PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Semester: Odd Sem. 2019-20
Course Code: CIV 203
Course Name: ENGINEERING GEOLOGY
Program & Sem: B.Tech. (CIV) & III

Date: 30.09.2019
Time: 2:30PM to 3:30PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries four marks. (3Qx4M=12M)

1. Define the following terms: (C.O.NO. 1) [Knowledge]
   a. Solar system
   b. Moho discontinuity
   c. Volcano
   d. Earthquake

2. Write four advantages and dis-advantages of volcanoes?
   (C.O.NO. 1) [Knowledge]

3. Explain four differences between tectonic and non-tectonic earthquakes?
   (C.O.NO. 1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries eight marks. (2Qx8M=16M)

4. "A seismic zoning map for engineering use is a map that specifies the levels of ground motions for earthquake-resistant design, and thus it differs from a seismicity map, which provides only the occurrence of earthquake information." What do you understand from the above statement? Explain the various Seismic zones in India and describe their importance in civil engineering profession?
   (C.O.NO.1) [Comprehension]

5. The origin of the Earth is the story of the birth of plant earth. There are number of hypothesis proposed on the beginning of our universe / solar system. What are the various theories proposed and explain, with a neat diagram the nebular hypothesis on the origin of the earth? (C.O.NO.1) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries six marks. (6Qx2M=12M)

6. With a neat labelled diagram describe the internal structure of the earth? (C.O.NO.1) [Comprehension]

7. What are the purpose of an earthquake resistant structures? Explain the shock absorber method to protect buildings from the intense shaking of an earthquake? (C.O.NO.1) [Comprehension]

SCHOOL OF ENGINEERING

Semester: Odd

Course Code: CIV 203

Course Name: Engineering Geology

Date: 30/09/2019

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
		Module 1 / Introduction to Earth Science and Engineering Geology	K			C			A			
1	1	1	1	4	1	-	-	-	-	-	-	4
2	1	1	1	4	1	-	-	-	-	-	-	4
3	1	1	1	4	1	-	-	-	-	-	-	4

4	1	1	-	-	-	1	8	2	-	-	-	8
5	1	1				1	8	2	-	-	-	8
6	-	-	-	-	-	-	-	-	1	6	2	6
7a /b	-	-	-	-	-	-	-	-	1	6	2	6
	Total Marks											40

K =Knowledge Level C = Comprehension Level. A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

[I hereby certify that All the questions are set as per the above guide lines. Dr. Chandankeri]

Reviewers' Comments

SCHOOL OF ENGINEERING

SOLUTION

Date: 30/9/2019
Time: 2:30 to 3:30 pm
Max Marks: 40
Weightage: 20%

Semester: Odd
Course Code: CIV 203
Course Name: Engineering Geology

Part A (3Q x 4M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1a	The Sun at the centre, and planets & planet like masses (Asteroids, Meteors and Comets) around the sun are called as **Solar system**	1 mark for definition	2 minutes
1b	**The Mohorovicic discontinuity:** This is the 1st major discontinuity in seismic record and occurs 30 to 40 km below the continents, 5 to 6 km under the oceans and 60 to 70 km beneath the mountains. The P & S waves reaching these depths undergo sharp increase in the velocity.	1 mark for definition	2 minutes
1c	A volcano is an opening in the Earth's crust through which molten rock, rock fragments and hot gases erupt from a magma chamber below the surface.	1 mark for definition	2 minutes
1d	An earthquake (also known as a quake, tremor or temblor) may be described as a sudden shaking phenomenon that creates irregularities on the earth's surface.	1 mark for definition	2 minutes
2	**Advantages** | **Dis-advantages**	2 marks for each types	6 minutes

	• Produces rich soil for farming • The volcanic ash helps farmers to have fertilized soil and, therefore allows them to grow bumper crops. • Precious metals are found near volcanoes, because volcanoes move diamonds and metals towards the surface. • Volcanoes provide resources for energy extraction, also known as geothermal resources.	• The running lava moves at a steady pace, destroying everything in its path. • Poisonous gasses can be far more dangerous than lava flows • Volcanic landslides can destroy nearby villages • The ash can clog up engines of cars and planes		
3	**Tectonic earthquakes** • Due to disturbances of geological formations taking place in the earth's interior. • Generally they are less frequent • more intensive • More destructive in nature.	**Non-tectonic earthquakes** • Due to external or surficial causes • They are very frequent • Minor in intensity • Generally not destructive in nature	2 marks for each types	6 minutes

Part B

(2Q x 8 = 16 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	The zoning map is mainly used by the Department of Disaster Management of the different state governments in the country. The map helps in planning for a natural disaster studies like earthquake. An Indian seismic zoning map assists one in identifying the lowest, moderate as well as highest hazardous or earthquake prone	Clarifications = 2 marks Classifications & Explanations = 6 marks	10 minutes

areas in India. Even such maps are looked into before constructing any high rise building so as to check the level of seismology in any particular area. This in turn results in saving life in the long run.

Seismologically, the country is divided into 4 seismic zones, namely Zone 2, 3, 4 and 5. According to the recent classification, 59% of the land mass of India is prone to earthquakes of different magnitude, 38 cities with population of half a million and above are located in these three regions.

Zone	Percent	Intensity	Region
V	11	Very high risk zone, area liable to shaking intensity IX and above	Kashmir, Western and Central Himalayas, the Northe-East Indian region, Rann of Kutch.
IV	18	High risk zone, Intensity VIII	The Indo-gangetic basin, Delhi, some parts of J&K, Maharashtra, Patan area.
III	30	Moderate risk zone. Intensity VII	Mumbai, Kolkata, Chennai, Andaman & Nicobar Islands, parts of Kashmir and Western Himalayas
II	41	Low risk zone, Intensity VI and lower.	Southern and western parts of India.

5	There are number of hypothesis proposed on the beginning of our universe / solar system, and are listed below: 1. Nebular Hypothesis 2. Tidal Hypothesis 3. Gas Cloud Hypothesis 4. Weizsacker's Hypothesis	Hypothesis list = 1 mark Nebular hypothesis = 5 Diagram = 2 marks	10 minutes

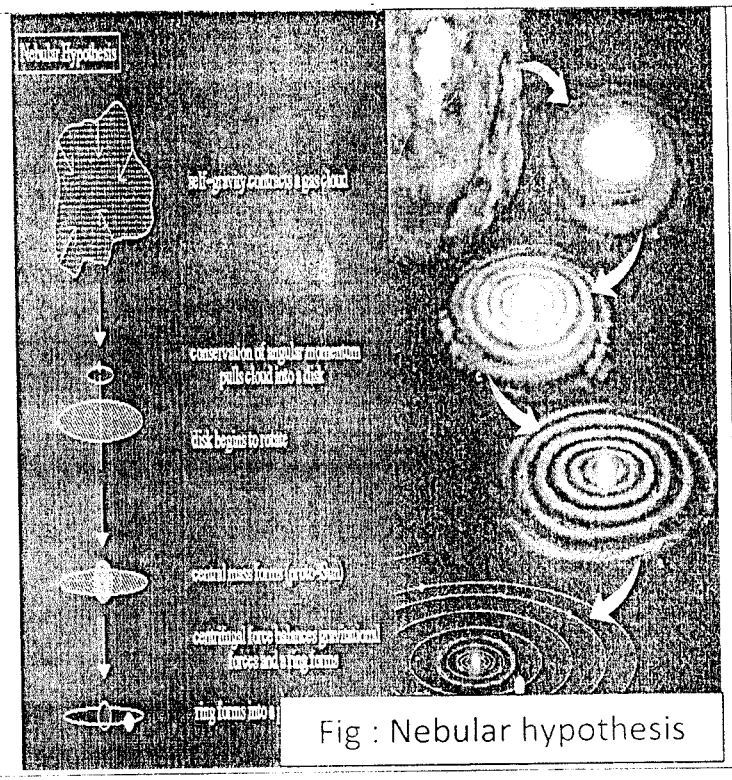
5. Schimidt's Hypothesis
6. Hoyle's Magnetic Theory

Nebular Hypothesis:

The nebular hypothesis was proposed in 1755 by the German philosopher **Immanuel Kant** and modified in 1796 by **Pierre Laplace**. It is most widely accepted theory of planetary formation, known as the nebular **hypothesis**. The **Solar System** formed **4.6 billion** years ago from the gravitational collapse of a giant molecular cloud which was light years (unit of length used to express astronomical distances It is about 9.5 trillion kilometers)

The **Nebular theory** is an explanation for the formation of solar systems. The word "**nebula**" **is** Latin for **"cloud,"** and according to the explanation, stars are born from clouds of interstellar gas and dust.

a) Firstly, a pre-solar nebula is formed consisting of large cloud and gas.
b) Due to gravitational forces the nebula slowly starts to collapse inwards. And thus the maximum mass was concentrated at the Centre.
c) Rings were formed around the contracting nebula which again formed proto-planets by coalescing together which started to revolve around the pre-solar nebula.
d) As the contraction took place, due to principle of conservation of angular momentum, the bodies thus formed started to rotate faster.
e) Along the course of time due to collisions and pressures the density of proto-star at the centre attains temperatures enough to start Fusion reactions thus forming the Star.

	With the rise of the sun, the remaining material began to clump up. Small particles drew together, bound by the force of gravity, into larger particles. The solar wind swept away lighter elements, such as hydrogen and helium, from the closer regions, leaving only heavy, rocky materials to create smaller terrestrial world like Earth.	 Fig : Nebular hypothesis		

Part C (2Q x 6M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	The earth is broadly classified into three major layers and they are explained below; a) **The Crust:** It is the uppermost layer of the earth and has varying thickness in different areas. i) Under the oceans: 5-6 km	Explanation= 6 marks	10 minutes

ii) Under the continents: 30-35 km\
iii) Under the mountains: 60–70 km.

The **Continental crust** is further divided into three layers and is described below;

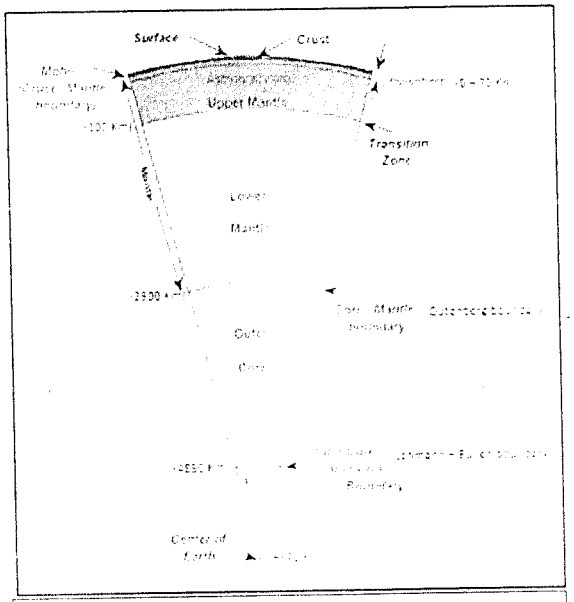


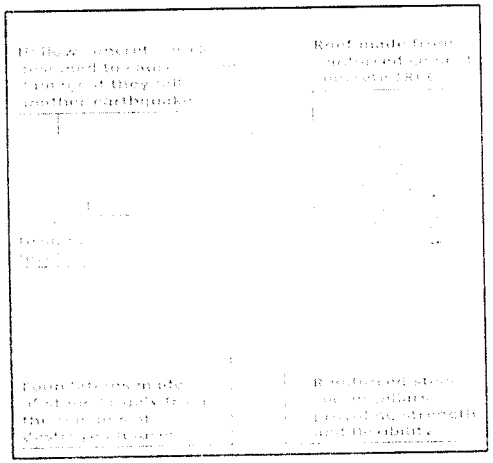
Fig. 8: Generalized internal structure of

Layers	Descriptions
Upper layer (A)	• 1– 10 km thickness • Low density (2.2 g/cc) • Generally sedimentary rocks • P waves velocity (1.8 to 5 km/sec)
Middle layer (B) (SIAL)	• 20 km thickness • Relatively dense (2.4 to 2.6 g/cc) • P waves velocity 5 to 6.2 km/sec • Mostly granitic layer (granites, gneisses and other igneous and metamorphic rocks • Mostly consists of Silicates of Aluminium and potassium and also referred as SIAL
Lower layer	• 25 to 40 km thickness • Density (2.8 to 3.3 g/cc)

		(C) **(SIMA)** • P waves velocity 6.0 to 7.6 km/sec • Basaltic layer • Generally known as SIMA (Silica + Magnesium) The **Oceanic crust** is the extension of layer C of continental crust that makes the top layer of oceanic crust. The layer A and B are absent **b) The Mantle** is the second concentric shell of the earth and lies beneath the crust everywhere. This zone starting from the lower boundary of the crust and continuous up to a depth of 2900 km. In geological literature, it is often called as Mohorovicic or Moho or M discontinuity. The material below Moho forms a nearly homogenous zone till a depth of 2900 km. This zone is characterized with a high density viscous material that increases with depth, where in overlying crustal blocks can virtually float over it (in broader sense). **The Mantle** is divided into outer (solid) layer and inner (liquid or plastic) layer Many important geological processes such as volcanic, seismic and formations of mountains are believed to be originate in the mantle. **c) The Core** is the innermost layer of the Earth. It starts at a depth of 2900 km below the surface and extends up to the centre of the earth at a depth of 6371 km. It is divided into outer (liquid) core and inner (solid) core. The outer core starts from a depth of 2900 km and extends up to 4850 km below the earth surface and behaves more like a liquid because S waves reaching this zone are not transmitted through this zone.		
7a		**The following are the purpose of an earthquake resistant structures;** • *To protect / minimize damages to buildings from earthquakes.* • *No structure can be entirely safe to damage from earthquakes*	General purposes = 3 marks Explanation for floating foundation = 3 marks	10 minutes

- *The aim of is to erect structures that are better during seismic activity than their conventional counterparts.*
- *Intended to withstand the largest earthquake of a certain probability that is likely to occur at their location.*
- *Loss of life should be minimized by preventing collapse of the buildings.*
- *Making use of experimental results, computer simulations and observations from past earthquakes.*
- *Sizing the structure to be strong and flexible enough to survive the shaking with an acceptable damage, to equipping it with base isolation or using structural vibration control technologies to minimize any forces and deformations.*
- *Base isolation method is used to important facilities, landmarks and cultural heritage buildings.*
- *Use of more advanced (and expensive) techniques of isolation or control to survive strong shaking with minimal damage.*

Shock Absorbers



Another tried and true technology to help buildings stand up to earthquakes takes its cue from the auto industry. Most of us familiar with the shock absorber -- the device that controls unwanted spring motion in your car. Shock absorbers slow down and reduce the magnitude of vibratory motions by turning the kinetic energy of your bouncing suspension into heat energy that can be dissipated through hydraulic fluid. In physics, this is known as **damping**, which is why some people refer to shock absorbers as dampers.

	Engineers, generally place dampers at each level of a building, with one end attached to a column and the other end attached to a beam. Each damper consists of a piston head that moves inside a cylinder filled with **silicone oil**. When an earthquake strikes, the horizontal motion of the building causes the piston in each damper to push against the oil, transforming the quake's mechanical energy.		
7b	**Procedure for determining the epicentre location**: a) Find the difference in clock time between the P-wave and S-wave by subtracting the given times. 06:34:20 - 06:32:20 00:02:00 b) Use the Y-axis (time travel) and use a piece of scrap paper to mark the time difference. c) Place the marked scrap paper between the P-wave and S-wave line on the graph. Slide the scrap paper along the graph to find the location that the interval is touching both P-wave and S-wave line. d) Determine the epicenter distance of this location using the X-axis. **Answer: 1200 Km**	Procedure = 4 marks Time lag calculation = 1 mark Epicentre distance answer = 1 mark	10 minutes

Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20 | **Date**: 18.11.2019

Course Code: CIV 203 | **Time**: 2:30 PM to 3:30 PM

Course Name: ENGINEERING GEOLOGY | **Max Marks**: 40

Program & Sem: B.Tech. (CIV) & III Sem | **Weightage**: 20%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries four marks. (3Qx4M=12M)

1. Explain the following terms; (C.O.NO.2)[Knowledge]
   a. Lithification
   b. Streak of a mineral
   c. Examples of Igneous and Metamorphic rocks
   d. Acidic igneous rock
2. What are the different physical properties of minerals? Explain hardness and luster of minerals? (C.O.NO.2)[Knowledge]
3. Write four difference between volcanic rocks and plutonic rocks? (CO.NO.2)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries eight marks. (2Qx8M=16M)

4. "The rocks and minerals are identified based on their physical properties". Explain the major differences between rocks and minerals? Describe the engineering importance of Igneous, Sedimentary and Metamorphic rocks? (CO.NO.2)[Comprehension]
5. What are sedimentary rocks and explain the process of formation of sedimentary rocks? Describe the classification of sedimentary rocks? (CO.NO.2)[Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries six marks. (6Qx2M=12M)

1. Explain the physical properties of limestones and why they are generally not preferred in the major Civil engineering projects? (CO.NO.2)[Application]
6. What are the different types of metamorphism? Explain the contact (thermal) metamorphism and its importance? (CO.NO.2)[Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: Odd Sem. 2019-20
Course Code: CIV 203
Course Name: ENGINEERING GEOLOGY
Program & Sem: B.Tech. (CIV) & III

Date: 18/11/2019
Time: 2:30 PM to 3:30 PM
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
		Module 2 / Minerals and Rocks	K			C			A			
1	2	2	1	4	1	-	-	-	-	-	-	4
2	2	2	1	4	1	-	-	-	-	-	-	4
3	2	2	1	4	1	-	-	-	-	-	-	4
4	2	2	-	-	-	1	8	2	-	-	-	8

5	2	2				1	8	2		-	-	8
6	2	2	-	-	-	-	-	-	1	6	2	6
7	2	2	-	-	-	-	-	-	1	6	2	6
	Total Marks											40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

SCHOOL OF ENGINEE\ NG

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: Odd

Course Code: CIV 203

Course Name: **Engineering Geology**

Date: 30/9/2019

Time: 2:30 to 3:30 pm

Max Marks: 40

Weightage: 20%

Part A [Memory Recall Questions] **(3Q x 4M = 12 Marks)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1a	Lithification is a process of conversion of soft & loose sediments into hard & dense rock. It involves physical & chemical changes and changes involved are called Digenetic changes Important process of Lithification are Compaction, Cementation and re-crystallization.	1 mark for definition	2 minutes
1b	Streak of a mineral is the powder of a mineral obtained by scratching or rubbing the mineral over a rough unglazed porcelain plate (surface) or streak plate. **Example:** Hematite is black, silver or red in colour in hand sample and their streak is cherry red to reddish brown.	1 mark for definition	2 minutes
1c	Examples of Igneous are Granite, Basalt, Gabbro and Rhyolite Examples of Metamorphic rocks are Marbles, Quartzites, Gneiss, Schist, Phyllite	1 mark for definition	2 minutes
1d	Acidic igneous rocks contain > 65 % of SiO_2 and examples are Granite, Rhyolite	1 mark for definition	2 minutes
2	Minerals are generally characterized with a set of properties, some of which are always distinctive related to the body of a mineral. There are ten physical properties of minerals and they are; colour, streak, luster, hardness, cleavage, fracture, tenacity, structure, specific gravity and Special / miscellaneous properties. **Hardness**: The hardness of a mineral defines how much it can resist scratching or abrasion. It depends on the chemical composition and crystalline structure.	2 mark for types and 2 marks for explanation	7 minutes

It was in 1872, a French mineralogist **Friedrich Mohs** proposed a relative broad quantitative "scale of hardness" of minerals starting with talc at 1 and ending with diamond at 10 and this scale has been universally accepted. All the minerals, when pure, have been found to have fairly constant hardness value, the higher the number indicate the harder the mineral (Softest: 1 and hardest: 10).

Moh's scale hardness for minerals (relative hardness) is given below;

Hardness	**Standard mineral**	**Composition**	**Some everyday items**	**Absolute hardness**
1	Talc	$Mg_3Si_4O_{10}(OH)_2$	Finger nail at 2.5	1
2	Gypsum	$CaSO_4,2H2_O$		3
3	Calcite	$CaCO_3$		9
4	Fluorite	CaF_2	Copper (old penny) at 3.5	21
5	Apatite	$Ca_5(PO4)_3$ (OH Cl F)	Window glass or typical knife blade at 5.5	48
6	Orthoclase	$KALSi_3O_3$		72
7	Quartz	SiO_2	Streak plate at over 6.5	100
8	Topaz	$Al_2SiO_4(OH,F)_2$		200
9	Corundum	Al_2O_3		400
10	Diamond	C		1600

Lustre is the shine of mineral surface or luster indicates how light reflects from the mineral surface with regard to its quality and intensity. Luster may be classified into metallic and non-metallic.

i. Metallic luster – high reflectivity like metal (Ex: Galena, Pyrite, chalcopyrite etc)
ii. Non-metallic luster – the reflection may vary from very brilliant shine (diamond) to very feasible greasy luster (olivine).

	Most commonly used terms to describe the luster of mineral are as follows; Metallic luster (Shines like metal – Galena), Adamantine (Very brilliant – Diamond), Vitreous (Shines like a glass –Quartz, Pearly (Shines like a pearl – Labradorite, Silky (Shines like pure silk – Gypsum), Earthy or dull (No Shine – Bauxite, chalk, clay).		
3	**Plutonic rocks:** These are igneous rocks formed at the considerable depths (generally 7 to10 km below the earth's surface) under high pressure and temperature. These are formed at very slow rate of cooling, resulting into a coarse grained rock. Ex: Granites, Syenites and Gabbro. **Volcanic rocks**: These are formed on the surface of the Earth by cooling (rapid) and crystallization of lava erupted from volcanoes. These rocks are fine grained or glassy in nature. Ex: Basalt and Obsidian (The Deccan traps in India covers an area of more than 4 lakh Sq.km).	4 mark (each 1 mark)	5 minutes

Part B [Thought Provoking Questions]

(2Q x 8 = 16 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>4</td><td>
<table>
<tr><th>Si No</th><th>Rocks</th><th>Minerals</th></tr>
<tr><td>1</td><td>Combination of one or more minerals</td><td>Combination of one or many elements</td></tr>
<tr><td>2</td><td>Physical properties include colour, texture, grain size etc.</td><td>Physical properties include colour, streak, Lustre etc.</td></tr>
<tr><td>3</td><td>Generally found in the outer layer of the earth crust.</td><td>Forms deep inside the earth.</td></tr>
<tr><td>4</td><td>Classified into Igneous, Sedimentary and Metamorphic rocks.</td><td>Classified into rock forming and ore forming minerals.</td></tr>
<tr><td>5</td><td>Civil engineers need to know the properties of rocks precisely to enable them to consider different rock types for any required purpose i.e., as a foundation rock, as a road & rail material,</td><td>Understanding of rock forming minerals are very essential for civil engineers. Ore minerals have more economic values than Civil Engineering applications. However, important metals are extracted from ore minerals.</td></tr>
</table>
</td><td>4 marks for major differences ,4 marks for importance</td><td>10 minutes</td></tr>
</table>

		as a concrete aggregate etc.			
	6	Blocks of rocks / stones are used in foundations, walls, bridge pier, abutments, lighthouses, aqueducts, retaining walls and covering floors of the building. Limestone is the basic material for the manufacture of lime concrete and cement.	The most widely-used industrial minerals include limestone, clays, sand, gravel, kaolin, Bentonite, silica, barite, gypsum, potash, pumice, and talc. Some of the industrial minerals commonly used in construction, such as crushed stone, sand, gravel, and cement. Silica sand is used to make glass, ceramics, and abrasives. Bauxite is the primary source of aluminum ore and is also used to make cement and abrasives. Bentonite and barite are non-fuel industrial minerals that have an important application in oil and gas extraction as components in drilling fluids.		
	7	Common rocks are granite, basalt, limestone, sandstone, marble, quartzite etc.	Common minerals are quartz, feldspars, micas, amphiboles, pyroxenes, olivine, calcite etc.		
5	Sedimentary (Secondary) rocks are formed by the accumulation, compaction and consolidation of sediments (rock fragments), which commonly takes place under water or at least in the presence of water (under water environment). Sedimentary rocks occur in layers and frequently contain fossils. These rocks cover 75% of the exposed crust of the Earth. **Formation / Origin of sedimentary rocks** The formation of sedimentary rocks involved the following three stages: a) Weathering and erosion of pre-existing rocks b) Sedimentation c) Lithification (digenesis) **a) Weathering** is process of disintegration & decomposition of pre-existing rocks under the influence of certain physical & chemical agencies. The decayed product / sediment generally remains at or			5 marks explanation 3 marks diagram	10 minutes

	near the parent / pre-existing rock because weathering agents don't invol themselves in the removal of disintegrated particles (Example: Quartz is most stable & olivine weathered rapidly). **Erosion** is a process of breaking down of rock by natural agencies – wind, water (river), moving ice (glacier) & accompanied by transportation of disintegrated particles of considerable distance. **b) Sedimentation is t**he process of accumulation of sediments @ the place of deposition. **c) Lithification (digenesis)** is a process of conversion of soft & loose sediments into hard & dense rock. It involves physical & chemical changes and changes involved are called Digenetic changes. Important process of Lithification; **Compact Process**: Sediments are compressed due to their overload. **Cementation process** Loose grains are held together by cementing material & percolating water **Recrystallization process** Minerals are rearranging themselves to form rocks like salt, gypsum etc.		

Part C [Application level questions] **(2Q x 6M = 12 Marks)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	**Limestone** is a sedimentary rock. Generally it is dense, fine-grained, and composed primarily of calcium carbonate ($CaCO_3$) in the form of the mineral calcite. Normally, it forms in clear, warm, shallow marine waters. It is usually an organic sedimentary rock that forms from the accumulation of shell, coral, algal, and fecal debris. It can also be a chemical sedimentary rock formed by the precipitation of calcium carbonate from lake or ocean water. **Colour:** Pure limestones are white or almost white. Because of impurities, such as clay, sand, organic remains, iron oxide and other materials, many limestones exhibit different colors. **Composition:** Composed of Calcium Carbonate	Explanation= 6 marks	10 minutes

	Texture: Great variety of textures. Fossiliferous nature. Other varieties include dense arid compact structure, loosely packed and porous while others may be compact and homogenous. **Grain size**: Usually fine grained. **Origin:** Most limestones are marine deposits, but some are formed in lakes, rivers and on land. **Other features:** smooth to rough to touch, dependent on composition and / or mode of formation. **Types:** Chalk: Purest form of Limestone. Shelly limestone: Fossiliferous limestone. Argillaceous limestone: Impure Limestone Kankar: Carbonate material formed by the evaporation of Sub-soil water **Distinguishing features:** Its solubility in weak hydrochloric or acetic acid accompanied by brisk effervescence. **Uses**: As a base material for cement; as dimension stone for decoration of walls and floors; in the production of lime fertilizer, paper, petrochemicals, pesticide, glass etc. Limestones are not very useful as building stone because of their poor strength values. However, dense, compact and massive varieties are used for stone masonry in walls. It is used as road metal. Limestone is partially soluble, especially in acid, and therefore forms many erosional landforms. These include limestone pavements, pot holes, caves and gorges. Limestone is less resistant than most igneous rocks. Karst topography and caves develop in limestone rocks due to their solubility in dilute acidic groundwater. The solubility of limestone in water and weak acid		

	solutions leads to karst landscapes. Regions overlying limestone bedrock tend to have fewer visible above-ground sources (ponds and streams), as surface water easily drains downward through joints in the limestone. While draining, water and organic acid from the soil slowly enlarges these cracks, dissolving the calcium carbonate and carrying it away in solution. Most cave systems are through limestone bedrock. Cooling groundwater or mixing of different groundwater will also create conditions suitable for cave formation. Hence, They are not preferred in major civil engineering projects.		
7	There are various kinds of metamorphism which are based on the **metamorphic agents such as heat, pressure and chemically active fluids** that have been the most dominant during the process. The different types of metamorphism are The following are important and common types of metamorphism: Contact / thermal metamorphism, Dynamic metamorphism, Cataclastic metamorphism, Dynamo-thermal metamorphism, Plutonic metamorphism and Regional Metamorphism. **Contact (thermal) metamorphism**: This type of metamorphism is caused due to the local heating of rocks by intrusion of hot magma. In this metamorphism, temperature is dominant with low pressure. The degree of alteration in the host rocks decreases with increasing the distance from its contact with intrusive. The altered zone is known as a contact **aureole**. As the temperature decreases away from the intrusive magma, the outer rocks in aureole are less metamorphosed than the innermost rocks. Under this metamorphism, the rocks get a granular structure and it is a fine grained that does not show schistocity, example: Hornfels. **Shale** Dark argillaceous hornfels, full of tiny plates of brownish biotite **Sandstone** Quartzite **Uses:** As an aggregate in the construction and road building. The hard, interesting looking stone may be used in architecture, monuments, interior flooring, decorations as well as exterior facing, paving, curbing, and decorations.	General purposes = 3 marks Explanation for floating foundation = 3 marks	10 minutes

Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: CIV 203
Course Name: ENGINEERING GEOLOGY
Program & Sem: B.Tech (CIV) & III

Date: 26 December 2019
Time: 1:00 PM to 4:00 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of 3 marks (Part A, B and C)
(iii) Scientific and Non-programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 5 marks. (4Qx5M=20M)

1. Define the following terms;

   a. Lava b. Tunnel c. Rock d. Permeability e. Joints [5 M]

   (C.O.No.1, 2,3 and 4) [Knowledge]

2. Explain the earthquake's body waves and surface waves? (C.O.No.1) [Knowledge]

3. What are the three major types of rocks? Write at least five names of each type of rock?

   (C.O.No.2) [Knowledge]

4. Write five names of remote sensing satellites? (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 10 marks. (3Qx10M=30M)

5. "The seismic zoning map of India is periodically updated on a regular basis". Explain the different Seismic zones in India and their significance? (C.O.No.1) [Comprehension]

6. a. "The sedimentary rocks are classified based on the various process? Explain the different process of formation of sedimentary rocks and their importance in Civil engineering? [5 M] (C.O.No.2) [Comprehension]

   b. "The geological structures affects stability of the rocks". Explain the engineering importance of folds". (C.O.No.3) [Comprehension]

7. "The lithological types and presence of geological structures influence the major Civil Engineering structures". Explain the problems and solutions associated with reservoirs site?

   (C.O.No.3) [Comprehension]

Part C [Problem Solving Questions / Applications]

Answer all the Questions. Each Question carries 10 marks. **(3Qx10M=30M)**

8. a. Write a short note on various types of dams?

[5 M] (C.O.No.2) [Comprehension]

b. Explain with a neat diagram, the zone of aeration and zone of saturation and write their significance in groundwater occurrence?

[5 M] (C.O.No.3) [Comprehension]

9. a. Describe the important properties of granite and its applications in Civil Engineering?

[5 M] (C.O.No.2) [Comprehension]

b. Describe various components of remote sensing with a neat diagram?

[5 M] (C.O.No.4) [Comprehension]

10. Write the various applications of Remote Sensing, GIS and GPS?

[5 M] (C.O.No.4) [Comprehension]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	1,2,3 & 4	1 to 4	5	---	---	5
2	1	1	5	---	---	5
3	2	2	5	---	---	5
4	3	3	5	---	---	5
5	1	1	---	10	---	10
6a	2	2	---	5	---	5
6b	3	3	---	5	---	5
7	3	3	---	10	---	10
8a	2	2			5	5
8b	3	3			5	5
9a	1	1			5	5
9b	4	4			5	5
10	4	4			10	10
	Total Marks		20	30	30	80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: CIV 203
Course Name: Engineering Geology
Program & Sem: B.Tech (CIV), 3

Date: 26 Dec 2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

Part A (4Q x 5M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**a. Lava** Lava is molten rock that comes out of a volcano during an eruption of volcano. **b. Tunnel** Tunnels are underground passages or routes used for different purposes. **c. Rock** is natural, solid, massive, aggregates of minerals forming the earth's crust. **d. Permeability** refers to how pore spaces connected to one another. **e. Joints** are divisional planes or fractures in the body of rocks along which there has been no relative movement.	1 marks for each	15 Minutes
2	**1. Body Waves:** Body waves travel through the earth below and on the surface and vibrating fast. Seismologists use body waves to determine an earthquake's epicenter, the point on the earth's surface above an earthquake's focus. There are two types of body waves: P waves and S waves. **P waves** are the fastest wave to move outward from the earthquake's focus, and it can move through both rock and liquid. P-waves travelling at about 6 km/sec, provide the initial jolt and cause building to vibrate in an up and down motion. The P wave motion is more like a sound wave than an ocean wave.	2.5 marks for each category	15 Minutes

<table>
<tr><td></td><td>The motion is pushed and pulled along the wave front in a series of compressions and expansions (like spring). The effect of a P wave on a building is like a sharp punch.

Certain animals, such as dogs, can feel the P waves much before an earthquake hits the crust (surface waves arrive).

b) S waves move more slowly through the earth and are most destructive. Unlike a P wave, an S wave cannot travel through liquid. S-waves travels about 4 km/sec. At the surface, an S wave produces an up- and-down motion much like rolling waves and a side-to-side motion like a slithering snake.

2. Surface Waves: Unlike body waves, surface waves travel only near or at the surface of the earth. The surface waves vibrate ground horizontally and vertically. These long period waves cause swaying of tall buildings and slight wave motion in bodies of water even at greater distances from epicenter. Love and Rayleigh waves are the two main types of surface waves</td><td></td><td></td></tr>
<tr><td>3</td><td>Rocks may be classified into 3 major groups on the basis of origin and they are Igneous, Sedimentary and Metamorphic rocks.

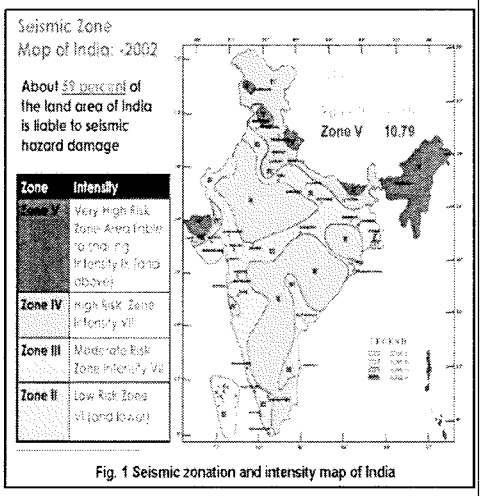
Igneous rocks: Granite, Basalt, Rhyolite, Andesite, Gabbro etc.

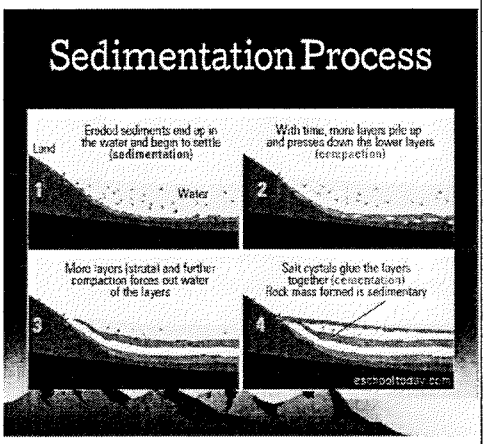
Sedimentary rocks: Sandstone, Limestone, Shale, Siltstone, Clay etc.

Metamorphic rocks: Marble, Quartzite, Gneiss, Schist, Phyllite etc.</td><td>2 marks for types and 3 marks for examples</td><td>15 minutes</td></tr>
<tr><td>4</td><td><table><tr><th>Satellite</th><th>Country</th></tr><tr><td>IRS 1A, B, C & D)</td><td>INDIA</td></tr><tr><td>Cartosat (2 & 3), Oceansat, Resourcesat, CARTOSAT</td><td>INDIA</td></tr><tr><td>QUICKBIRD, IKONOS, LANDSAT</td><td>USA</td></tr><tr><td>RADARSAT</td><td>CANADA</td></tr><tr><td>Yaogan YAOGAN (1 to 30)</td><td>CHINA</td></tr></table></td><td>5 marks</td><td>15 Minutes</td></tr>
</table>

Part B (3Q x 10M = 30 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

5	A seismic zoning map for engineering use is a map that specifies the levels of force or ground motions for earthquake-resistant design, and thus it differs from a seismicity map, which provides only the occurrence of earthquake information. The zoning map is reviewed and revised periodically based on additional data from the research in the field. Seismologically, the country is divided into **4 seismic zones, namely** Zone 2, 3, 4 and 5 unlike its previous version, which consisted of five or **six zones** for the country. According to the recent classification, 59% of the land mass of India is prone to earthquakes of different magnitude, 38 cities with population of half a million and above are located in these three regions.  Fig. 1 Seismic zonation and intensity map of India **Zone** | **Percent** | **Intensity** | **Region** V | 11 | Very high risk zone, area liable to shaking intensity IX and above | Kashmir, Western and Central Himalayas, the Northe-East Indian region, Rann of Kutch. IV | 18 | High risk zone, Intensity VIII | The Indo-gangetic basin, Delhi, some parts of J&K, Maharashtra, Patan area. III | 30 | Moderate risk zone, Intensity VII | Mumbai, Kolkata, Chennai, Andaman & Nicobar Islands, parts of Kashmir and Western Himalayas II | 41 | Low risk zone, Intensity VI and lower. | Southern and western parts of India.	2 marks for diagram and 2 marks for table 6 marks for description	20 minutes

6a	The formation of sedimentary rocks involved the following three stages: a) Weathering and erosion of pre-existing rocks b) Sedimentation c) Lithification (digenesis) a) Weathering is process of disintegration & decomposition of pre-existing rocks under the influence of certain physical & chemical agencies. The decayed product / sediment generally remains at or near the parent / pre-existing rock because weathering agents don't involve themselves in the removal of disintegrated particles (Example: Quartz is most stable & olivine weathered rapidly). Erosion is a process of breaking down of rock by natural agencies – wind, water (river), moving ice (glacier) & accompanied by transportation of disintegrated particles of considerable distance.  b) Sedimentation The process of accumulation of sediments @ the place of deposition. c) Lithification (digenesis) Lithification is a process of conversion of soft & loose sediments into hard & dense rock. It involves physical & chemical changes and changes involved are called Digenetic changes Important process of Lithification;	5 marks for description	10 minutes

Compaction process	Sediments are compressed due to their overload
Cementation process	Loose grains are held together by cementing material & percolating water
Recrystallization process	Minerals are rearranging themselves to form rocks like salt, gypsum etc.

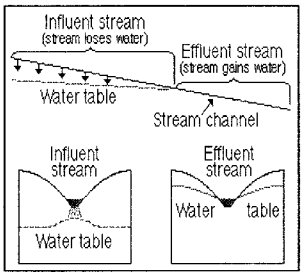
Engineering importance

Sedimentary rocks are generally are used in domestic construction and housewares even in prehistoric times. They are relatively soft, making it easy to carve and are widely used around the world in constructing temples, homes, and other buildings.

The rocks like sandstone are used for artistic purposes to create ornamental fountains and statues. Some sandstones are resistant to weathering, yet are easy to work. This makes sandstone a common building and paving material including in asphalt concrete. Because of the hardness of individual grains, uniformity of grain size and friability of their structure, some types of sandstone are excellent materials from which to make grindstones, for sharpening blades and other implements.

Shales are used to manufacture bricks and tiles. Cement is another important construction material that is often made with shale and also they are sources of Alumina, Paraffin and oil.

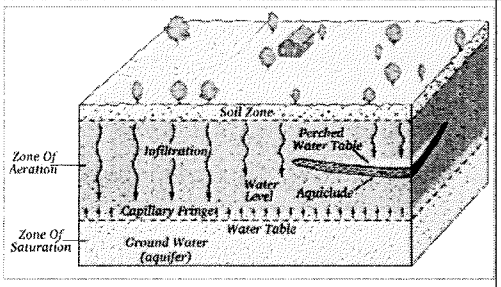
Limestone are used as a base material for cement; as dimension stone for decoration of walls and floors; in the production of lime fertilizer, paper, petrochemicals, pesticide, glass etc.'

6b	**Effects of folding / engineering importance of folds** **1.** Folding causes shattering in rocks, especially in axial regions, that reduces rock bearing capacity. Hence shattered rocks are not suitable to be used as foundation rock. **2.** Shattering due to folding makes the rocks permeable. This causes a great trouble in tunnels and in dams. **3.** Folded rocks are generally under considerable strain. Excavation through them may become risky. Because this will result in the release of pressure that may be accompanied by slips of blocks causing rock burst. **4.** Folding induces change in the attitude of the rocks and this may lead to the repetition of same beds or encounter of some unexpected rocks in any given alignment	5 marks for description	10 minutes
7	The main geological problems associated with the reservoirs are 1) Groundwater conditions, 2) Silting, 3) Permeable rocks  **1. Ground water conditions** If the water table occurs at considerable depth below the river floor, the river water percolates through the country rock and reaches the ground water. This means loss of water from the river continues till the water table rises to the level of the river. Such rivers are called ***influent rivers***. Hence there is leakage. If the water table occurs at shallow depth or near or intersecting the valley sides, then seepage of ground water will occur and water will be added to the river. Hence there is no leakage. Such a river is known as ***Effluent Rivers***. **2. Silting of reservoirs** The reservoirs built on rivers, which carry large amount of sediments, may silt up very soon and its water storage capacity may be reduced considerably. The amount of silt produced and supplied to the rivers depends mainly upon lithological character and topography of the catchment's area. The rivers flowing over the soft rocks and high gradient areas carry	2 marks for problems names, 8 marks for explanations	15 minutes

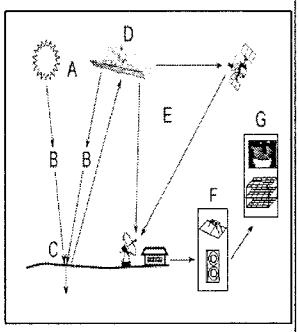
	greater amounts of silt. On such rivers silt traps may be constructed up stream in order to check the rate of silting in the reservoir. Provisions should also be made for washing out the silt through the passage of the dam. The measures that help to reduced silting of reservoirs are a) Vegetation b) Covering with slabs on weak zones c) Terracing of the slope and construction of retaining walls d) Check dams e) by diversion of sediment-loaded waters. **3) <u>Permeable rocks</u>** During the geological investigations it is necessary to locate the highly permeable rocks that are present in the reservoir area. The rocks, which are highly porous, are likely to cause series leakage from the reservoir. Generally the leakage of water from the strata that have down stream dip, will be more than those which have upstream dip. The following methods used to seal permeable zones: a) Natural silting b) Grouting c) Covering weak zones with concrete slabs		

Part C (3Q x 10M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8a	(1) Gravity dam (2) Arch dam (3) Buttress dam (4) Coffer dams **1. Gravity dam:** This dam has heavy and massive wall like concrete or masonry structure in which the whole weight acts vertically down ward and it stands by its own weight. The entire force acting on the dam wall is transmitted to small area of the foundation. Therefore a sound foundation rock is required for the construction of gravity dam. **Example:** ***Bhakra Dam on Sutlej River in Bilaspur, Himachal Pradesh*** **2. Arch dam:** This dam has an arch shape, which is always convex in the upstream side. The shape or	5 marks for description	10 minutes

	design of an arch dam transmits the water pressure to the abutments by the arching action. Hence, very strong rocks are required in the abutments for the construction of the arch dam. **Example: *Iddki Dam (Kerala)*** **3. Buttress dam:** This is concrete structure in which there is a deck sloping upstream. This deck, which takes the entire load, supported from behind by walls called buttresses, extending perpendicular to the axis of the dam from downstream side. **4. Coffer dam:** these are small wall like structure made for diverting of the river water before construction of the main tunnel.		
8b	**Zone of Unsaturation**  This zone is characterized by the groundwater that is held by surface tension in small passages between grains of soil / sediment. The area above the water table that consists of capillary fringe and soil moisture zone is known as the ***unsaturated zone or zone of aeration or vadose zone.*** This general zone may be further subdivided into the soil water zone, the intermediate vadose zone (sub-soil zone), and capillary zone. **Vadose zone:** a subsurface zone in which rock openings are generally unsaturated and filled partly with air and partly with water; located above the saturated zone. **Capillary fringe:** a transition zone with higher moisture content at the base of the vadose zone just above the water table. **Zone of Saturation** The saturated zone extends from the upper surface of saturation down to underlying impermeable rock. In the absence of overlying impermeable strata, the water table, or phreatic surface, forms the upper surface of the zone of saturation. This is defined as the surface of atmospheric pressure and appears as the level at which	5 marks (2.5 marks for each type)	10 minutes

	water stands in a well penetrating the aquifer. Actually, saturation extends slightly above the water table due to capillary attraction; however, water is held here at less than atmospheric pressure. *Water occurring in the zone of saturation is commonly referred to simply as groundwater.* In general, zone of saturation is the area where all the pores space in ground is filled with water; whereas the zone of aeration is the area where the pore space is mostly empty, or full of air.		
9a	**Granite:** It is a Latin word, granum means grain. Granite is a plutonic, acidic igneous rock, occur at greater depth. The rock is rich in silica (> 65%) and makes it very resistant to weathering or decaying process. It is most abundant and easily available plutonic igneous rock and offer reasonable fire and frost (ice) resistant because of uniform nature of minerals. Due to its high crushing strength, good polishing, resistant to fire, frost and abrasion (scratch), granite becomes suitable as foundation rock, building stone, road stone, and railway ballast or for flooring. The impermeable and non-porous granites don't pose any groundwater problem during tunneling and also doesn't require any lining of its competence. India has varieties of granite in over 200 shades. Granites occurs in Madhya Pradesh, Orissa, Tamil Nadu, Karnataka, Jharkhand, Chhattisgarh, Rajasthan, Telangana, and Andhra Pradesh. **Mineralogical Composition:** Composed of Quartz + Feldspar + Biotite + Hornblende **Texture:** Porphyritic to Intergrowth. Depending upon the abundance of quartz to feldspar. **Occurrence:** Situated as deep seated intrusive bodies like sills and batholiths. **Megascopic identification:** 1. Light coloured (grey, pink, brown and yellowish). 2. Coarse to Medium grained. 3. Abundance of quartz and feldspar (orthoclase) essential minerals.	5 marks for description	10 minutes

	Origin: forms from the cooling of magma deep within the Earth (*intrusive*). **Uses:** Granite is used as an ornamental stone, monuments, floor tiles, cutting boards and countertops. It may also be crushed for construction aggregate and desert landscaping. **Engineering importance of Granites:** The Igneous rocks like Granite, Syenite and Dolerite are characterized by very **high compressive strength** and can be easily trusted in most construction works. Granite is hard, massive, dense, competent and has interlocked texture. It is impermeable, and non-porous. These properties provide strength to this rock and hence, used as a foundation rock, building stone, road stone, railway ballast or for flooring. The impermeable and non-porous granites don't pose any groundwater problem during tunnelling and also doesn't require any lining due to its competence. Granite also has either Equi-granular or porphyritic texture and on polishing, it takes a mosaic appearance or mottled (speckled) appearance, hence in large construction projects.		
9b	**Remote Sensing Process Components (7)** A. Energy Source or Illumination B. Radiation and the Atmosphere C. Interaction with the Target D. Recording of Energy by the Sensor E. Transmission, Reception, and Processing F. Interpretation and Analysis G G. Application 	3 marks for components and 2 marks for diagram	10 minutes
10	**Remote sensing applications** 1. Urban and regional planning, site investigation 2. Terrain mapping and analysis 3. Road and highway construction 4. Urban mapping 5. Water resources engineering 6. Environment	5 marks for Remote Sensing and 5 marks for GIS and GPS applications	20 minutes

	7. Natural hazard analysis (earthquakes, floods, landslides) 8. Geology 9. Hydrology 10. Environmental monitoring: **GIS and GPS applications** 1. Land, Sea and Air Navigation and Tracking 2. Surveying and Mapping 3. Military Applications 4. Recreational Uses 5. Other specialized uses 6. Environmental applications		