

WINTER-18 EXAMINATION

Model Answer

Subject Code:

17602

Important Instructions to examiners:

Subject Name: Highway Engineering

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.	Sub	Answor	Marking
No.	Q. N.	Aliswei	Scheme
Q.1	(A)	Attempt any THREE of the following :	(12)
Q.1	A)a)	Enlist any four characteristics of road transport.	
	Ans:-	Characteristics of road transport-	
		1) The roads are the connecting links between the various regions or parts of a country.	
		It requires relatively less investment by the government.	01M each
		3) Construction and maintenance of road transport is cheaper.	(any four)
		4) Road transport is a important access or way to reach a railway station, an airport,	
		terminal bus stations etc. (Road provides door to door service)	
		5) Road transport offers a complete freedom to road users to transfer the vehicle from	
		one lane to other according to need and convenience.	
		6) Road transport saves time of travel for short distance and also saves the time of light	
		traffic.	
		Roads are used by various types of road vehicles.	
		8) Degree of accidents is more but severity of accident is less.	
Q.1	A)b)	Describe in brief classification of urban road.	
	Ans:-	The urban roads are classified as:	
		1) Arterial roads: The streets primarily for through traffic on a continuous route, but	
		with high level of traffic mobility are known as arterial roads.	
		2) Sub-arterial roads: The streets primarily for through traffic on a continuous route but	01M oach
		have a lower level of traffic mobility than the arterials are known as sub-arterial	O IN Each
		roads.	
		3) Collector streets: The Street which provides access to arterial streets and they collect	
		and distribute traffic from and to local streets is known as collector streets.	
		4) Local streets: The streets which provide access to abutting streets are known as local	
		streets.	
Q.1	A)c)	Enlist any two instruments used & two details to be collected while conducting	
		reconnaissance survey.	
	Ans:-	Two instruments used while conducting reconnaissance survey are:-	01M each
		1)Prismatic compass 2)Abney level 3)tangent clinometers 4)barometer	(any two)
		Following details are collected while conducting reconnaissance survey:	



		1) To	collect the details of obstruction along	g the route which are	not available in the	
		m	ap. For example, valleys, ponds, lakes,	marshy land, ridge, hi	ills, permanent	01M each
		st	ructure etc.			(any two)
		2) To	collect geological features of field. For	example, soil type ald	ong the route and	(any two)
		ob	servation required for foundation work	of bridges and const	ruction of road	
		pa	vement.			
		3) To	collect information regarding the available	ability of local constru	iction material, water	
		an	d labour.			
		4) To	locate the obligatory points along the a	alternative routes.		
Q.1	A)d)	Enlist	t eight drawings required for road proj	ect.		
	Ans:-	1) Key map			
		2) Index map			
		3) Preliminary survey plan			1/2 14
		4) Detail location survey plan and longit	udinal section		
		5) Detail cross section of road			each
		6) Land acquisition plans			(Any
		7) Drawing of cross drainage and masor	nry structures		eight)
		8) Road junction drawing			
		9) Drawings for retaining walls and othe	er structure.		
Q.1	A)e)	State	the necessary of providing shoulder a	nd write minimum w	idth of shoulder as per	
	, ,	IRC.	, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,		, ,	
	Ans:-	Nece	ssity of shoulder:			
		1) Shoulders are provided along the roa	id edge to serve as an	emergency lane for	
			vehicle compelled to be taken out of	pavement or road wa	ay.	02M (any
		2) Shoulder also acts as service lanes fo	r break down vehicles	5.	two)
		3	,) They provide lateral stability to the c	arriage way.		,
		4) They serve as parking places for vehi	cles in case of emerge	ency.	
		5) They provide the space for erecting r	oad signals.		
		Mini	mum width of shoulder as per IRC:			
		Sr.	Category of roads	Shoulder wid	Ith in meters	
		No	<i>o ,</i>	Plain area	Hilly areas	
		1	National and state highways:			
			a) Single lane	4.125m	1.25m	02M
			b) Two lane	2.5m	0.90m	
		2	Maior district roads:			
			a) Single lane	2.625m	0.5m	
			b) Two lane	1m		
		3	Other district roads:			
			a) Single lane	1.875m	0.5m	
			b) Two lane	1m		
		Δ	Village roads	2.05m	0.5m	
0.1	(B)	Atter	nnt any ONE of the following ·	2.2311	0.0.11	(06)
~.+		/ 1000/				(00)











Q.2	d)	State necessity of providing super elevation	and write minimum and maximum super	
		elevation values.		
	Ans:-	Necessity of providing super elevation:-		
		1) To counteract the effect of centrifugal for	rce acting on moving vehicle.	02M (any
		2) To help a fast moving vehicles to negotiat	e a curved path without overturning and	two)
		skidding.		
		3) To ensure smooth and safe movements o	f passengers and goods on the road.	
		4) To prevent damaging effect on the road s	urface due to improper distribution of load.	
		5) The maintenance cost of road on curve is	reduced.	
		The maximum value of super elevation in pla	in and ruling terrains and in now bound	02M
		areas are 7% i.e. 1 in 15. However for hill roa	ds it should be up to 10% i.e. 1 in 10.	-
0.2	e)	Enlist test carried on gagregate and state re	auirement of gagregate in highway	
	-,	construction.	4	
	Ans:-	Test on aggregate: -		
	-	1) Abrasion test		
		2) Impact test		1/2 M
		3) Soundness or durability test		, each (any
		4) Crushing test		four)
		5) Water absorption test		
		6) Flakiness index and elongation index		
		7) Angularity number test		
		8) Specific gravity test.		
		Requirement of aggregate in highway const	ruction:	
		1) It is used to bear the stresses occurrin	ng in the road structure.	02M (any
		2) It resists the wear and tear of the road	d due to abrasive action of traffic.	two)
		3) It transfers the load of traffic to the so	oil subgrade.	-
		4) It resists the impact on vehicular load	of the traffic.	
Q.2	f)	Differentiate between Rigid and Flexible pay	vement.	
	Ans:-	Rigid pavement	Flexible pavement	
		1) It does not undergo any change, but	1) It undergoes the change in shape before	
		fails due to rupture under load.	failure.	
		2) Temperature variation exerts stresses.	2) Temperature variation does not	
			produce stresses.	
		3) The total load is taken by topmost	3) The load is transferred through layer by	04M (any
		wearing surface.	layer.	four)
		4) Initial cost is more.	4) Construction cost is less.	
		5) Maintenance cost is low.	5) Maintenance cost is more.	
		6) Less tractive resistance.	6) More tractive resistance.	
		7) Good visibility at night.	7) Poor visibility at night.	
		8) More durable.	8) Less durable.	
Q.3		Attempt any FOUR of the following :		(16)
Q.3	(a)	Calculate S.S.D. for two way traffic on single	e lane road. The design speed of road is 70	
		Kmph. Assume reduction time of driver 2 sec	c. and coefficient of friction 0.6.	
	Ans.	Given data,		
		V = 70 Kmph.		
		T = 2 sec.		
		f = 0.6		01 M
		SSD = 0.278 V t + (V ² / 254 f)		(for
		= (0.278 x 70 x 2) + (70 ² / (254 x 0.6))		formula)



		= 38.92 + 32.15	01 M
		SSD = 71.07 m. for one way traffic.	
		SSD for Two Way traffic on single lane road = 2 x SSD for one way traffic	
		= 2 x 71.07 m	02 M
		= 142.14 m	
03	(b)	Draw a neat sketch of overtaking zone with necessary provision of sign post	
Q.5	(D) Ans	Following is the sketch of overtaking zone:	
	A113.		
		MINIMUM LENGTH = 3 (OSD)	02 M
		SP1 b SP2	02 111
		ě.	02 M
		deba i deba	(01 M
		OSD OSD OSD OSD	each sign
		OSD = (d1+ d2) FOR ONE WAY TRAFFIC	post)
		OSD = (d1 + d2 + d3) FOR TWO WAY TRAFFIC	p = = = ;
		SP1 - SIGN POST "OVERTAKING ZONE AHEAD" SP2 - SIGN POST "END OF OVERTAKING ZONE"	
		Figure : Overtaking Zones	
Q.3	(c)	Discuss special consideration to be adopted while deciding alignment of hill road.	
	Ans.	The following are the special considerations to be adopted while deciding alignment of	
		hill road:	
		(i) Length of Road: The alignment of hill road should be as short as possible because cost	
		of road kilometerage in hilly area is comparatively very high.	
		(ii) Geometrical standards of hill roads: The alignment should have proper geometrical	
		standards such as gradient, curves, radius of curves etc. It should be free from sharp hair-	
		pin bends. The minimum radius of curve for a hill road allowed is 50 m. for a National or	
		State highway. In order to provide proper geometrical standards, the alignment is likely	04 M
		to be changed.	(01 M
		(iii) Stability: The alignment should be provided along that side of hill which is stable and	each –
		not very steep. Thus, the alignment of road is to be changed to provide the road on that	any four)
		side of the hill, which is free from landslides.	
		(iv) Cutting through rocks: The alignment should avoid cutting through solid rocks	
		because it is a very costly item. Thus, in order to avoid excessive cutting through rocks,	
		the alignment is to be changed.	
		(v) Existing saddle or pass: The alignment should cross series of hills through the existing	
		saddle or pass. This may tend to make change in the alignment of the road so as to avoid	
	(Definer (i) hitumen (ii) Tan Falist ander of Situmen S. Tan	
Q.3	(a)	(i) Ditumen , (ii) Iar. Enlist grades of Bitumen & Iar.	
	AIIS.	associes liquid comi solid or solid in state and completely soluble in carbon disulphide	01 14
		(CS.) is called "Bitumen"	01 101
		(ii) Tar: The residual product obtained by destructive distillation of organic matter such	01 M
		as coal oil wood etc in known as TAR	
		(iii) Grades of Bitumen: Following are the grades of Bitumen:	01 M
		Viscosity Grade-VG VG10, VG20, VG30 and VG40	
		(iv) Grades of Tar: Following are the grades of Tar:	01 M
		Road Tar- RT RT1. RT2. RT3 and RT4	
0.3	(e)	Define cutback bitumen and enlist types of cutback bitumen.	
	Ans.	Cutback:	
		The solution of a bituminous material (asphalt or road tar) in a volatile solvent is	
		known as cutback.	01 M



		Types of cutback: The types of cutbacks are enlisted below:	
		Grade A: It is light and is recommended for use as a primer.	(01 M
		Grade B: It is medium and is recommended for surface dressing and resurfacing	each)
		operations.	03 M
		Grade C: It is heavy and is recommended for premix type road construction.	
Q.4	(A)	Attempt any THREE of the following:	(12)
Q.4	A)(a)	Define:	(4 M)
		(i) Lead	
		(ii) Lift	
		(iii) Borrow pit.	
		(iv) Spoil bunk	
		(i) Lead: The horizontal distance through which the excavated earth is carried and placed	
		for constructing the bank is called lead.	
		(ii) Lift: The vertical distance through which the excavated earth is lifted for constructing	04 M
		a bank is called lift.	(01 M
		(iii) Borrow pit: The pit dug along the alignment of a road for using their material in the	each)
		construction of road embankment is known as borrow pit.	
		(iv) Spoil bank: The bank constructed from surplus excavated earth on the side of cutting	
<u> </u>	• > / _ >	parallel to the alignment of the road is known as spoil bank.	
Q.4	A)(b)	Define traffic control device and enlist various types of traffic control device.	
	Ans.	Frame Control Device: The improvement made and facilities provided to the road users	
		so as to obtain efficient, free and rapid now of traffic with less number of accidents are	02 M
		Known as traffic control devices.	02 101
		(1) Traffic signs or Road signs	02 M
		(1) Traffic markings or Poad markings	(All four -
		(2) Traffic signals	(AII IOUI - 1/2 mark)
		(3) Traffic islands	1/2 mark
0.4	A)(c)	(4) Traffic volume study and state methods for counting traffic	eaciij
Q.4	A)(C)	Traffic Volume Study (TVS). The survey of the number of vehicles and nedestrians	
	AIIS.	crossing a soction of road nor unit time during any selected period is called "Traffic	01 M
		Volume Study"	UTIVI
		Methods for counting Traffic: The following are the methods for counting traffic:	
		(1) Manual Counting: In this method, a field team of enumerators (traffic persons) is	
		deputed to record traffic volume on the prescribed record sheets in a specified	01 M
		neriod	01 IVI
		(2) Automatic Recorders: In this method, the total number of vehicles crossing at a	
		road intersection in the desired period is automatically recorded by a mechanical	01 M
		recorder. These recorders are either fixed type or portable type.	
		(3) Moving car method: In this method, the number of vehicles met. overtaken and	
		the time taken to travel is noted by the observer moving in a car once against the	01 M
		traffic and second time along with the traffic.	
			l



Q.4	A)(d)	State requirement of highway drainage system :	
	Ans.	The requirements of highway drainage system are as follows:	
		(1) The surface water from the carriage way and shoulder should effectively be	
		drained off without allowing it to percolate to subgrade and weaken the soil.	
		(2) The surface water from the adjoining land should be prevented from entering the	
		roadway.	
		(3) The side drain should have sufficient capacity and longitudinal slope to carry away	(
		all the surface water collected from the roadway.	(any four)
		(4) Flow of surface water across the road and shoulders and along slopes should not cause erosion or form cross ruts.	each
		(5) Seepage and other sources of under-ground water should be effectively	
		intercepted and drained off by the suitable subsurface drainage system.	
		(6) Highest level of ground water table should be kept well below the level of	
		subgrade, preferably by at least 1.2 m. If the highest level of ground water level is	
		closer than 1.2 m., it is desirable to lower the same with a well-planned and laid	
		subsurface drainage system.	
		(7) In water-logged areas special precautions should be taken, especially if	
		detrimental salts are present or if flooding is likely to occur.	
Q.4	(B)	Attempt any ONE of the following:	(06)
Q.4	B)(a)	Describe in brief construction procedure of W.B.M. road.	
	Ans.	The construction procedure of W.B.M. road is discussed below:	
		1. Preparation of subgrade : The subgrade is prepared to the required grade and camber.	
		2. Preparation of the base course : After preparing the subgrade or sub base, the	
		required type of base course is constructed with specified materials in conformity with	01 M
		lines, grade and thickness.	
		3. Preparation of intermediate and wearing course: The preparation of intermediate	
		and wearing course of a WBM road is done in following steps:	
		(i) <u>Preparing the surface</u> :- The surface of the newly laid base course on which some	
		traffic has been allowed, is checked and the defective portions are rectified.	
		(ii) Providing edging or earthen kerbs :- After preparing the surface brick-on-end	
		edging is provided along the outer edges of the carriage way of the road.	
		(iii) Spreading of coarse aggregate :- The road metal is spread evenly over the	
		prepared base to the specified thickness.	
		(iv) Dry rolling :- After spreading the course aggregate, dry rolling is done by means of	
		a suitable roller. The rolling should be started from edges and gradually shifted towards	
		the centre after properly rolling each strip.	
		(v) Spreading of screenings :- After dry rolling, a blindage layer consisting of stone	04 M
		screenings (12 mm grits) is spread at a slow and uniform rate so as to ensure filling of all	
		voids.	
		(vi) <u>Wet rolling</u> :- After spreading the screenings, the surface is sprinkled over with	
		sufficient quantity of water, swept and rolled.	
		(vii) Application of binding material, watering and rolling :- After the application of	
		screening and wet rolling, the binding material is applied successively in two or more thin	
		layers at a slow and uniform rate. After each application, the surface is freely sprinkled	
		with water and rolled with 6 to 10 tons roller.	
		(viii) <u>Finishing the surface</u> :- After the final compaction, road surface is allowed to dry	
		overnight.	
		(ix) <u>Setting and drying</u> :- The surface is then allowed to cure for 7 to 9 days.	
		4. Preparation of shoulders : During curing, the shoulders are prepared by filling earth to	
		the specified cross slope. These are then properly compacted by rolling or tamping.	01 M







Q.5	(a)	Draw following signs: i) Give way	
		II) Speed limit iii) Hair nin hend left	
		iv) No parkina	
	Ans.	The following are road signs:	
		(i) Give Way :-	
		GIVE: WAY	01 M
		(ii) Speed Limit :-	
		SPEED LIMIT	01 M
		(iii) Hair pin bend left:-	
		HAIR PIN BEND LEFT	01 M
		(iv) No parking :-	
		NO PARKING or	01 M
Q.5	(b)	Enlist four techniques of prevention and controlling of land slides.	
	Ans.	The land slide cannot prevented due to earthquakes, but landslides due to other causes	
		can be prevented by taking the following measures:	any four
		2) By providing sub-surface drains at foot of the hill slope to control seepage flow.	(01 M
		3) By providing benching to soil slope.	each)
		4) By reducing the angle of slope or providing breast walls and retaining walls.	
		5) By constructing buttress at toe of hill slopes.	
		6) By slope treatment to minimize the erosion and to improve the stability of hill	
		slopes. This is done by turfing, stone pitching, cement grouting etc.	



Q.5	(c)	Describe in brief different types of gradient.	
	Ans.	(1) Ruling gradient: - The gradient usually adopted while making the alignment of a	
		road is called "Ruling Gradient". This is such a gradient that all vehicles, whether	
		drawn by power or by animals, can traverse long lengths of the road without	
		undue consumption of fuel or much fatigue.	
		(2) Limiting gradient: - The gradient steeper than the ruling which may be used in	
		restricted road lengths where the later is not feasible is called "maximum or	
		limiting gradient". This type of gradient may be used where the topography of a	
		place compels this course or where the adoption of greater gradients would add	
		enormously to the cost.	(any four)
		(3) Exceptional gradient: - The gradient steeper than the limiting which may be used	01 M
		in short lengths of the road, only in extraordinary situations, is called "Exceptional	each
		gradient". This type of gradient is adopted only in very difficult situations and for	
		short lengths not exceeding 100 m at a stretch.	
		(4) Average gradient: - The total rise or fall between any two points along the	
		alignment of a road divided by the norizontal distance between them is called "average Gradient"	
		(5) Floating gradient: - The gradient on which a motor vehicle moving with a	
		constant speed, continues to descend with the same speed without any	
		application of power or brakes is called "floating gradient".	
		(6) Minimum gradient: - The minimum desirable slope essential for effective	
		drainage of rain water from the road surface is called "minimum gradient".	
Q.5	(d)	Describe in brief methodology for Pothole repair in Bitumen road.	
	Ans.	Methodology for Potholes repair in bitumen road is called patching of pothole which is	
		discussed below:	
		For patching pot holes (over 35 mm) depth, these should be cut out square or	
		rectangular in shape up to the affected depth. The holes are then cleaned of all loose	
		aggregate, dust, foreign matter, etc. The internal portion of the holes is then painted	04 M
		with tar or bitumen. After this, usually premixed patching mix is placed in the holes and	
		the surface is rammed or rolled according to the size of the patch. When the pot hole is	
		more than 75 mm deep, the patch should be made in two or three layers and each layer	
		is rammed before placing the next layer. The finished level of the patches is kept slightly	
		above the original level to allow for further compaction under traffic.	
		when the pot holes are only 12 to 25 mm deep, their patching is done simply by	
		finished according to the adjacent road surface	
0.5	(e)	Draw a neat sketch of Power shovel.	
-	Ans.	The sketch of power shovel is given below:	
		DIPPER	
		STICK	
		BOOMHOIST LINE	
			(
		CAB	(02 M for
		1 Det -	diagram
			UZ IVI TOP
		CRAWLER	ianeiiiik)
		Man Milling	
		DIPPER	



Q.5	(f)	State use of following in highway construction	
		i) grader	
		ii) dragline	
		iii) bulldozer	
		iv) power shovel	
	Ans.	(i) Grader: A grader is mainly used for the following purposes:	01 M
		 To give the proper shape to the road subgrade. 	(any two
		2) To construct earth roads quickly.	1/2 M
		3) To spread the loose material evenly.	each)
		(ii) Dragline: Dragline is used to excavate soft earth and deposit in near-by banks or to	
		load into wagons.	01 M
		(iii) Bulldozer: Bulldozer is commonly used for excavating the material and for pushing	
		the same in the forward direction. It is mainly used for pushing and levelling a heap of	
		excavated material.	01 M
		(iv) Power shovel: Power shovels are used for the following purposes:	
		 To excavate soils of all types except solid soils. 	
		2) To collect and dump the material at the required place within the reach of dipper	01 M
		stick.	(any two
		3) To load the excavated soil into dump trucks, conveyor belts or other haling	1/2 M
		equipment.	each)
Q.6		Attempt any FOUR of the following:	(16)
Q.6	(a)	Enlist different types of roller and state two uses of roller.	
	Ans.	Types of roller: The different types of rollers are as follows:	
		(1) Smooth wheeled roller (also called static roller)	02 M
		(2) Vibratory roller	(1/2
		(3) Pneumatic tyred roller	mark
		(4) Sheep foot roller	each)
		Uses of roller: The following are the uses of roller.	
		(i) To prepare subgrade of soils for both flexible and rigid pavements.	
		(ii) To compact thick layers of road metal in WBM road construction.	
		(iii) To compress bituminous concentrated layers in roads.	02 M
		(iv) To consolidate the stone chippings, soil and sand.	(any four
		(v) To consolidate the sides of embankments of road.	1/2 mark
		To compact concrete slabs in rigid pavements.	each)
Q.6	(b)	Enlist the component parts of Hot mix plant.	
	Ans.	Following are the component parts of Hot mix plant:	
		(1) Cold bins.	
		(2) Cold elevator.	
		(3) Aggregate dryer.	(any eight
		(4) Dust collector.	1/2 M
		(5) Hot elevator.	each)
		(6) Screening Unit.	,
		(7) Hot bins.	
		(8) Hot asphalt cements storage unit.	
		(9) Mineral filler storage unit.	
		(10) Mechanical Mixer.	



Q.6	(c)	Describe in brief drainage structure in hill road.	
	Ans.	An adequate and effective drainage is very essential for better service and less	
		maintenance cost of hill roads. The drainage of hill roads consists of the following	
		structure:	
		1. Surface Drainage	
		2. Controlling Seepage flow	01 M
		3. Cross drainage	
		1) Surface Drainage: In case of hill roads, surface water causes erosion to the road	
		surface and hill sides and may result in landslides or slips. A proper arrangement for	
		drainage of surface water is therefore, importance to prevent erosion and landslides. An	
		efficient network of surface drainage system of a hill road consists of Side drains and	01 M
		Catch water drains or Intercepting drains.	
		2) Controlling Seepage flow: When the general ground as well as the impervious strata	
		lying underneath are slopping, the seepage flow is likely to exist. If the seepage zone is at	
		a depth less than 0.6 to 0.9 m from the surface of pavement, it is desirable to intercept	
		the seepage flow. For controlling seepage flow, <u>sub-surface drains</u> are provided at foot of	01 M
		the hill slope.	
		3) Cross drainage: An efficient cross drainage system is essential for disposing off the	
		surface water collected by catch water drains and side drains across the hill road. It	
		consists in providing cross drainage structure at frequent intervals. An effective cross	
		drainage system prevents side drains from overflowing and flooding the road surface.	
		Cross drainage is provided by constructing <u>Small under drains</u> , <u>Scuppers</u> , <u>Causeways</u> ,	01 M
		<u>Culverts</u> and <u>Minor</u> or <u>Major bridges</u> .	
Q.6	(d)	Explain necessity of maintenance of road.	
	Ans.	Following are the reasons which highlights the necessity of road maintenance:	
		(1) Road maintenance is necessary because timely and routine maintenance of the	
		road helps in preventing the accidents.	
		(2) Road maintenance is necessary to maintain various component of road like	
		pavement, shoulder, drains, side edges such that it provides the better services to	
		road users.	04 M
		(3) Road maintenance is necessary to provide the safe and convenient movements of	(any four)
		passengers and goods at all the time.	01 M
		(4) Road maintenance is necessary to maintain the road in the best possible	Each
		condition to enable the traffic to move smoothly and safely thereby decreasing	
		the inconvenient movement of traffic.	
		(5) Road maintenance is necessary to increase the life of the road.	
Q.6	(e)	Suggest suitable types of roller for compacting following:	
		i) Clayey soil	
		ii) Sandy soil	
		iii) Gravel	
		iv) Finishing of bitumen road	
	Ans.	The suitable types of roller for the given soils are as below:	
		(i) Clayey soil: - Sheep foot roller.	
		(ii) Sandy soil: - Smooth wheeled roller or vibratory roller.	01 M for
		(iii) Gravel: - Smooth wheeled roller or vibratory roller.	each