Civil Services (Main) Examination, 2011

CIVIL ENGINEERING
(Paper II)

Time Allowed : Three Hours **Maximum Marks : 300**

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.
Candidate has to attempt FIVE questions in all.
Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.
The number of marks carried by a question/part is indicated against it.
Wherever any assumptions are made for answering a question, they must be clearly indicated.
Word limit in questions, wherever specified, should be adhered to.

SECTION 'A'

1. (a)(i) Classify the sedimentary rock on the basis of types of deposits. Give examples. **5**

(a)(ii) Explain the soundness test on cement. **5**

(b)(i) Draw the neat sketches of the strip footing in black cotton soil. **5**

(b)(ii) Explain the 'Rippers'. Draw line diagrams. **5**

(c)(i) Draw a line diagram of a trenching machine and explain briefly. **5**

(c)(ii) Draw the plan of Double Flemish bond for various wall thicknesses with pier of same thickness. **5**

(d) Draw neat sketches of pattern of contours that show (i) Vertical cliff, (ii) Ridge line, (iii) A pond, (iv) Area having uniform steep slope, (v) A Hillock. Also explain with suitable sketch how the contour map will help in canal alignment. **10**

(e) Explain the requirements of rail section. What factors are considered in determining the maximum limit of vertical rail wear? What is the most common cause of failure of rail and also give its explanation. **10**

(f) Explain the terms traffic density, traffic flow and mean free speed and describe their inter-relationships using appropriate sketches/diagrams. **10**

2. (a)(i) Explain Resource Management. **10**

(a)(ii) With line diagram explain the operation of a drag line. **10**

(b)(i) Give the classification of Arches according to number of centres. Explain them with sketch only. **5**

(b)(ii) Describe in brief the advantage of hollow concrete masonry. **5**

(c)(i) Explain the natural errors in the levelling. A page of level book is reproduced below in which some readings marked of 'X' are missing. Complete the page with all arithmetic checks:

Station	B.S.	I.S.	F.S.	RISE	FALL	R.L.	Remarks
1	3.150					X	
2	1.770		X		0.700	X	C.P.
3		2.2			X	X	
4	X		1.850	X		X	C.P.
5		2.440			0.010	X	
6	X		X	1.100		X	C.P.
7	1.185		2.010	X		222.00	C.P.

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8		–2.735		X		X	Staff held inverted
9	X		1.685		4.420	X	C.P.
10			1.525		0.805	X	
Σ	12.055		X	X	X		

(c)(ii) What are conditions which necessitate taking up of a realignment project of the highway? Discuss the general principles in the re-alignment of a highway and explain how the work is carried out. **10**

(c)(iii) The following defects were recorded upon inspection of a railway track: (a) Battered ends of rail joints (b) Angular cracking of rails (c) Excessive closing and opening of spaces at rail joints. Give reasons for these defects and suggest any remedial measures. **8**

3. (a)(i) Determine the project completion time, the critical path and the total float available for each activity using C.P.M.:

Activity	Duration (Days)	Preceeding Activities
A	2	None
B	3	A
C	4	A
D	3	B
E	2	B
F	3	A, E
G	3	C
H	5	D, E
I	4	F, G
J	5	F, G
K	4	H, I
L	2	K, J

10

(a)(ii) Define: EST; LFT; Total Float; Free Float, Interfering Float. **10**

(b) What are the functions of cement ingredients? **10**

(c)(i) An area 40 km in the north-south direction and 36 km in the east-west direction, is to be photogrammetrically surveyed. For this aerial photography is to be made with following data:

Average scale of photograph	1 : 15000
Average elevation of terrain	450 m
Photograph size	20 cm × 20 cm
End lap	60%
Side lap	30%
Ground speed of Aircraft	200 km/hr
Focal length of camera lens	30 cm

Calculate the flying height of the aircraft, number of photographs in each flight, number of flights, total number of photographs, spacing of flight lines, ground distance between exposures and exposure interval. **12**

(c)(ii) Explain sight distance and factors causing restrictions to sight distance. Explain the significance of stopping sight distances. Also derive an expression for finding the stopping sight distance at level. Making necessary assumptions, calculate the minimum sight distance required to avoid a collision of two cars approaching from opposite directions at 90 and 60 kmph. **12**

(c)(iii) Draw a neat sketch of diamond crossing and list its important features. **6**

4. (a)(i) Differentiate between standard equipments and special equipments. **5**

(a)(ii) Explain the economic life of an equipment. **5**

(a)(iii) The proposed terms of two loans are as follows: Loan I: of Rs. 2.00 lacs at 41/2 % p.a. with redemption in 50 years at 3% p.a. Loan II: of Rs. 2.00 lacs at 4% p.a. with **10**

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redemption in 60 years at 2% p.a. Which of the two loans is more favourable to the borrower?

(b) Explain with reasons the defects in Plastering. **10**

(c)(i) Explain the objectives of triangulation surveys and explain the criteria for selection of the layout of triangles. Also explain the term well conditioned triangles, and strength of figure. **10**

(c)(ii) List the fundamental lines of a theodolite and explain briefly the desired relationships between these lines and the effects if such relationships are not maintained. Also describe the checks need to be applied on an open traverse. **8**

(c)(iii) Discuss the importance of gross wheel load and contact pressure in stress distribution pattern and in pavement design. **6**

(c)(iv) Explain how the elastic modulii of subgrade and base course are estimated using plate bearing test data. **6**

SECTION 'B'

5. Answer the following:

(a) What is open channel? List the design characteristics of open channel. **10**

(b) Differentiate between Thermophilic and Mesophilic bacteria explaining their roles in anaerobic digestion. **10**

(c) What is an aquifer? How are they classified? Describe salient features of aquifers. **10**

(d) 15 mL of the waste sample has been added into a 300 mL BOD incubation bottle. The initial D.O. of the diluted sample was 7.8 mg/L and the final D.O. after 5 days was 1.7 mg/L. The corresponding initial and final D.O. of the seeded dilution water was 8.1 and 6.9, respectively. What is the 5-day BOD of the wastewater sample? **10**

(e) What are spillways? Why they are needed in the dams? Briefly describe salient features of ‘shaft’ and ‘chute’ spillways. **10**

(f) Based on type of air pollution and climate, differentiate between ‘Gray air’ and ‘Brown air’ cities, with examples. **10**

6. (a)(i) Explain the types of sedimentation with examples. **2**

(a)(ii) What path trajectory the settling particles follow in circular and rectangular settling tanks? **2**

(a)(iii) Given the following data below, design a circular sedimentation tank with launders and find out: (i) The diameter of the settling tank. (ii) Total depth of the settling tank with free board including the depth of the hopper portion.

Total township area	20 ha
%age areas for roads, public utilities, and open spaces	10%, 15%, 15%
Floor to space ratio	1.5
Floor area required for each person	10 m^2
Water losses accounts for	4%
Working hours for plant	23 hrs.
Surface loading rate	1.25 $m^3/hr/m^2$
Detention time	2.5 hrs
Slope for floor slab	1 in 12
Incoming velocity of flow	0.6 m/sec.

Check the design with weir loading calculations. Assume water supply rate as 135 lpcd. Give a neat sketch of final designed circular tank showing all design parameters. **16**

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	(b)(i)	What do you understand by multipurpose reservoir? Describe in brief various investigations required for reservoir planning.	**10**
	(b)(ii)	What is reservoir sedimentation? Discuss various methods used for control of silting of reservoir.	**10**
	(c)(i)	Explain with the help of a neat sketch the hydrological cycle indicating its various phases.	**10**
	(c)(ii)	Discuss different forms of precipitation. How measurement of precipitation is done?	**10**
7.	**(a)(i)**	What are the factors that influence the flow of sewage in sewers? Define 'Time of Concentration' for storm water drains and explain its significance.	**5**
	(a)(ii)	A vitrified clay sewer is to carry a discharge of 1000 l.p.s. When flowing half full, it is laid at a gradient of 0.0032. The manning coefficient of the sewer is same as that of a triangular notch with unit depth and having a slope of 1 in 2. The velocity in the notch is obtained as 0.804 m/s with a gradient of 1 in 400. Determine the velocity of flow and diameter of sewer.	**15**
	(b)(i)	Explain the terms duty and delta. Derive a relationship between the two.	**10**
	(b)(ii)	A soil has field capacity of 23% and wilting coefficient of 10%. If the root zone depth is 65 cm, determine the storage capacity of soil. Irrigation water is applied when moisture content falls to 10%. If water application efficiency is 70%, determine the water depth required to be applied in the field. The dry unit weight of soil is 1.5 gm/cm^3.	**10**
	(c)(i)	What is unit hydrograph? Explain various propositions of the unit hydrograph.	**10**
	(c)(ii)	Explain various steps adopted to derive a unit hydrograph from an observed flood hydrograph.	**10**
8.	**(a)(i)**	Differentiate between Garbage and Rubbish.	**6**
	(a)(ii)	What are the advantages and disadvantages of sanitary landfills?	**7**
	(a)(iii)	Define Municipal solid waste. List out the good practices that should be followed for an efficient management of MSW.	**7**
	(b)(i)	What do you understand by term river training? What are the works that come under this category?	**10**
	(b)(ii)	Draw a sketch of a guide bank. Give its design features.	**10**
	(c)(i)	What is radioactive pollution? How is radioactive waste disposed?	**10**
	(c)(ii)	Discuss the need of Environmental Impact Assessment study. How do thermal power plants affect the environment?	**10**

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