

# WINTER-17 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		Marking
No.	Q.	Answer	Scheme
	IN.		
Q. 1	(A)	Attempt any THREE of the following :	(12)
	(a)	State the classification of roads according to Nagpur Road Plan.	(4)
	Ans.	<ul> <li>According to Nagpur Road Plan, Roads in India are classified into the following categories:-(i) National Highways (N.H.):- The main highways running through the length and breadth of the country connecting major ports, foreign highways, capitals of states, large industrial and tourist places etc. are known as National Highway (N.H.).</li> <li>(ii) State Highways (S.H.):- The highways linking district head quarters and important cities within the state or connecting them with National Highways or with Highways of the neighboring states are known as State Highways (S.H.).</li> <li>(iii) Major District Roads (M.D.R.):- The important roads within a district serving areas of production and markets and connecting these places with each other or with the main highways are known as Major District Roads (M.D.R.).</li> <li>(iv) Other District Roads (O.D.R.):- The roads serving rural areas of production and providing them with outlet to market centers, Tehsil head quarters, block development head quarters, railway stations, etc. are known as Other District Roads (O.D.R.).</li> <li>(v) Village Roads (V.R.):- The roads connecting villages or group of villages with each other or with the nearest road of higher category are known as Village Roads (V.R.).</li> </ul>	Any Four 01 mark each
	(b)	State the importance of transportation.	(4)
	Ans.	The importance of transportation are as follows:	( ')
		<ul> <li>(1) The development of any country largely depends on the efficiency of its transportation system because the transportation triggers off a chain of activities related to economic development.</li> <li>(2) Transport carries the perishable goods produced by such industries to the consumers</li> </ul>	
		living in different distant places in time	Any Four
		(3) Transportation helps in mass production. Whether it is to purchase and bring raw	01 mark
		materials or it is to distribute finished goods, one or the other means of transport is necessary.	each.
		(4) Transportation opens up new avenues in agriculture, trade and commerce, service	
		industry, health and tourism industry by being means of communication.	
		Dea	a Na 1/12



		<ul> <li>(5) Transportation system improves the social awareness among the people, as one can travel far in a short time.</li> <li>(6) Transportation naturally greates ich expertunities for millions of people. Deeple from</li> </ul>	
		rural areas can travel to urban areas in search of better job opportunities. In this way transportation contributes to the social development of a nation.	
	(c)	Write four objectives of preliminary survey.	(4)
	Ans.	The main objectives of preliminary survey are:	
		reconnaissance survey and to collect all necessary details.	
		(2) To compare the different proposals in view of the requirements of a good alignment of	
		the Road.	Four pts.
		(3) To estimate quantity of earthwork materials and other construction aspects and to work out the cost of alternate proposals.	01 marк each
		(4) To finalise the best alignment from all considerations.	cucin
	(d)	State the contents of drawings required for road project.	(4)
	Ans.	(1) Key map (2) Index Map (3) Preliminary Survey Plan (4) Detailed location survey plan	½ mark
		and longitudinal section (5) Detailed cross-section (6) Land acquisition plans (7) Drawing	each.
		of Road intersections (8) Land plans for quarries	( - )
	(e) Ans	Explain term 'Design speed'. Design Speed:	(4)
	/	The maximum safe speed of vehicle assumed for geometrical design of a highway is	01 mark
		known as Design Speed.	
		This is the approximately uniform speed that can be maintained by majority of the drivers over the specified category of road. This speed is assumed for correlation of geometrics	
		(physical features) of a road that influence the operation of vehicles.	02 marks
		The sight distances, radius of horizontal curve, super elevation, extra widening of	
		pavement, length of horizontal transition curve and the length of summit and valley curve	01 mark
		are dependent on design speed.	OT IIIdI K
0 1	(B)	Attempt any ONE of the following :	(6)
Q. 1	(a)	Draw the cross-section of a NH in embankment showing clearly the component parts.	(0)
	Ans.	The cross-section of NH in embankment is drawn below:	02 marks
		RDAD SIDE TREE	for figure
		million and the	02 marks
		ROAD WAY	for
		SHOULDER SHOULDER BRUNDARY	labeling
		BOUNDARY STONE (2.5m) CARRIAGE WAY COND STONE (TOP)	
		STOPE SLOPE SLOPE DRAZN	02 marks
		t 3 hits which is the stand	for
		(DESTRABLE)	dimensio
		PERMANENT LAND WIDTH (30 to 60 m)	ns
		CROSS-SECTION OF A NATIONAL HIGHWAY (NOH) IN EMBANKMENT	



	(b)	Calculate the length of stopping sight distance for two way traffic in a single lane road having descending gradient of 2%. The design speed is 70 kmph. Assume reaction time of driver as 2.5 seconds and coefficient of friction as 0.6	(6)
	Ans.	Given data: 1) Descending gradient n% = 2% = 0.02	
		<ul> <li>2) Design Speed = V= 70 Kmph</li> <li>3) Total reaction time = t = 2.5 seconds</li> <li>4) coefficient of friction = f = 0.6</li> </ul>	
		As the road has descending gradient of 2 percent, the wheels will skid downward due to gradient after applying brakes.	
		S.S.D. = $0.278 \text{ V t} + (\text{V}^2 / 254 (\text{f} - 0.01 \text{ n}\%))$ = $0.278 \times 70 \times 2.5 + (70^2 / 254 \times (0.6 - 0.02))$ = $0.278 \times 70 \times 2.5 + (70^2 / 254 \times (0.58))$ = $48.65 + 33.26$	01 mark 01 mark
		= 48.03 + 53.20 = 81.91 say 82 m. Therefore, S.S.D. for two way traffic on a single lane road = 2 x SSD for one way traffic rd.	02 marks
		= 2 x 82 m. = 164 m.	02 marks
Q. 2		Attempt any FOUR of the following :	(16)
	<b>(a)</b> Ans.	<ul> <li>Write the use of any four drawings to be prepared for road project.</li> <li>The following are the various type of drawings which are to be prepared for road project with their use:</li> <li>(1) Key map: - The key map is use to identify the proposed road, existing roads and</li> </ul>	(4)
		important places to be connected. (2) Index Map: - Index map is use to understand the general topography of the area on	
		<b>(3) Preliminary Survey Plan</b> : - These plans show the details of various alternate alignments and other information collected during preliminary survey.	
		(4) Detailed location survey plan and longitudinal section: - The detailed location survey plan also known as detailed plan, shows the ground plan along with alignment of the road. The longitudinal section helps in deciding the formation level of the road so as to obtained economical earthwork.	
		<b>(5)</b> Detailed cross-section:- These drawings show the cutting and filling at the different reduced distances along the centre line of the road. These sections help in finding the quantities of earthwork to be done in the road project.	any four 01 mark each.
		<b>(6)</b> Land acquisition plans: - These plans show the land acquisition details. They also show all general details such as buildings, wells, nature of land and other details required for assessing the values.	
		<ul> <li>(7) Drawing of Road intersections: - These drawing should prepared showing all details of pavement, shoulders etc. of road intersecting the alignment to scale.</li> <li>(8) Land plans for quarries: - These plans show the details of quarries to be acquired for the road project.</li> </ul>	



(b)	Give t	he details to be shown on 'L' se	ection of proposed	d road.		(4)
Ans.	The 'L' section of proposed road should have the following details shown in it:					
	1) Chainage					
	2)	Distance in meter				
	3)	Ground level (R.Ls. and line sh	owing G.L.)			
	4)	Formation level (R. Ls and line	showing Formation	on of proposed re	oad)	
	5)	Datum (for drawing vertical pr	ofile of road along	g center)		
	6)	Depth of cutting in meter (for	earthwork)			any eight
	7)	Height of filling in meter (for e	arthwork)			½ mark
	8)	Gradient (value and line showi	ng gradient)			each.
	9)	Location (chainage) Cross Drai	nage Work			
	10	) Summit and valley curves if an	y (radius and othe	er details)		
(c)	Defin	e formation width. State it's IRC	value for variou	s types of roads i	n plain terrain.	(4)
Ans.	Forma	ation Width: - The top with of	a highway embar	nkment or botto	n with of highway	( )
	cuttin	g excluding the side slopes and	side drains is call	ed "Formation w	idth" or "Roadway	
	Width	,				02 marks
	The w	idth of Roadway in plain terrain	standardized by t	the IRC are given	in table below:	
	6			Ro	adway width for	
	Sr.     Road Classification     plain and rolling       No     terrain.		lain and rolling			
			terrain.			
	01	H 2 bre H V	a) Single lane		12.0 m.	
	01	N. H. and S. H.	b) Two lane		12.0 m.	
	02	MDB	a) Single lane		9.0 m.	
	02		b) Two lane		9.0 m.	02 mark
	03		a) Single lane		7.5 m.	
	05	0. D. N.	b) Two lane		9.0 m.	
	04	V. R.	Single lane		7.5 m.	
(d)	State	the IRC specification of gradien	ts for different ty	pes of terrain.		(4)
Ans.	The va	alues of Ruling, maximum and ex	ceptional gradier	nts as recommen	ded by the IRC are	
	given	in table below:	1			
	Sr.	Nature of terrain(Area)	<u> </u>	Value of Gradien	ts	
	No.	Nature of terrain(Area)	Ruling	Limiting	Exceptional	
	01	Plain or Rolling terrain(Area)	3.3 % (1 in 30)	5 % (1 in 20)	6.7 % (1 in 15)	04 marks
	02	Mountainous terrain(Area)	5.0 % (1 in 20)	6 % (1 in 16.7)	7.0 % (1 in 14.3)	
	03	Steep Area	6 % (1 in 16)	7 % (1 in 14.3)	8.0 % (1 in 12.5)	
	1					



	(e)	Differentiate between Asphalt and Tar.		(4)
	Ans.	The differentiation between asphalt and tar is as follow:		
		Asphalt	Tar	
		1) It is obtained by fractional distillation of	1) It is obtained by destructive distillation	
		crude petroleum.	organic matter.	
		2) It is black or brownish black in colour.	2) It is jet black in colour.	
		3) It is solid or semi-solid in state	3) It is viscous in state.	
		4) It is less adhesive.	4) It is more adhesive.	
		5) It contents less percentage of carbon.	5) It contains more percentage of carbon.	any eight
		6) It is more durable.	6) It is less durable.	½ mark
		7) Its setting time is less.	7) Its setting time is more.	each.
		8) It melts when heated.	8) It becomes more fluid when heated.	
		9) It hardens slowly.	9) It hardens quickly.	
		10) It is costly.	10) It is cheap.	
	(6)	Define seil stabilized word. Chate the words:		(4)
	(T) Ang	Definition - Soil stabilized road.	ty of soil stabilization.	(4)
	Ans.	<b>Definition</b> : Soli stabilized road:-	wearing surface consisting of one or two	
		the earth road having its roundation and	wearing surface consisting of one of two	01 mark
		Necessity: The soil stabilization is necessary		ULIIIdik
		(1) To increase the bearing newer of the	soil	
		(1) To increase resistance to softening ac	tion (due to water) of the soil	
		(2) To increase shear strength i.e. resistan	to nunching action of the soil	
		(4) To increase flexibility in the soil to ta	ke the wheel load without deformation and	
		cracking.		any six ½
		(5) To reduce the tendency of swelling	g or increase in volume of the soil due to	mark
		wetting and shrinkage on account of w	withdrawal of moisture.	each
		(6) To increase the stability of earthwork	in embankment as a whole.	0000
03	2)	Explain significance of gradient in road alignm	hent	
Q.J	αj Δns	1 Gradients are useful to connect roads	at different elevations	
	A115	2 Gradients play a vital role for effective	drainage of rain water along the road side	01 mark
		2. Gradients are useful to decide balancing of earthwork and to reduce material cost		
		of road project.		
		4. Gradients allow the movements of ve	hicle on the vertical curve smoothly.	
0.3	b)	Design of super elevation for a National High	way with design speed 80 kmph, and	
2.0	~,	horizontal curve of radius 150 m. Consider co	efficient of friction $f = 0.15$ .	
	Ans	To design the super elevation. 75 percent of a	design speed is considered and friction is	
	_	neglected.		
		$e = (0.75 * V)^2 / (127 x R)$ or formula can be	used as $e = V^2 / (225 \times R)$	01
		$e = (0.75 * 80)^2 / (127 \times 150) = 3600/19050$		
		e = 0.188, As the value is greater than the m	aximum super elevation of 0.07, so actual	
		super elevation to be provided is restricted to	0.07	01
		check for coefficient of lateral friction		
		$f=(V^2/(127 \times R)) - 0.07$		
		=(80) <sup>2</sup> / (127 x 150) - 0.07		
		= (6400 /19050) - 0.07		
		=0.335 -0.07 = 0.265 , it is greater than 0.15	( maximum allowable safe coefficient of	01
		friction),		
		Maximum allowable value of e is 0.07 (7%).	So as the radius cannot be increased, the	01
		speed has to be restricted.		



c)	Draw a cross-section of a hill road showing it's component parts.	
Ans	Side in Road pavement Porsapet wall Catch drain Pit Water Dreast (1:4:8) Retaining wall	03 marks for diagram and 01 mark for labeling
d)	What is meant by (i) Balancing of earthwork?	
Ans	<ul><li>(ii) Prime coat in bituminous surfacing?</li><li>i) Balancing of earthwork: When the earthwork is so arranged that the earth obtained from cutting is equal to earth required for filling. This is known as balancing of earthwork.</li></ul>	02
	applied to an existing untreated base of pervious nature like WBM in order to promote adhesion between the base and the bituminous surface is called as prime coat.	02
e) Ans	Write the construction procedure of bituminous carpet road.	
	<ul> <li>Fill the potholes or depressions with percolated chippings as required before the carpet is applied to the existing layer.</li> <li>A tack coat is applied over the WBM or old bitumen surface.</li> <li>If the existing surface consists of soft aggregate then a prime coat is applied.</li> </ul>	01
	<ul> <li>2. Application of tack coat:</li> <li>The bitumen binder is heated to a specified temperature before its application.</li> <li>The tack coat or prime coat is applied just before spreading the premix.</li> </ul>	01
	<ul> <li>3. Preparation and placing of premix:</li> <li>The premix is prepared in a mechanical mixer or in an improvised hand drum</li> </ul>	
	<ul> <li>The premix is prepared in a mechanical linker of in an improvised hand druin mixer.</li> <li>The aggregate and bitumen are however heated separately up to required temperature.</li> <li>After proparation of homogeneous mix, it is taken out and corried at the site.</li> </ul>	01
	<ul> <li>After preparation of nomogeneous mix, it is taken out and carried at the site for spreading and rolling.</li> <li>4. Rolling and finishing:</li> </ul>	
	c) Ans d) Ans e) Ans	<ul> <li>c) Draw a cross-section of a hill road showing it's component parts.</li> <li>Ans</li> <li>a) Draw a cross-section of a hill road showing it's component parts.</li> <li>a) Draw a cross-section of a hill road showing it's component parts.</li> <li>b) Draw a cross-section of a hill road showing it's component parts.</li> <li>c) Draw a cross-section of a hill road showing it's component parts.</li> <li>c) Draw a cross-section of a hill road showing it's component parts.</li> <li>c) Draw a cross-section of a hill road showing it's component parts.</li> <li>c) Draw a cross-section of the assisting surface:</li> <li>a) D cross a cross-section of a cross-section a cross of a specified temperature before the carpet is applied to tac coat:</li> <li>c) A tack coat or prime coat is applied or a cross of a specified temperature before tis application.</li> <li>c) The bitume binder is heated to a specified temperature before tis application.</li> <li>c) The bitume binder is heated to a specified temperature before tis application.</li> <li>d) Preparation and placing of premix:</li> <li>d) The premix is prepared in a mechanical mixer or in an improvised hand drum mixer.</li> <li>c) The aggregate and bitumen are however heated separately up to required temperature.</li> <li>c) After preparation of homogeneous mix, it is taken out and carried at the site for spreading and rolling.</li> <li>d) Alling and finishing reserved.</li> </ul>



		• After spreading the mix, the rolling operation is started.		
		• Rolling is done until there is no further movement of aggregate in the mix.		
		<ul> <li>Then road may be opened to traffic after 24 hours.</li> </ul>		
Q.4	A)a	What is the necessity of joint filler in construction of concrete roads? State the joint filler		
		materials.		
	Ans	Necessity of joint filler in construction of cement concrete roads:		
		The continuity of concrete pavement is broken at the place of joint. If these joints are	01 mark	
		not filled properly these can allow the infiltration of water and ingress of stone grits.		
		Infiltration of water damages the soil sub-grade. If the stone grit enters into the joint	01 mark	
		space, the effective joint width gets reduced and faults like spalling of joint edges take		
		place.		
		Joint filler materials:		
		1. Soft wood	any two	
		2. Impregnated fibre board	01 mark	
	a \ 1.	3. Cork or cork bound with bitumen	each	
Q.4	A)D	(i) pour		
	AIIS	(i) FCO.	02 marks	
		convert the other vehicle classes and this unit is called Passenger Car Unit or PCU		
		(ii) Traffic Island: Traffic islands are raised areas constructed within the roadway to		
		establish physical channels through which the vehicular traffic is guided.	02 marks	
Q.4	A)c	Give the four situations where traffic volume study is used in road planning.		
	Ans	Situations where traffic volume study is used in road planning:		
		1) Traffic volume is generally accepted as a true measure of the relative importance of		
		2) Traffic volume study is used in planning, traffic operation and control of existing	any four	
		facilities and also for planning and designing new facilities	01 mark	
		3) This study is used in the analysis of traffic patterns and trends.	each	
		4) Classified volume study is useful in structural design of pavements, in geometric design	00.011	
		and in computing roadway capacity.		
		5) Volume distribution study is used in planning one-way streets and other regulatory		
		measures.		
		6) Turning movement study is used in the design of intersections, in planning signal		
		timings, channelization and other control devices.		
		7) Pedestrian traffic volume study is used for planning sidewalks, cross walks subways and		
	• • •	pedestrian signals.		
Q.4	A)d	State the functions of surface. drainage and sub-surface drainage.	any two	
	Ans	1) To collect the drained off water from the surface of read	OT Mark	
		2) To keen the road surface dry from water	Cacil	
		3) To travel the collected water by gravity into the nearby natural nallah or stream or		
		river.		
		4) To increase the stability of road pavement.		
		Functions of sub-surface drainage:		
		1) To control the moisture content of the road sub-grade.		
		2) To maintain the bearing capacity of the sub-grade soil by preventing the entry of	any two	
		water into it.	01 mark	
		3) To reduce the capillary rise, sometimes due to capillary action, the water rises into	each	
		the sub-grade from the ground water. It can be controlled by introducing a cut-off		
		layer of granular material or impervious bituminous layer.		



Q.4	B)a	Why following tests are conducted on road materials :,	
		(i) C.B.R. test (ii) Penetration test (iii) Softening point test	
	Ans	C.B.R. Test: The California bearing ratio test is penetration test meant for the evaluation of	
		subgrade strength of roads and pavements. The results obtained by these tests	2 marks
		are used with the empirical curves to determine the thickness of pavement and	
		its component layers. This is the most widely used method for the design of	
		flexible pavement.	
		ii) Penetration Test: 1) To determine the hardness and softness of bitumen.	
		2) To assess the suitability of bitumen for use under different	2 marks
		climatic conditions and various types of construction.	
		iii) Softening Point Test: This test is carried out to find out the temperature at which the	
		bituminous material attains a particular degree of softening for	2 marks
		deciding its suitability for the construction of road pavement.	
Q.4	B)b	Explain construction procedure for WBM road as per IRC.	
-	Ans	1) Preparation of foundation for receiving WBM Layer:	
		The subgrade, sub-base or base to receive the WBM course shall be prepared	06 marks
		to the required grade and camber and cleaned of all dust, dirt and other	
		extraneous matter. Any ruts or soft yielding places that have appeared due to	
		improper drainage, service under traffic or other reasons shall be corrected	
		and rolled until firm.	
		As far as possible, laying of WBM course over an existing bituminous surface	
		should be avoided since it will cause problems of proper bond and internal	
		drainage of the pavement at the interface of two course.	
		In all cases, the foundation shall be kept well drained during the construction	
		operations.	
		2) Provision of lateral confinement of aggregates: For construction of WBM,	
		arrangement should be made for the lateral confinement of aggregates. This shall	
		be done by building adjoining shoulders along with WBM layers.	
		3) Spreading of coarse aggregates:	
		The coarse aggregates shall be spread uniformly and evenly upon the prepared	
		base in required quantities from stockpiles along the side of the road or	
		directly from vehicles. The WBM course shall be constructed in layers such that	
		thickness of each compacted. The coarse aggregates as spread shall be uniform	
		gradation with no pockets of fine materials. The coarse aggregates shall	
		normally not be spread in lengths exceeding three days average work ahead of	
		the rolling and bonding of the preceding section.	
		4) Rolling:	
		After the laying of the coarse aggregates, compacted to full width by rolling	
		with three wheel-power roller. The rolling shall begin from edges with roller	
		running forward and backward until the edges have been firmly compacted.	
		Slight sprinkling of water may be done, if required. On super elevated portions	
		of the road, rolling shall commence from the lower edge and progress	
		gradually towards the upper edge of the pavement.	
		Rolling shall not be done when the subgrade is soft or yielding or when it	
		causes a wave-like motion in the base course or subgrade. The surface shall	
		also be checked transversely by template for camber, and any irregularities	
		corrected in the manner described above. In no case shall the use of screenings	
		to make up depressions be permitted.	



		5) Application of screenings:				
		After coarse aggregates have been rolled. Dry rolling shall be done when the				
		screenings are being spread so that the jarring effect of roller causes them to				
		settle into the voids of the coarse aggregate. The screenings shall be applied at				
		a slow rate in three or more applications as necessary.				
		6) Sprinkling of water and grouting:				
		After application of screenings, the surface shall be copiously sprinkled with				
		water, swept and rolled. Hand brooms shall be used to sweep the wet				
		screenings into the voids, and to distribute them evenly.				
		7) Application of binding material: after the application of screenings, binding				
		material where it is required to be used shall be applied at a uniform and slow rate				
		in two or more successive thin layers.				
		8) Setting and drying:				
		After final compaction of the course, the layer shall be allowed to dry				
		overnight. Next morning. In the case of WBM base course to be provided with				
		bituminous surfacing, the latter shall be laid only after the WBM course is				
		completely dry and before allowing any traffic on it.				
Q.5	a)	Draw road signs for following: (i) Narrow bridge (ii) Speed limit (iii) No parking (iv) Railway				
	Anc	Crossing.				
	Ans	i) Narrow Bridge II) Speed limit (III) NO parking OK	01 mark			
			Cach			
		(iv) Railway crossing.				







Q.5 Q.5	e) Ans f)	<ul> <li>State the use of any four excavating equipments during construction of road.</li> <li>Uses of excavating equipment: <ol> <li>Bulldozers: It can be used for moving earth for short haul distances of about 100 m.</li> <li>Scrappers: It is used for loading &amp; hauling operations without taking help of other equipment. It also deposits the loads of discharge material in uniformly thick layers.</li> <li>Graders: It is used to create finely flat and finished road surface.</li> <li>Power shovels: It is having a good control over digging.</li> <li>JCB: It is used as a multi-purpose excavator machine which can be fitted with a variety of excavator bucket widths and with various attachments to the loader arm.</li> </ol> </li> <li>Enlist four types of road rollers giving suitability of each.</li> </ul>	Any four 01 mark each
	Ans	<ol> <li>Types of road rollers with suitability:         <ol> <li>Plain rollers: Used for ordinary rolling work where deep compaction is not required.</li> <li>Sheep footed rollers: Used whenever the compaction is to be done to a great depth the place like in embankment or canal sheep footed rollers are used.</li> <li>Pneumatic rollers: Used for compaction up to depth of 60 cm and are suitable for any type of soil.</li> <li>Vibratory rollers: Used for the compaction of dry lean concrete. Mainly for construction of dams and pavements.</li> <li>Rammer: Used and permitted in case of unreinforced foundation concrete or in ground floor construction.</li> </ol> </li> </ol>	Any four 01 mark each
Q.6	a)	Draw neat line sketch of power shovel and show its component parts.	
	Ans	tick	
		Cab Hoist bine Dipper stick Cab Cab Crawler mounting Dippez	03 marks for diagram and 01 mark for labeling
Q.6	b) Ans	Explain the working of bitumen road paver. The placement of bitumen and aggregate mix on the road way is efficiently done by self-propelled machine termed as bitumen paver. It has two main parts, power unit and screed unit. <u>Power unit</u> : The power unit consists of following operating parts. 1. Receiving hopper 2. Feed conveyor 3. Flow control gates 4. Distributing angers 5. Engine 6. Transmission 7. Dual control and operator seat. First of all, hot mix is deposited in the receiver hopper and then to feed conveyor through flow control gates to the spreading screw also known as distributing angers. The anger distributes the hot mix uniformly and evenly across the full width of paver for uniform placement on the road surface. All the operations are controlled by the operator. <u>Screed unit</u> : Screed unit consists of- 1. Screed low arm 2. Screed plate 3. Heating unit	02
			1



		<ul> <li>4. Tamping bars 5. Vibratory attachments 6. Controls.</li> <li>Screed unit performs two major functions as follows.</li> <li>i. It provides initial compaction to the hot mix laid on the road surface.</li> <li>ii. It strikes off the mix which is more than the specification for thickness and smoothness.</li> </ul>	02
Q.6	c) Ans	<ul> <li>Write any four preventive measures for landslides.</li> <li>1. Providing effective drainage system using catch water drains.</li> <li>2. Providing appropriate slopes to minimize erosion of soil.</li> <li>3. Providing jute netting and wire netting for stability of slopes.</li> <li>4. Application of asphalt mulch treatment to slopes for stability.</li> <li>5. Removal of vegetation to avoid growth of cracks.</li> <li>6. Using chemical treatment for ground surface.</li> <li>7. Relocation of highway in unavoidable landslide regions.</li> </ul>	Any four 01 mark for each
Q.6	d) Ans	Explain how pot-hole repairs work is carried out for bituminous pavement. In the process of patching the pot holes, the pot holes are first cut square or rectangular in shape up to the required depth. The holes are cleaned and broomed properly and suitable tack coat or bitumen coat is applied. Then usually a premixed patching mix is placed in the holes and spread properly with the help of crow bar and then the surface is rammed and rolled. The finished surface of the pot holes is kept slightly above the normal surface for compaction under traffic. In cold weather, cut back or emulsion is used as a refilling materials to repair the pot	02
Q.6	e) Ans	State the component parts of hot mix bitumen plant.         1. Three bin cold feed system.         2. Cold feed system.         3. Cyclone dust collector.         4. Storage structure configuration.         5. Dryer         6. Pyrometer.         7. Screeding unit.         8. Segregation of aggregate in hot bins.         9. Sampling device.         10. Binder measuring and delivery system.         11. Pugmill.	Any eight 1/2 mark for each