Scoring Indicators

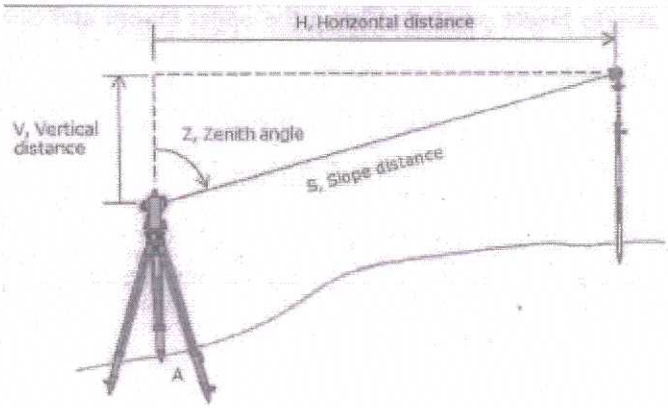
COURSE NAME: **Surveying for Architecture** VERSION: 2

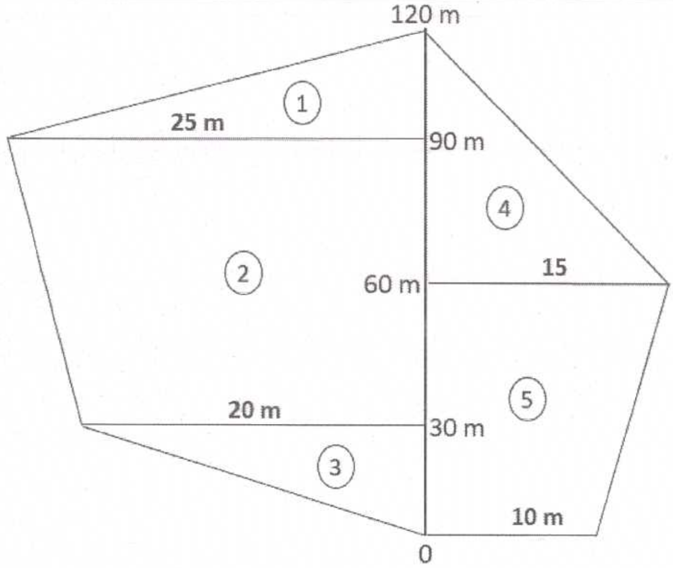
COURSE CODE: (21) **4182** QID: 2103230160

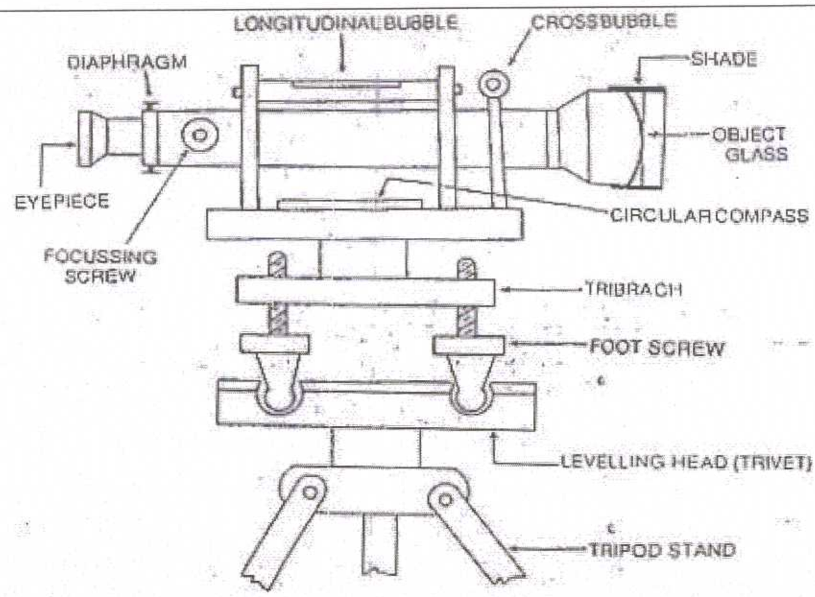
Qn. No.	Scoring indicator	Split up score	Sub Total	Total [75]
	PART – A			
I. 1	Plane surveying	1	1	9
I. 2	100 links	1	1	
I. 3	Parallax is the displacement in the apparent position of an object viewed along two different lines of sight. This happens when the image formed by the objective lens fails to fall in the plane of diaphragm.	1	1	
I. 4	Change point	1	1	
I. 5	Transiting is revolving the telescope in a vertical plane about a horizontal axis by 180°.	1	1	
I. 6	Swinging is the process of turning the telescope in horizontal plane about a vertical axis.	1	1	
I. 7	The inclined distance between total station and target is called slope distance.	1	1	
I. 8	Global Positioning System	1	1	
I. 9	Total station	1	1	
	PART – B (*any 8*)			
II. 1	Temporary adjustments of Prismatic Compass Centering Centering is the process of keeping the instrument exactly over the station. It is done by adjusting the legs of the tripod. A plumb-bob may be used to judge the centering and if it is not available, it may be judged by dropping a pebble from the centre to the bottom of the instrument. Levelling If the instrument is a hand instrument, it must be held in hand in such a way that graduated disc is swinging freely and appears to be level as judged from the top edge of the case. Generally, a tripod is provided with ball and socket arrangement with the help of which the top of the box can be levelled. Focusing the prism The prism attachment is slided up or down for focussing till the readings are seen sharp and clear.	1 1 1	3	8×3 = 24
II. 2	(a) AB: Back bearing = 220° 30 ’ = S 40° 30’ W (b) BC: Back bearing = 60° 30 ’ = N 60° 30’ E (c) CD: Back bearing = 110° = S 70° E	1 1 1	3	

II. 3	**Disadvantages of Plane table surveying:** ▪ The plane table survey is not possible in unfavorable climates such as rain, fog etc. ▪ This method of survey is not very accurate and thus unsuitable for large scale or precise work. ▪ As no field book is maintained, plotting at different scale require full exercise. ▪ The method requires large amount of time to be spent in the field. ▪ Quality of the final map depends largely on the drafting capability of the surveyor. ▪ This method is effective in relatively open country where stations can be sighted easily. (*any* 4)	¾ × 4 = 3	3	
II. 4	1. Contours of different elevations cannot cross each other (caves and overhanging cliffs are the exceptions). 2. Contours of different elevations cannot unite to form one contour (vertical cliff is an exception). 3. A single contour cannot split into two lines. 4. The horizontal distance between any two contour lines indicates the amount of slope and varies inversely on the amount of slope. Thus, contours are spaced equally for uniform slope; closely for steep slope contours and widely for moderate slope. 5. The steepest slope of terrain at any point on a contour is represented along the normal of the contour at that point. They are perpendicular to ridge and valley lines where they cross such lines. 6. Contours do not pass through permanent structures such as buildings. 7. A contour line must close itself but need not be necessarily within the limits of the map. 8. A closed contour line on a map represents either depression or hill. A set of ring contours with higher values inside, depicts a hill whereas the lower value inside, depicts a depression (without an outlet). 9. Contours deflect uphill at valley lines and downhill at ridge lines. Contour lines in U-shape cross a ridge and in V-shape cross a valley at right angles. The concavity in contour lines is towards higher ground in the case of ridge and towards lower ground in the case of valley. 10. Contours do not have sharp turnings. 11. A series of straight, parallel and equally spaced contours represent a plane surface. (*any* 4)	¾×4 = 3	3	
II. 5	Parallax is a condition arising when the image formed by the objective is not in the plane of the cross hairs. Parallax can be eliminated in two steps:- <u>Focussing the eye-piece lens</u> First, point the telescope towards the sky or hold a sheet of white paper in front of the objective; Next, move the eye-piece in or out by rotating it gradually until the cross hairs appear quite sharp and clear. Focusing of eye-piece	1½	3	

	depends on the eye-sight of observer and so for each observer it needs to adjusted accordingly. <u>Focussing the objective</u> First, direct the telescope towards the object for observation. Next, turn the focusing screw until the image of the object appears clear and sharp as the observer looks through properly focused eye-piece. If focusing has been done properly, there will be no parallax i.e., there will be no apparent movement of the image relative to the cross hairs if the observer moves his eye from one side to the other or from top to bottom. The telescope is directed towards the objects and focusing screw is turned clockwise (or) anticlockwise until the image appears clean and sharp.	1½		
II. 6	i. Vertical axis ii. Horizontal axis / Trunnion axis / Transverse axis / Transit axis iii. Line of collimation / Line of sight iv. Axis of plate level v. Axis of altitude level vi. Axis of striding level	½ ½ ½ ½ ½ ½	3	
II. 7	▪ To measure the horizontal angle and vertical angle between two points accurately up to a precision of 1''. ▪ To check the alignments of roads, railways track tunnel and bridges. ▪ It is used in the prolongation of alignment of road, railways etc. ▪ It is used for measurements of bearing and measurements of horizontal and vertical distances and determination of the direction of true north. (any 3)	1×3 = 3	3	
II. 8	<u>**Uses of GIS**</u> **Facility management** Locating underground cables Planning facility maintenance Telecommunication network services Energy use tracking and planning **Environmental and natural resource management** Agriculture crop suitability Management of forests, agricultural land, water resources, wetlands, etc Environmental Impact Analysis (EIA) Disaster management and mitigation Waste dumping sites location **Street Networking** Car navigation Locating houses and streets Site selection Ambulance services Transportation planning **Planning and engineering** Urban planning Regional planning	¾×4 = 3	3	

	Route selection for highways Public facility development **Land information system** Cadastre administration Taxation Zoning of land use Land acquisition (*any 4*)			
II. 9	1. **Horizontal angle**: The rotation of the instrument's optical axis from the instrument north in a horizontal plane. When the user first sets up the instrument the choice of zero direction is made, which is the North. 2. **Vertical angle**: The inclination of the optical axis from the local vertical. Vertical angle is usually measured as zenith angle. 0° is vertically up, 90° is horizontal and 180° is vertically down. 3. **Slope distance**: The inclined distance between the instrument and the target. 	1 1 1	3	
II. 10	Distomats are latest in the series of EDM instruments. These instruments measure distances by using amplitude modulated infrared waves. Two identical instruments are used, one at each end of line to be measured. The master unit sends the signals to the remote unit, which receives and reflects back the signals. The instrument can automatically send each of the signals and calculates the phase-shift in each case. The distance is them automatically displayed. **Distomat D1 1000** It is a very small, compact EDM, particularly useful in building construction and other civil engineering works, where distance measurements are less than 500 m. To measure the distance, one has to simply point the instrument to the reflector, touch a key and read the result.	2 1	3	

	PART – C			
III		1	7	
	Area Calculations			
	Area of portion 1 = $bh/2 = 25\times30/2 = 375$ m^2	1		
	Area of portion 2 = $(l_1+l_2)\times h/2 = (20+25)\times60/2 = 1350$ m^2	1		
	Area of portion 3 = $bh/2 = 20\times30/2 = 300$ m^2	1		
	Area of portion 4 = $bh/2 = 15\times60/2 = 450$ m^2	1		
	Area of portion 5 = $(l_1+l_2)\times h/2 = (10+15)\times60/2 = 750$ m^2	1		
	Total area = 3225 m^2	1		6×7 = 42
IV	**Chain** The chain is usually made of steel wire, and consists of long links joined by shorter links. They are formed of straight links of galvanized mild steel wire bent into rings at the ends and joined each other by 3 small circular or oval rings, the ends of the chain are provided with brass handles at each end with swivel joint, so that the chain can be turned or twisted. It is designed for hard usage, and is sufficiently accurate for measuring the chain lines and offsets of small surveys. *Types of chains* 1. Metric chains 2. Steel band or Band chain 3. Gunter's chain or surveyor's chain 4. Engineer's chain 5. Revenue chain **Tapes:** Tapes are used where greater accuracy of measurements are required, such as the setting out of buildings and roads. They are 15m or 30m long marked in metres, centimeter and millimeters. **Arrows** Arrows are made of good quality hardened steel wire of 4 mm diameter and are made in 25 cm to 50 cm length. They are pointed at one and the other end is bent into a loop or circle. **Ranging rods**	1¾×4 = 7	7	

	Ranging rods are used to range intermediate points in the survey line. The length of the ranging rod is either 2 m or 3 m. They are shod at bottom with a heavy iron point. Ranging rods are divided into equal parts 20 cm long and they are painted alternately black and white or red. When they are at considerable distance, red and white or white and yellow flags about 25 cm2 should be fastened at the top. **Offset rod** An offset rod is similar to ranging rod, but it is provided with a hook at the top for pulling or pushing the chain through a hedge. It is divided into metres and decimeters with alternate bands of paints. Offset rods are mainly used for measuring offsets. **Cross staff** Cross staff is the simplest instrument used for setting out a right angle. The common forms of cross staff are: open cross staff, french cross staff and adjustable cross staff. **Pegs** These are rods made from hard timber tapered at one end. Generally 25 mm^2 or 30 mm^2 and 150 mm long wooden pegs are used to mark the position of the stations on the ground. They are driven into the ground using a wooden hammer and kept about4 cm projecting above the surface. **Plumb bob** It is a solid cone attached to a thread. It is used to transfer points to the ground. (*any* 4)			
V	 Dumpy level consists the following parts or components:- **Telescope** Telescope is used to sight a staff placed at desired station and to read staff reading distinctly. The important parts of telescope are eye piece, objective lens, diaphragm, focusing screw and ray shade. Diaphragm is provided in front of the eye piece. It contains cross hairs made of dark metal which are arranged in perfect perpendicular positions. These cross hairs are used by the eye piece to bisect the objective through objective lens.Eye	3	7	

	piece is used by the observer's eye to view the distant object. It contains magnifying glass which magnify the observing image and also the cross hairs of diaphragm. So, accurate reading can be obtained. **Vertical spindle** Vertical spindle is located at the center of the whole instrument. The telescope can be rotated in horizontal direction with respect to vertical spindle. The instrument is connected to the tripod stand using vertical spindle. **Tribrach** Tribrach plate is parallel to the leveling head or trivet. It is connected to trivet by leveling screws or foot screws which can adjust the tribrach plate. The horizontal level of the instrument can be achieved by adjusting this tribrach plate. **Bubble Tube** Bubble tube is used to make the axis of the telescope horizontal. Bubble tubes are provided to check the level of the instrument. Two bubble tubes are provided in a dumpy level which are arranged perpendicular to each other on the top of the telescope. One tube is called as longitudinal bubble tube and another is called as cross bubble tube. The instrument is said to be in perfect position when both the bubbles of the tubes are at center or middle of the tube. **Leveling screws** Foot screws are provided to regulate the tribrach position and hence the instrument can be leveled which is known by observing the bubble tube. The tribrach plates can be lowered or raised using foot screws. The position of tribrach is said to be correct when the bubble in bubble tube is at center. **Leveling head** Leveling head is also called as trivet. It contains two triangular shaped plates which are arranged parallel to each other. Three groves are provided at the three corners of the plates in which foot screws are supported. **Tripod stand** Tripod stand fix the instrument (level) at a convenient height of an observer. Tripod is used to support the whole leveling instrument on its top. It consists of three legs which can be adjustable to required position. The legs are of same height and they may be solid or hollow. Steel shoes are provided at the bottom of each leg to hold the tripod in a fixed position.	1×4 = 4		
VI	**Uses of contour maps** 1. Contours provide valuable information about the nature of terrain. 2. Suitable site for the project works to be taken up. 3. Contour map helps in finding out the depth of cutting and filling, if formation level of road/railway is decided. 4. Contour map provides useful information for locating a route at a given gradient such as highway, canal, sewer line etc. 5. When the intervisibility between two points cannot be ascertained by inspection of the area, it can be determined using contour map. 6. The catchment area of a river can be determined using contour map. 7. The storage capacity of a reservoir can be determined from contour map.	1×7 = 7	7	

VII (Total: 7)

Instrument station	Station	Readings (m) BS	IS	FS	HI (m)	RL (m)	Remarks	Marks
O_1	BM	0.235			100.235	100.000	Bench mark	½
	A		0.195		100.235	100.040		½
	B		0.645		100.235	99.590		½
O_2	C	0.295		0.125	100.405	100.110	Change point	1
	D		0.185		100.405	100.220		½
O_3	E	0.555		0.635	100.325	99.770	Change point	1
	F		0.375		100.325	99.950		½
	G			0.255	100.325	100.070		½
$\sum$		1.085		1.015				½

$\sum BS - \sum FS = 0.07$ ½

Last RL - First RL = 0.07 ½

Therefore, $\sum BS - \sum FS =$ Last RL - First RL ½

VIII (Total: 7)

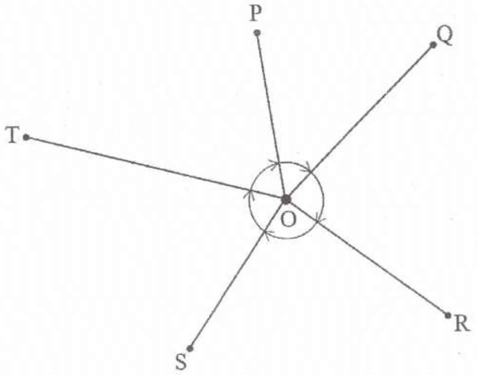
Instrument station	Station	Readings (m) BS	IS	FS	Rise (m)	Fall (m)	RL (m)	Remarks	Marks
O_1	BM	0.235					100.000	Bench mark	
	A		0.195		0.040		100.040		½
	B		0.645			0.450	99.590		½
O_2	C	0.295		0.125	0.520		100.110	CP	1
	D		0.185		0.110		100.220		½
O_3	E	0.555		0.635		0.450	99.770	CP	1
	F		0.375		0.180		99.950		½
	G			0.255	0.120		100.070		½
$\sum$		1.085		1.015	0.970	0.900			½

$\sum BS - \sum FS = 0.07$ ½

Last RL - First RL = 0.07 ½

$\sum Rise - \sum Fall = 0.07$ ½

Therefore, $\sum BS - \sum FS =$ Last RL - First RL $= \sum Rise - \sum Fall$ ½

IX	**Reiteration method** The method of reiteration is usually adopted in case several angles of well distributed points are to be measured from the same instrument station with high precision. In this method, angles are measured successively starting from a point termed as initial station. The angle between the terminating station and the initial station is the last observation during a set of measurement of horizontal angle by method of reiteration. The process of measuring the angle between the last station and the initial station is termed as *closing the horizon*. When the horizon is closed, the final reading of the vernier should be the same as its initial reading if there is no discrepancy.	1		
	 	2		
	3.1 *Procedure* (i) Set-up the instrument at 'O' and carry out temporary adjustments. (ii) With the face left and right swing, adjust the vernier A to 0° 00' 00" by using the upper clamp and its tangent screw. (iii) Loosen the lower clamp and direct the telescope to sight station 'P'. Now tighten the lower clamp and bisect the station 'P' exactly by using the lower tangent screw. (iv) Unclamp the upper clamp and swing the telescope and bisect the station 'Q'. Tighten the upper clamp and bisect 'Q' accurately using the upper tangent screw. (v) Read both the verniers 'A' and 'B'. (vi) Unclamp the upper clamp and swing the telescope and bisect the station 'R'. Tighten the upper clamp and bisect 'R' accurately using the upper tangent screw. (vii) Read both the verniers 'A' and 'B'. (viii) Likewise, sight stations 'S', 'T' etc. and read the verniers. (ix) Finally, close the horizon by sighting the reference object P again. Note down the readings. (x) The vernier 'A' should now read zero at the end. Otherwise, the error is equally distributed among all the observed angles. If the error is large, the readings should be discarded. (xi) Change the face of the instrument to face right. Repeat the procedure in the anti-clockwise direction. (xii) The average value of each angle obtained with the face left and the face right provides the observed values of the angles. (xiii) Calculate the included angles from the observed angles.	4	7	

X	Temporary adjustments At each station point, before taking any observation, it is required to carry out some operations in sequence. This is known as temporary adjustment. Temporary adjustment of a vernier theodolite consists of following operations: ▪ Setting ▪ Centering ▪ Levelling ▪ Focussing			
	Setting The tripod is placed over the station with its legs widely spread so that the centre of the tripod head lies above the station point and its head approximately level (by eye estimation). The instrument is then fixed with the tripod by screwing through trivet. The height of the instrument should be such that observer can see through telescope conveniently. After this, a plumb bob is suspended from the bottom of the instrument.	1		
	Centering First, the approximate centering of the instrument is done by moving the tripod legs radially or circumferentially as per need of the circumstances. Due to radial movement of the legs, plumb bob gets shifted in the direction of the movement of the leg without seriously affecting the level of the instrument. When the legs are moved sideways or circumferentially, the plumb does not shift much but the level gets affected. Sometimes, the instrument and the tripod have to be moved bodily for centering. Finally, the screw-clamping ring of the shifting head is loosened and the upper plate of the shifting head is slide over the lower one until the plumb bob is exactly over the station mark. After the exact centering, the screw clamping ring is tightened.	2	7	
	Levelling The plate bubble is made parallel to a pair of foot screws and its bubble is brought in the center by means of these two foot screws, which are to rotated either both inwards or both outwards by the same amounts. The bubble always moves in the direction of movement of the left thumb. The plate bubble is then turned through 90° so that it lies over the third foot screw. Then by rotating third foot screw the bubble is brought in the centre. Then the plate bubble is brought to its original position and the bubble is again centered by two foot screws. This process is repeated till the bubble remains in the centre in the original and right angled position.	2		
	Focussing Focusing operation involves two steps: Focussing the eye-piece lens First, point the telescope towards the sky or hold a sheet of white paper in front of the objective; Next, move the eye-piece in or out by rotating it gradually until the cross hairs appear quite sharp and clear. Focusing of eye-piece depends on the eye-sight of observer and so for each observer it needs to adjusted accordingly. Focussing the objective	1		

First, direct the telescope towards the object for observation. Next, turn the focusing screw until the image of the object appears clear and sharp as the observer looks through properly focused eye-piece. If focusing has been done properly, there will be no parallax i.e., there will be no apparent movement of the image relative to the cross hairs if the observer moves his eye from one side to the other or from top to bottom. The telescope is directed towards the objects and focusing screw is turned clockwise (or) anticlockwise until the image appears clean and sharp. 1

XI

Line	*Length, l (m)*	*WCB, θ (°)*	*Latitude (m)* $L = l \cos\theta$	*Departure (m)* $D = l \sin\theta$	Marks
					1
AB	14	25	12.69	5.92	1½
BC	20	120	-10.00	17.32	1½
CD	16	60	8.00	13.86	1½
DE	30	220	-22.98	-19.28	1½

Total: 7

XII **Methods of traversing**

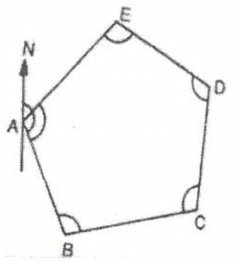
By direct observation of angles

In this method, the angle between successive lines is measured directly by the theodolite and the bearing of the initial line is observed. The bearing of the remaining lines are then computed from the observed bearing and the measured angles. This method is adopted for long traverses requiring high precision. 1

Traversing by included angles

The process consists of measuring included angles by taking a backsight on the preceding line and a foresight on the forward station. It is usually adopted for closed traverse. 1

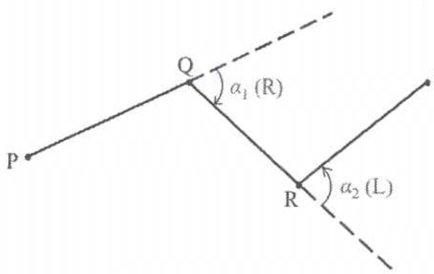
If the direction of progress is anti-clockwise, the angles measured will be interior angles and if it is clockwise, the angles measured will be exterior angles.



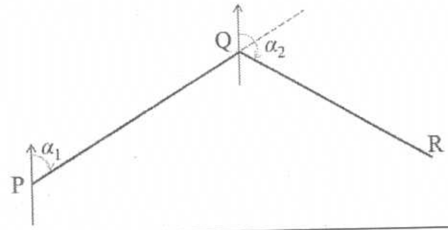
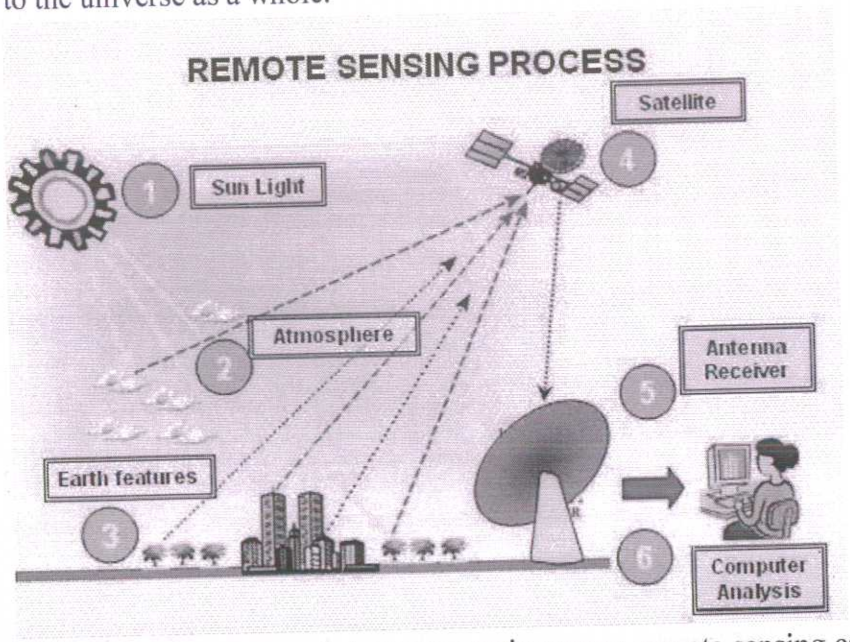
1   7

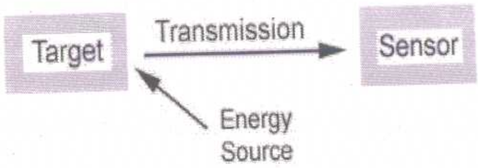
Traversing by deflection angles 1

The process consists of measuring deflection angles and it is mainly adopted for open traverse.



1

	By fast needle method In this method, the magnetic meridian is established at the first station and the magnetic bearing of the subsequent lines are worked out accordingly. It is usually used for short traverses. 	1 1		
XIII	Remote sensing is the science & art of acquiring information about a material object by making measurements at a distance from without coming into physical contact with the help of the electromagnetic energy it radiates. It is a method of gathering information about the Earth's surface from a distance. Remote sensing includes imagery and other data collected from satellites, balloons, and drones. Remote sensing is used to study things on all scales ranging from the smaller atom to the universe as a whole.  Depending upon the source of electromagnetic energy, remote sensing can be classified as passive remote sensing and active remote sensing. Most of the remote sensing uses passive mode. Using solar energy as the source of electromagnetic radiation. In case of active remote sensing, energy is generated and sent from remote sensing platform towards the targets. The energy is reflected back from the targets and recorded using sensors onboard the remote sensing platform. `Aircrafts and satellites are the common platforms used for remote sensing.	2 2 1	7	

	Components of remote sensing:-  ▪ Energy source illuminates or provides electromagnetic energy to the target. ▪ The energy interacts with the target depending upon the properties of target. ▪ Sensor is a remote device that will collect and record the the electromagnetic radiation. ▪ Data sent to data processor ▪ Data is processed into a usable format – often as image ▪ The image is then interpreted in order to extract information about the target. This interpretation can be done visually or electronically with the help of computers and image processing software. **Applications of Remote sensing** ▪ Forestry ▪ Agriculture ▪ Water resources ▪ Ocean and marine sources ▪ Management of waste land ▪ Detection of water pollution ▪ Geology and mineral resources ▪ Soil mapping ▪ Mapping of land use / land cover ▪ Monitoring of environmental hazards	1 1		
XIV	<u>Facility management</u> Locating underground cables Planning facility maintenance Telecommunication network services Energy use tracking and planning <u>Environmental and natural resource management</u> Agriculture crop suitability Management of forests, agricultural land, water resources, wetlands, etc Environmental Impact Analysis (EIA) Disaster management and mitigation Waste dumping sites location <u>Street Networking</u> Car navigation Locating houses and streets Site selection Ambulance services Transportation planning	1×7 = 7	7	

	Planning and engineering Urban planning Regional planning Route selection for highways Public facility development Land information system Cadastre administration Taxation Zoning of land use Land acquisition (*any* 7)			

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1. Rangwala SC, Rangwala PS. Surveying and Levelling. Charotar Publ.; 1985.
2. https://nptel.ac.in/courses/105107122
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6. https://rashidfaridi.com/2018/03/03/prismatic-compass-a-simple-survey-tool-for-geographers/
7. https://theconstructor.org/surveying/dumpy-level-surveying-components-procedure-advantages/20456/