes performed in precast concrete elements or segments, they can be used to prestress a number of small precast elements together to form a single large structural member. This technique, frequently referred to as segmental construction.

The cost of post-tensioned tendons, measured in either cost per pound of prestressing steel or cost per pound of effective prestressing force, generally is significantly greater than the cost of pretensioned tendons, because of the larger amount of labor required in placing, stressing, and grouting (where applicable) post-tensioned tendons, as well as the cost of special anchorage devices and stressing equipment. On the other hand, a post-tensioned member may require less total prestressing force than an equally strong pretensioned member.
For this reason, one must be careful when comparing the relative costs of these modes of prestressing.

Post-tensioning generally is regarded as a method of making prestressed concrete at job site, yet post-tensioned beams often are made in precasting plants and transported to the job site. Prestressing often is thought of as a method of manufacturing that is limited to permanent precasting plants.

1. It can be shown that in general ..... concrete is more economical than reinforced concrete.

1) post-tensioning
2) prestressing
3) cast-in-place
4) prestressed

2. According to the passage, one advantage of prestressed concrete is that it ..... .

1) can be crack free
2) requires less material
3) expedites the construction time
4) requires more skilful labor

3. Segmental construction is one form of ..... .

1) precasting
2) pretensioning
3) post-tensioning
4) reinforced concrete

4. For a given member, prestressing usually requires ..... prestressing force compared to post-tensioning.

1) less
2) more
3) the same amount of
4) very little

5. In general, post-tensioning is ..... prestressing.

1) less expensive than
2) more expensive than
3) as expensive as
4) identical to

6. The word "virtually" in line 1 is closet in meaning to ..... .

1) simply
2) superficially
3) nearly
4) efficiently

7. The word "utilize" in line 3 is closest in meaning to which of the following?

1) To apply
2) both (3&4)
3) To make good use of
4) To misuse

8. In many structural applications, prestressed concrete is lower in ..... cost than other types of construction.

1) variable
2) manufacturing
3) maintenance
4) initial

9. According to the text, which of the following is NOT true?

1) Reinforced concrete flexural members are always free of cracks.
2) Prestressed members function better than reinforced concrete members in highly corrosive atmosphere.
3) Post-tensioning is regarded as prestressing at job site.
4) Considering the initial and maintenance costs, reinforced concrete is less economical than prestressed concrete.

✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪ ✪

APPENDIX B

"Suffixes & Prefixes"

Word formation - Suffixes

AFFIXES

PREFIXES + (STEM) + SUFFIXES

SUFFIXES

NOUNS	VERBS	ADJECTIVES	ADVERBS
-ance	-ize	-able	-ly
-ence	-ate	-ible	
-or	-fy	-less	
-er	-en	-ic	
-ist	-ify	-ical	
-ness		-ish	
		-ive	

Noun-forming suffixes

SUFFIX	MEANING	EXAMPLES
-ance	state	performance
-ence	quality of	independence
-er, -or	a person who a thing which	programmer, operator compiler, accumulator
-ation -tion	the act of	execution
-ista -yst	person who	analyst, typist
-ness	condition of	cleanliness
-ion	action/state	conversion
-ing	activity	multiplexing
-ment	state, action	measurement
-ity	state, quality	electricity
-ian	pertaining to	electrician
-ism	condition/state	magnetism
-dom	domain/condition	freedom
-ship	condition/state	relationship,partnership, friendship
-ary		binary

Verb-forming suffixes

SUFFIX	MEANING	EXAMPLES
-ize	to make	computerize
-ate		automate,activate, calculate
-fy		simplify
-en		harden, widen

Adverb-forming suffix

SUFFIX	MEANING	EXAMPLES
-ly	in the manner of	electronically, logically, comparably, helpfully

Adjective-forming suffixes

SUFFIX	MEANING	EXAMPLES
-al	have the quality of	computational, logical
-ar		circular
-ic		magnetic
-ical		electrical
-able	capable of being	comparable
-ible		divisible
-ous	like, full of	dangerous
-ious		religious
-ful	characterized by	helpful
-less	without	careless
-ish	like	yellowish
-ed	having	computed, punched
-ive	quality of	interactive
-ing	to make or do	programming,coding, processing, multiplexing

Word formation - prefixes

PREFIXES

NEGATIVE AND POSITIVE	SIZE	LOCATION	TIME AND ORDER	NUMBER
un-	semi-	inter-	pre-	mono-
non-	mini-	super-	ante-	bi-
in-	micro-	trans-	fore-	hex-
dis-		ex-	post-	oct-
re-		extra-		multi-
		mid-		

Negative and positive prefixes

PREFIX	MEANING	EXAMPLES
Negative		
un-	not,	unmagnetized, unpunched
in-	not good enough	incomplete
im-		impossible
il-		illegal
ir-		irregular, irrelevant
non-	not connected with	non-programmable, non-impact
mis-	bad, wrong	mispronounce
dis-	opposite feeling	disagree
	opposite action	disconnect
anti-	against	antisocial
de-	reduce, reverse	demagnetize, decode
under-	too little	underestimate
Positive		
re-	do again	reorganize
over-	too much	overheat, overuse

Prefixes of size

PREFIX	MEANING	EXAMPLES
semi-	half, partly	semiconductor
equi-	equal	equidistant
maxi-	big	maxicomputer
micro-	small	microcomputer
mini-	little	minicomputer
macro-	large	macroeconomics
mega-		megabyte

Prefixes of location

PREFIX	MEANING	EXAMPLES
inter-	between, among	interface, interactive
super-	over	supersonic
trans-	across	transmit, transfer
ex-	out	exclude, extrinsic
extra-	beyond	extraordinary
sub-	under	subschema
infra	below	infra-red
peri-	around	peripheral

Prefixes of time and order

PREFIX	MEANING	EXAMPLES
ante-	before	antecedent
pre-		prefix
prime-	first	primary, primitive
post-	after	postdated
retro-	backward	retroactive

Prefixes of numbers

PREFIX	MEANING	EXAMPLES
semi-	half	semicircle
mono-	one	monochromatic
bi-	two	binary
tri-	three	triangle
quad-	four	quadruple
penta	five	pentagon
hex-	six	hexadecimal
septem-	seven	September
oct	eight	octal
dec-	ten	decimal
multi	many	multiprogramming, multiplexor

Other prefixes

PREFIX	MEANING	EXAMPLES
pro-	for	program
auto	self	automatic
co -	together	coordinate
neo-	new	neoclassical
pan-	all	Pan-American

✪ ✪ ✪ ✪

APPENDIX C

"Answer Key"

SECTION 2 (M.Sc. EXAM's QUESTIONS)

Part A: Vocabulary & Technical Terms

1- (1)	2- (1)	3- (4)	4- (2)
5- (3)	6- (2)	7- (1)	8- (3)
9- (4)	10- (1)	11- (3)	12- (2)
13- (2)	14- (4)	15- (1)	16- (4)
17- (3)	18- (2)	19- (2)	20- (1)
21- (4)	22- (2)	23- (3)	24- (4)
25- (2)	26- (4)	27- (2)	28- (3)
29- (1)	30- (1)	31- (2)	32- (3)
33- (1)	34- (4)	35- (1)	36- (2)
37- (1)	38- (3)	39- (4)	40- (3)
41- (3)	42- (2)	43- (1)	44- (1)
45- (3)	46- (4)	47- (1)	48- (2)
49- (2)	50- (4)	51- (3)	52- (2)
53- (1)	54- (1)		

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55- (2)	56-(4)	57-(3)	58-(2)
59-(2)	60-(4)	61-(1)	62- (2)

Part B: Reading Comprehension

READING A

63- (4)	64- (3)	65- (2)	66- (1)
67- (4)			

READING B

68- (1)

READING C

69- (3)	70- (2)	71- (4)	72- (1)
73- (2)	74- (4)	75- (1)	76- (3)
77- (1)	78- (4)		

READING D

79- (3)	80- (2)	81- (4)	82- (2)
83- (1)			

READING E

84- (2)	85- (2)	86- (2)	87- (4)
88- (1)			

READING F

89- (1)	90- (4)	91- (2)	92- (1)

READING G

93- (3) 94- (2) 95- (4) 96- (1)
97- (1)

READING H

98- (1) 99- (4) 100- (1) 101- (2)

READING I

102- (1) 103- (1) 104- (4) 105- (3)
106- (4) 107- (3)

READING J

108- (4) 109- (3) 110- (3) 111- (3)
112- (1) 113- (4)

READING K

114- (2) 115- (2) 116- (2) 117- (1)
118- (4) 119- (2) 120- (4) 121- (1)

READING L

122- (3) 123- (4) 124- (4) 125- (2)

READING M

126- (1) 127- (1) 128- (4) 129- (4)

READING N

130- (1) 131- (3) 132- (3) 133- (1)
134- (1) 135- (4)

READING O

136- (4) 137- (2) 138- (4) 139- (1)
140- (3) 141- (2)

APPENDIX A (PRACTICE TESTS)

PRACTICE TEST 1

1- (2) 2- (1) 3- (3) 4- (1)

PRACTICE TEST 2

1- (2) 2- (1) 3- (2) 4- (4)
5- (1) 6- (4) 7- (1) 8- (4)
9- (3) 10- (2)

PRACTICE TEST 3

1- (3) 2- (2) 3- (1) 4- (4)
5- (4) 6- (3) 7- (4) 8- (2)
9- (1) 10- (2) 11- (1) 12- (4)
13- (1) 14- (3) 15- (3)

PRACTICE TEST 4

1- (3)	2- (3)	3- (1)	4- (1)
5- (4)	6- (2)	7- (1)	8- (4)
9- (1)	10- (1)	11- (3)	12- (1)

PRACTICE TEST 5

1- (1)	2- (3)	3- (2)	4- (2)
5- (3)	6- (4)	7- (2)	8- (1)
9- (3)	10- (3)		

PRACTICE TEST 6

1- (2)	2- (4)	3- (3)	4- (4)
5- (1)	6- (3)	7- (4)	

PRACTICE TEST 7

1- (1)	2- (4)	3- (3)	4- (4)
5- (1)	6- (1)	7- (3)	8- (2)
9- (4)	10- (4)		

PRACTICE TEST 8

1- (4)	2- (1)	3- (3)	4- (2)
5- (2)	6- (3)	7- (2)	8- (4)
9- (1)			

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