Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem 2019-20
Course Code: CIV 305
Course Name: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS
Program & Sem: B.Tech (Civil) & V

Date: 27.09.2019
Time: 11.00AM to 12.00PM
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:
   a) Remote sensing
   b) Spectral signatures
   [4M] (C.O.NO.1) [Knowledge]
2. What are the advantages of remote sensing?
   [4M] (C.O.NO.1) [Knowledge]
3. Write a short note on aircraft and satellite platforms.
   [4M] (C.O.NO.1) [Knowledge]

Part B (Thought Provoking Questions)

Answer both the Questions. Each Question carries six marks. **(2Qx6M=12M)**

4. Camera with flash is an active sensor and camera without flash is a passive sensor. Give the difference between active and passive remote sensing.
   [6M] (C.O.NO.1) [Comprehension]

5. The nature of reflection depends on the roughness of the surface. Explain the types of reflection based on smooth and rough surface. [6M]
(C.O.NO.1) [Comprehension]

Part C (Problem Solving Questions)

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

6. Explain the interaction mechanism of EM radiation with atmosphere [8M]
(C.O.NO.1) [Comprehension]
7. Explain the radiometric errors [8M]
(C.O.NO.1) [Comprehension]

SCHOOL OF ENGINEERING

Semester: V

Course Code: CIV 305

Course Name: Remote Sensing and Geographic Information Systems

Date: 27/09/2019

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
			K	C	C	
A1	1	Module 1	2 2			4
A2	1	Module 1	4			4
A3	1	Module 1	4			4
B1	1	Module 1		6		6
A2	1	Module 1		6		6
C1	1	Module 1			8	8
C2	1	Module 1			8	8
	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 .Bhavya N]

Reviewers' Comments

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: V

Course Code: CIV 305

Course Name: Remote Sensing and Geographic Information Systems

Date: 27/09/2019

Time: 1 hour

Max Marks: 40

Weightage: 20%

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

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	a) Remote sensing is the science and art of obtaining the information about an object, area and phenomena by using a device that is not in direct contact with object, area and phenomena. b) Spectral signatures are the combinations of the reflected, absorbed , transmitted or emitted electromagnetic radiation by the objects at various	2X2M=4M	4 MINS

	wavelengths. which can uniquely identify the object		
2	▸ Better and fast. ▸ Large area coverage. ▸ Data acquisition from remote and inaccessible areas. Multidisciplinary utility. ▸ Economic and efficient technology.	4 X1M=4M	4 MINS
3	**Aircraft:** High resolution of data recording. • Possibility of carrying larger payloads. • Capability of covering larger area economically. • Accessibilty of remote areas. • Convenience of selecting different scales. • Possibility of repititive surveys. • Adequate control at all time. • Flexible timetable. • Resolution determined by altitude. **Satellite:** Satellites is a piece of equipment that is sent into the space, revolving around the earth, to receive and send signals or to collect information about earth's surface features. • Sees larger area, continuous for several years. • Repititive coverage in all weathers.	2 X 2M=4M	4 MINS

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

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	▸ **Active RS** • generates and uses its own energy to illuminate the target and records the reflected energy. • Operate in the microwave region of the electromagnetic spectrum. • Wavelengths are longer than one mm. • Do not rely on detection of solar or terrestrial emission as the solar irradiance in the microwave region is negligible. • Eg: synthetic aperture radar ▸ **Passive RS** • They depend on solar radiation to illuminate the target.	2 X 3M =6	9 MINS

	They operate in the visible and infrared region of the electromagnetic spectrum. • Their wavelength range from 0.4to10μm. • They rely on detection of solar emission. • Eg: camera without flash light.		
2	**Smooth surface** I. Surface height variation is lesser than eight times the wavelength. II. Specular surface gives mirror like reflection. III. angle of incidence = angle of reflection IV. Doesn't contain spectral information on the color of reflecting surface. ▸ **Rough surface** i. Surface height variation is greater than eight times the wavelength. ii. Gives diffused reflection (Lambertian) iii. Angle of incidence ≠ angle of reflection iv. EMR is scattered equally in all directions v. Contains information on the color of reflecting surface.	2 X3 M=6 M	9 MINS

Part C (2Q x 8M = 16Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**Scattering:** Unpredictable diffusion of radiation by particles in the atmosphere(dust particles, gases, water vapor, water droplets) **Adverse effect on Remote Sensing:** i. Reduces image contrast. ii. Changes spectral signature of ground objects as seen by the sensors (Difficult to differentiate the objects) **Absorption:** ▸ Absorption is the process by which radiation is absorbed and converted into other forms of energy such as heat or chemical energy etc. ▸ The atmosphere prevents, or strongly attenuates, transmission of radiation through the atmosphere ▸ Absorption of energy at a given wavelength is due to the presence of water vapor, CO2 and O3. ▸ Three gases: - Ozone (O3): absorbs ultraviolet radiation high in atmosphere - Carbon-dioxide (CO2): absorbs mid and far infrared in lower atmosphere	2 M 2 M	15 MINS

	Water vapor (H_2O): absorbs mid and far infrared in lower atmosphere Spectral bands in which atmosphere is transmissive of energy are referred to as **-atmospheric windows**. **Refraction:** The bending of light rays at the contact between two media that transmit light but with different density: when light enters the denser medium, it is diffracted toward surface normal. ▸ Refraction is minimum in the zenith and maximum at the horizon. **Emission:** ▸ Atmosphere emits EMR due to its thermal state. ▸ Due to gaseous structure only discrete band of radiations are emitted by the atmosphere.	2 M 2 M	
2	**PERIODIC LINE DROPOUT:** ▸ On MSS image or TM image every sixth or sixteenth line is a black line i.e., in CCD is a string of zeros . This is called periodic line dropout & it is due to recording problems. ▸ To restore the image the average DN value for each scan line is compared with scene average. ▸ Any scan line deviating from the average more than the threshold specified, is called defective line and replaced by the average of preceding and succeeding line. original / corrected 19 26 25 21 23 — 19 26 25 21 23 22 24 21 18 26 — Scene avg=25 — 22 24 21 18 26 25 26 23 24 22 — 25 26 23 24 22 **PERIODIC LINE STRIPPING:** • For each spectral band, the detectors were calibrated and matched before the Landsat was launched. • With time, however, the response of some detectors may drift towards higher or lower levels, as a result every scan line recorded by that detector is brighter or darker than the other line. • The general term for these defected lines is periodic line stripping. • These defected lines are corrected by multiplying the line by a factor to get the corrected DNs.	2 M 2 M	15 MINS

original

18	22	24	25	21
23	25	19	26	20
24	22	25	21	26
23	21	25	24	26

Scene
avg=26

*by by 0.5

corrected

18	22	24	25	21
23	25	19	26	20
24	22	25	21	26
23	21	25	24	26

LINE START PROBLEM:

The DN values of an image do not start from row 1 and column 1.

		22	24	26	23	21
		24	21	23	25	22
		19	22	24	26	21
		23	18	23	25	21
		22	24	26	21	25

2 M

LINE END PROBLEM:

The DN values of an image do not end at nth row and nth column.

21	23	22		
24	26	25		
22	23	26		

2 M

Roll No.														

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem. 2019-20
Course Code: CIV 305
Course Name: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS
Program & Sem: B.Tech, (CIV) & V

Date: 16.11.2019
Time: 11:00 AM to 12:00 PM
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: (C.O.NO.2) [Knowledge]
   a) Nadir
   b) Stereoscopy
   c) Scale
   d) Photogrammetry
2. Write the application of aerial photogrammetry. (C.O.NO.2) [Knowledge]
3. Write a short note on types of stereoscopes? (C.O.NO 2) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries six marks. (2Qx6M=12M)

4. Explain the advantages and disadvantages of aerial photogrammetry. (C.O.NO.2) [Comprehension]
5. Differentiate between vertical photographs, low oblique photographs and high oblique photographs. (C.O.NO.2) [Comprehension]

Part C [Problem Solving Questions]

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

6. Explain the methods of determining the scale of an aerial photograph. Compute the scale of an aerial photograph when the flying height of aircraft is 7500 m and the focal length of the camera is 15 cm. (C.O.NO.2) [Comprehension]

7. A tall tower was photographed from an elevation of 700 m above the datum. The radial distance of the top and bottom of the tower from the principal points are 112.5 mm and 82.4 mm respectively. If the bottom of the tower is at elevation of 250 m above the datum, find the height of the tower.
(C.O.NO.2) [Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: V

Course Code: CIV 305

Course Name: Remote Sensing and Geographic Information Systems

Date: 16/11/2019

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
			K				C			C			
1	2	Module 2	1	1	1	1							4
2	2	Module 2	4										4
3	2	Module 2	4										4
4	2	Module 2					6						6
5	2	Module 2					6						6
6	2	Module 2								8			8
7	2	Module 2								8			8
	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.

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SOLUTION

Semester: V

Course Code: CIV 305

Course Name: Remote Sensing and Geographic Information Systems

Date: 16/11/2019

Time: 1 hour

Max Marks: 40

Weightage: 20%

Part A (3Q x4 M =12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	a) **Nadir:** It is the point vertically beneath the center of the camera lens during exposure. b) **Stereoscopy:** It is a technique used to enable a 3 dimensional effect, adding an illusion of depth to a flat image. c) **Scale:** It is the ratio of a distance on an aerial photograph to the distance between the same two points on the ground. d) **Photogrammetry:** It is the art, science and technology of obtaining reliable information about physical objects and the environment through process of recording, measuring and interpreting the image or photograph.	**4X1=4M**	**4 MINS**
2	• Site selection • Military intelligence • Cartography • Environmental studies • Telecommunication network planning • Topography mapping • Earth work volumes • Production of digital elevation model	**4X1M=4M**	**4 MINS**

3	1) **Lens or Pocket stereoscopes** • Simplest device • Least expensive • Used in the field • 2 to 4 times magnification 2) **Mirror stereoscopes** • Used in the field • Photos can be placed separately for viewing	**2X2M=4M**	**4 MINS**

Part B (2Q x6 M = 12 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>1</td><td>Advantages of aerial photogrammetry:
• It covers larger area
• Minimizes field work
• Can be used in areas that are unsafe and inaccessible.
• Flexible flight time
• It has broader sensitivity
Disadvantages of aerial photogrammetry:
• Weather conditions would affect the quality of picture flight schedule
• The ground i.e. hidden by structures and trees cannot be accurately mapped
• It cannot map, desert or snowy regions as the photographs will give uniform shades of color.
• It is not accurate as of traditional survey methods.</td><td>2X3M = 6M</td><td>10 MINS</td></tr>
<tr><td>2</td><td>
<table>
<tr><th>Attributes</th><th>Vertical photographs</th><th>Low oblique photographs</th><th>High oblique photographs</th></tr>
<tr><td>Optical axis</td><td>Tilt <3° i.e. exactly or nearly coincides with vertical axis</td><td>Deviation is <30° from the vertical axis</td><td>Deviation is >30° from the vertical axis</td></tr>
<tr><td>Coverage</td><td>Small area</td><td>Relatively larger area</td><td>Largest area</td></tr>
<tr><td>Shape of the area</td><td>Square</td><td>Trapezoidal</td><td>Trapezoidal</td></tr>
<tr><td>Photograph scale</td><td>Uniform</td><td>Non - uniform</td><td>Non - uniform</td></tr>
</table>
</td><td>3X2M=6M

(2 differences for each)</td><td>10 MINS</td></tr>
</table>

Part C (2Q x 8M = 16 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**Method 1: By establishing the relationship between photo distance and ground distance** If the distance between 2 points on an aerial photograph and distance between the same two points on the ground is known, $$Scale\ of\ \ photograph = \frac{Distance\ on\ a\ photograph}{Distance\ on\ the\ ground}$$ **Method 2: By establishing the relationship between photo distance and map distance** If a reliable map is available for the area shown on an aerial photograph it can be used to determine the scale of a photograph $$Scale\ of\ photograph = \frac{Distance\ on\ a\ photograph}{Distance\ on\ map\ X\ Photo\ scale}$$ **Method 3: By establishing relationship between focal length(f) and flying height(H) of the aircraft** If no information is available about the relative distances on photograph and ground or map and the focal length of the camera lens and flying height of the aircraft is known, $$Scale\ of\ photograph = \frac{focal\ length}{flying\ height}$$ Given data: Flying height = 7500 m = 750000 cm Focal length = 15 cm	3X2M=6M 2 M	14 MINS

	$Scale\ of\ photograph = \frac{15}{750000}$ Therefore, $Scale\ of\ photograph = \frac{1}{50000}$ = 1:50000		
2	Radial distance from principal point to top of the tower, r =112.5 mm Radial distance from principal point to bottom of the tower, r' = 82.4 mm Relief displacement, d = r- r' d = 112.5 – 82.4 d = 30.1 mm Flying height of aircraft, H = 700 m Elevation of the ground, h_{avg} = 250 m Height of tower, h =? $d = \frac{rh}{H - h_{avg}}$ $30.1 = \frac{112.5h}{700 - 250}$ $h = 120.4\ m$	1 M 1 M 2 M 2 M 1 M for step 1 M for answer	14 MINS

Roll No.													

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Sem. 2019-20
Course Code: CIV 305
Course Name: REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM
Program & Sem: B.Tech (CIV) & V (DE-I)

Date: 20 December 2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

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 05 marks **(4Qx5M=20M)**

1. Explain the following terms; (C.O.No.1 to 3) [Knowledge]

   a) Atmospheric windows b) Spectral reflectance c) Scale d) Stereo pair e) Map

2. Explain briefly about the Aircraft and Satellite remote sensing platforms? (C.O.No.2) [Knowledge]

3. Describe the advantages and disadvantages of vector and raster data model in GIS? (CO.No.3) [Knowledge]

4. Write a short note on the spherical and ellipsoidal model of the earth's shape? (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

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

5. "Aerial photography is about taking of photographs from an aircraft or other flying object". Describe with a neat diagram, the various types of aerial photographs?

(C.O.No.1) [Comprehension]

6. "Remote sensing system is based on the electromagnetic radiations". Explain the statement and write about the interaction mechanism of Electromagnetic radiation with earth atmospheres?

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

7. "Map projection is a method by which we transform the earth's spheroid (real word) to a flat surface (abstraction), either on paper or digitally". Explain the Azimuthal, Conical and Cylindrical projections and how are they different from each other?
(C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

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

8 a. What are the advantages of remote sensing system? [5M] (C.O.No.1) [Application]

b. A rectangular agricultural field measures 8.65 cm length and 5.13 cm width on a vertical photograph having a scale of 1:20,000. Find the area of field at down level?

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

9 a. The Coordinates of Bangalore is written as 12° 58′ 21″ N, 77° 34′ 50″ E. Convert coordinate pair from degree minute second to decimal degree? [5M] (C.O.No.3) [Application]

b. Explain the applications of vector and raster data in GIS? [5M] (C.O.No.3) [Application]

10. Write the GIS applications in Civil Engineering fields and other areas?
(C.O.No.3) [Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

END TERM EXAM

Semester: Odd Sem. 2019-20
Course Code: CIV 305
Course Name: REMOTE SENSING AND GIS
Program & Sem: B.Tech. V (CIV)

Date: 20/12/2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

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, 2 & 3	K			C			A			
1	1	1,2 and 3	5	5	1							5
2	2	2	1	5	1							5
3	3	3	1	5	1							5

4	4	1	1	5	1							5
5	1					2	10	2				10
6	2					2	10	2				10
7	3					2	10	2				10
8	1								3	10	3	10
9	2								3	10	3	10
10	3								3	10	3	10
	Total Marks											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.

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: CIV 305
Course Name: REMOTE SENSING AND GIS
Program & Sem: B.Tech. V (CIV)

Date: 20/12/2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

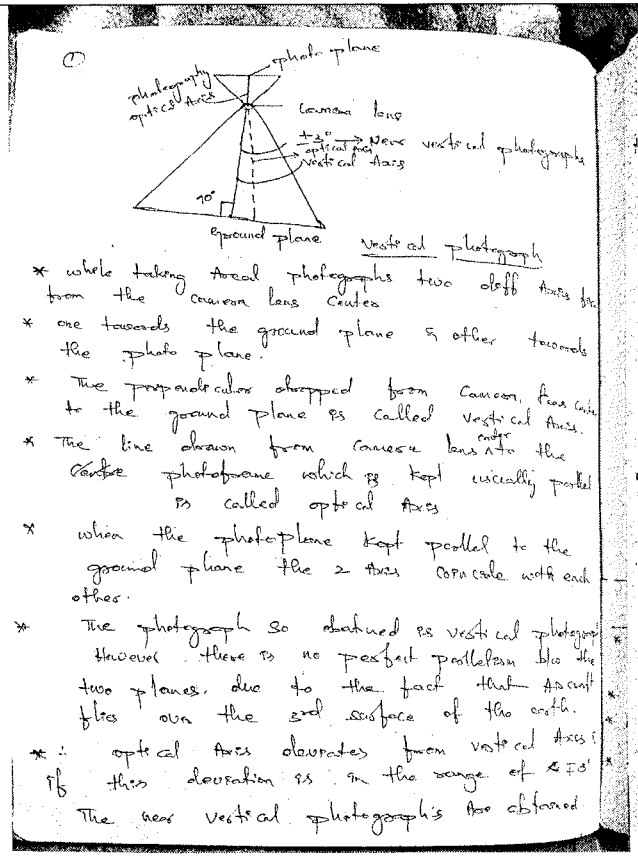
Part A [Memory Recall Questions] **(4Qx5M=20 Marks)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**a. Atmospheric windows**: Spectral bands in which atmosphere is transmissive of energy are referred to as -atmospheric windows. **b. Spectral reflectance:** The reflectance characteristics of earth surface features may be quantified by measuring the portion of incident energy that is reflected. This is measured as a function of wavelength and is called spectral reflectance given by **c. Scale:** Shows the relationship of map distance to the actual distance on the ground. **d. Stereo pair**: A pair photographs of the same area taken from slightly different positions so as to give a stereoscopic effect when properly mounted and viewed. **e. Map** is a two dimensional representation of earth surface which uses graphics to convey geographical information. It describes the geographical location of features and the relationship between them.	1 mark each for definition	15 minutes

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>
<table>
<tr><th>Aircraft Platforms</th><th>Satellite Platforms</th></tr>
<tr><td>• High resolution of data recording.
• Possibility of carrying larger payloads.
• Capability of covering larger area economically.
• Accessibility of remote areas.
• Convenience of selecting different scales.
• Possibility of repetitive surveys.
• Adequate control at all time.
• Flexible timetable.
• Resolution determined by altitude.</td><td>Satellites is a piece of equipment that is sent into the space, revolving around the earth, to receive and send signals or to collect information about earth's surface features.
• Sees larger area, continuous for several years.
• Recitative coverage in all weathers.</td></tr>
</table>
</td><td>3 mark for explanation & 2 marks for diagram</td><td>15 minutes</td></tr>
<tr><td>3</td><td>Advantages and disadvantages of vector and raster data model in GIS
<table>
<tr><th>VECTOR</th><th>RASTER</th></tr>
<tr><td><u>Advantages</u>
• Compact data structure (less data volume)
• Efficient topology encoding, good for operations, such as network analysis
• Better graphics for precise expression</td><td>• Simple data structure
• Easier and efficient overlay operation
• High spatial variability is efficiently Represented
• Efficient in manipulation and enhancement of digital images</td></tr>
</table>
</td><td>3 mark for explanation & 2 marks for diagram</td><td>15 minutes</td></tr>
</table>

	Disadvantages • Complex data structure • Implementation of overlay operations is Difficult • Inefficient representation of high spatial variability • Not effective for manipulation and enhancement of digital images	• Large data volume (data compression technique can overcome this problem) • Difficult to represent topological relationships • Less aesthetic graphic output • Not good for some operations, such as network analysis		
4	**Spherical model** • Based on a circle, it treats earth as a sphere to make mathematical calculations easier	**Ellipsoid/ Oblate spheroid model** • Rotating an ellipse around the semi-minor axis creates an ellipsoid. • Earth is flattened at poles with a bulge at equator and this is attributed to the earth's rotation. • The force is greatest at equator causing an outward bulge and thus giving that region a larger circumference	each category 2.5 marks	15 minutes

Part B [Thought Provoking Questions] **(3Qx10M=30)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
5		Diagram 3 marks and explanations 7 marks	20 minutes

(a)

Vertical photograph

* while taking Aerial photographs two optical Axes from the camera lens Centre
* one towards the ground plane & other towards the photo plane.
* The perpendicular dropped from Camera lens centre to the ground plane is called Vertical Axis.
* The line drawn from Camera lens centre to the photoplane which is kept vertically parallel is called optical Axis
* when the photoplane kept parallel to the ground plane the 2 Axes coincide with each other.
* The photograph so obtained is vertical photograph However there is no perfect parallelism bcz the two planes, due to the fact that Aircraft flies over the curved surface of the earth.
* ∴ optical Axis deviates from vertical Axis if this deviation is in the range of ≤ 3° The near vertical photographs are obtained

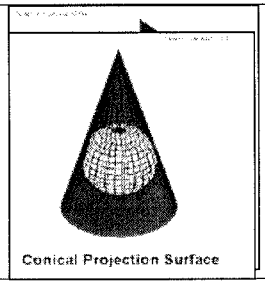
Low oblique photographs:

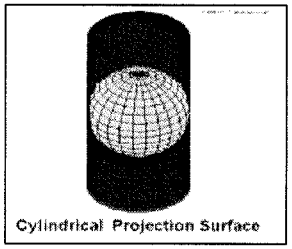
* An Aerial photograph an intentional deviation of 15° to 30° in the optical Axis from vertical Axis is selected to as low oblique photograph.

High oblique photographs

These are photographs obtained when the optical Axis is intentionally inclined > than 30° from the vertical Axis.

6	**Interaction mechanism of Electromagnetic radiation with earth atmospheres** **a) Scattering:** Unpredictable diffusion of radiation by particles in the atmosphere (dust particles, gases, water vapor, water droplets) **Rayleigh scattering** • Caused by gas molecules of oxygen and nitrogen in the sky. Hence also called molecular scattering. • When radiation interacts with atmosphere molecules that are much smaller in diameter compared to wavelength of radiation. • Effect of Rayleigh scatter is inversely proportional to 4th power of wavelength. • Short wave EMR is scattered more by this mechanism. • It is responsible for blue skies and red sunsets. • During sunrise and sunset the atmosphere scatters sunrays in longer wavelength region hence sky appears in red color. • The remaining times the shorter wavelength is scattered hence sky appears blue color. **MIE scattering** • Exists when particle size is equal to the energy wave length being sensed. • Caused by water vapor and dust. • Influences longer wave length (from UV to NIR) **Non Selective scattering** • Occurs when particle size is much larger than the energy wave length. • Water droplets cause such scattering. • Do not depend on wavelength. It scatters blue, green and red light in equal quantities • Makes fog and cloud appear white or whitish appearance of sky. **Adverse effects of scattering on Remote Sensing:** i i. Reduces image contrast. ii ii. Changes spectral signature of ground objects as seen by the sensors (Difficult to	Diagram 3 marks and explanations 7 marks	20 minutes

	differentiate the objects) **b) Absorption:** • Absorption is the process by which radiation is absorbed and converted into other forms of energy such as heat or chemical energy etc. • The atmosphere prevents, or strongly attenuates, transmission of radiation through the atmosphere • Absorption of energy at a given wavelength is due to the presence of water vapor, CO2 and O3. • Three gases: - Ozone (O3): absorbs ultraviolet radiation high in atmosphere - Carbon-dioxide (CO2): absorbs mid and far infrared in lower atmosphere - Water vapor (H2O): absorbs mid and far infrared in lower atmosphere Spectral bands in which atmosphere is trans missive of energy are referred to as - **atmospheric windows**. c) **Refraction:** The bending of light rays at the contact between two media that transmit light but with different density; when light enters the denser medium, it is diffracted toward surface normal. Refraction is minimum in the zenith and maximum at the horizon. **d) Emission:** • Atmosphere emits EMR due to its thermal state. • Due to gaseous structure only discrete band of radiations are emitted by the atmosphere.		
7	**Azimuthal (Planar)** projections, points are projected from the surface of the Earth to the plane. A commonly used projection of this type is the stereographic conformal projection. **Planar or Azimuthal Projections are used most often to map Polar Regions.** Planar projections were developed to help people find the shortest distance between two points. A planar map is good for plotting ocean  	Each type 2 marks	20 minutes

	or air voyages and for showing the north and south Polar Regions. However, landmasses farther away from the center point are greatly distorted. **Conical** projections result from conceptually transferring the earth's coordinates onto a cone. Conic map projections are generally not well-suited for mapping very large areas. They are more suitable for mapping continental and regional areas. For example, Albers Equal Area Conic and LCC are common for mapping the United States.  Cylindrical Projection Surface **Cylindrical** projections are a family of projections resulting from conceptually transferring the earth's coordinates onto a cylinder. **Universal Transverse Mercator (UTM) projection** system is one of the commonly used projection systems. A cylindrical projection is accurate near the equator but distorts distances and sizes near the poles. One advantage to cylindrical projections is that parallels and meridians form a grid, which makes locating positions easier. On a cylindrical projection, shapes of small areas are usually well preserved. **Earth intersects the cylinder on two small circles. All points along both circles have no scale distortion.**		

Part C [Application level questions] **(3Qx10M=30)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8a	Advantages of remote sensing system • Easy data acquisition at various scales and resolution. • Large area coverage.	Formula 2 marks and calculation 2 marks and Answer 1 mark (5 marks)	10 minutes

	• Data acquisition of remote and inaccessible areas. • Multidisciplinary utility. • Repetitive coverage allows monitoring of dynamic themes like water, agriculture etc. • Reduces field work • Economic and efficient technology		
8b	Sol: L = 9.65cm, W = 5.12cm $S = \frac{1}{20000}$ Ground Area = photo Area $\times \frac{1}{S^2}$ photo Area = $L \times B = 9.65 \times 10^{-2} \times 5.12 \times 10^{-2}$ $= 49.41 \times 10^{-4}\ m^2$ Ground Area = $49.41 \times 10^{-4} \times \frac{1}{\left(\frac{1}{20,000}\right)^2}$ $= 1.977 \times 10^{6}\ m^2$ or Hectares = $10^4\ m^2$	1 marks for each class (5 marks)	10 minutes

<table>
<tr>
<td>9a</td>
<td>Decimal Degree is another format of expressing the coordinates of a location. To convert a coordinate pair from degree minute second to decimal degree following method is adopted.

We have 12 full degrees, 58 minutes - each 1/60 of a degree, and 21 seconds - each 1/60 of 1/60 of a degree

12 +(58/60)+(21/3600) = 12+0.9+0.0058 = 12.9058

While writing coordinates of a location, latitude is followed by longitude. For example, coordinates of Bangalore is written as

Similarly 77° 34′ 50″ can be written as 77.5138. So, we can write coordinates of Bangalore in decimal degree format as: 12.9058 N, 77.2088 E</td>
<td>5 marks for calculation</td>
<td>10 minutes</td>
</tr>
<tr>
<td>9b</td>
<td>Applications of vector and raster data in GIS
<table>
<tr><th>Vector data</th><th>Raster data</th></tr>
<tr><td>Vector data is extremely useful for storing and representing data that has discrete boundaries, such as borders or building footprints, streets and other transport links, and location points. Ubiquitous online mapping portals, such as Google Maps and Open Street Maps, present data in this format.</td><td>Raster data are used to represent thematic data (also known as discrete or categorical), which show features such as land-use or soil class data. All raster images are made up of up of thousands (or millions) of individual "picture elements" or pixels. The data can be continuous like elevation, temperature, precipitation etc., and categorical data such as land cover type, soil type, vegetation type.</td></tr>
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</td>
<td>5 marks for explanations</td>
<td>10 minutes</td>
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10	Applications in Civil Engineering fields and other areas • **Foundation engineering -** GIS helps in generating soil and geology maps of the area that needs to be investigated. This will greatly help in finalizing the type and depth of foundation, load bearing capacity of the soils etc. Though the complete finalization is not possible without insitu lab tests of the soil. • **Structural engineering-** GIS will be useful in designing, modelling, scheduling work flow and maintenance of buildings and other structures. • **Construction management-** Along with Infrastructure management, GIS can be employed to carry out the study on site suitability analysis and cost estimates in order to save the cost and time. • **Environmental engineering**- Flood modelling, routes for inundation canals, estimation of pollution of various sites • **Transportation engineering-** Traffic engineering is boosted with the help of GIS. Once the database is created (It might take lot of time and needs constant up gradation too) and network analysis is performed, it becomes immensely useful to predict the traffic conditions, finalize the optimum route, locate nearest police stations, hospitals, find alternate routes, you name it, all can be carried out using GIS. • **Reservoir Site Selection:** To find a suitable site for the dam. • GIS tries to find best location that respect to natural hazards like earthquake and volcanic eruption • Watershed analysis • Wastewater, storm water and Solid Waste Management • Regional Planning and Site Investigations • Landslides, land use / land cover • Agriculture, Forestry, flood damage, • Terrain Mapping and Analysis • **Disaster Management**	1 marks for each application (10 marks)	20 minutes