सिविल इंजीनियरी (प्रश्न-पत्र-II)

प्रश्न-पत्र सम्बन्धी विशेष अनुदेश

(उन्हें देने के पूर्ब निर्देशित निर्देशों को कृपया सावधानीपूर्वक पढ़ें)

दो खण्डों में कुल आठ प्रश्न दिए गए हैं जो हिंदी एवं अंग्रेज़ी दोनों में छपे हैं।
उम्मीदवार को कुल पाँच प्रश्नों के उत्तर देने हैं।

प्रश्न संख्या 1 और 5 अनिवार्य हैं तथा बाकी प्रश्नों में से प्रत्येक खण्ड से कम-से-कम एक प्रश्न चुनकर तीन प्रश्नों के उत्तर दिए।

प्रत्येक प्रश्न/भाग के लिए निर्दिष्ट अंक उसके सामने लिखे गए हैं।

प्रश्नों के उत्तर उसी प्रारंभिक माध्यम में लिखे जाने चाहिए, जिसमें उभरे आपके प्रश्न-पत्र में किया गया है, और यह माध्यम का स्पष्ट उस्ते देखे प्रश्न-सह-उत्तर (स्पू-सी॰ प॰॰) पुस्तिका के मुक्तपथ पर निर्दिष्ट स्थान पर किया जाना चाहिए। प्रारंभिक माध्यम के अतिरिक्त अन्य किसी माध्यम में लिखे गए उत्तर पर कोई अंक नहीं मिलेगा।

प्रश्नों के उत्तर दिखाए समय यदि कोई पूर्ववर्ती अंकह, उसकी सहायता निर्दिष्ट किया जाना चाहिए।

जब आवश्यक हो, आरोह/चित्र उत्तर के लिए दिए गए स्थान में ही दर्शाए।

प्रश्नों के चन्दन में प्रत्येक प्रश्न/भाग अंतिम अंत में हो, जब तक अंकहार नहीं गया।

प्रश्नों के प्रश्नों की गणना क्रमांक की जाएगी। आंशिक रूप से दिए गए प्रश्नों के उत्तर को भी मान्यता दी जाएगी, तब उन्हें काटा न गया हो। प्रश्न-सह-उत्तर पुस्तिका में खाली छोड़े गए कोई पूर्व अथवा पूर्व के भाग को पूर्णतः काट दीजिए।

CIVIL ENGINEERING (PAPER-II)

Time Allowed : Three Hours Maximum Marks : 250

QUESTION PAPER SPECIFIC INSTRUCTIONS

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

There are EIGHT questions divided in two Sections and printed both in HINDI and in ENGLISH.

Candidate has to attempt FIVE questions in all.

Question Nos. 1 and 5 are compulsory and out of the remaining, 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.

Answers must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in medium other than the authorized one.

Wherever any assumptions are made for answering a question, they must be clearly indicated.

Diagrams/figures, wherever required, shall be drawn in the space provided for answering the question itself.

Unless otherwise mentioned, symbols and notations carry their usual standard meanings.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.
1. (a) What are the constituents of a good brick earth? Discuss the properties of a first class brick. Describe the tests to be performed to check the quality of bricks.

(b) A national highway with dual 2-lane carriageway is to be constructed in the year 2017 for a design life of 25 years. However, traffic count reveals that only 2000 commercial vehicles (summation of both directions) are plying per day in the year 2015 and annual rate of increase in commercial vehicles is 5%. Hence, from economical reasons, it was decided to construct new flexible pavement for this national highway in stages initially for a period of 15 years. Determine the traffic for which this new flexible pavement is to be designed assuming vehicle damage factor as 4.8. Assume any other data suitably, if required.

(c) (i) Explain various uses of a contour map in Civil Engineering projects.

(ii) An aerial photograph was taken from a flying height of 15 km above m.s.l. A straight portion of a canal measures 20 cm on this photograph, whereas it is 10 km on the ground. If the height of the terrain is 5000 m above m.s.l., compute the focal length of camera lens used for taking the photograph.
What are the basic requirements to be considered for construction of a railway track to achieve higher speeds and better riding quality? Sketch a typical cross-section of a BG railway track for double line on curve in cutting section.

5+5=10

Define PERT and discuss its significance. Explain different time estimates used in PERT.

10

2. (a) What is meant by proportioning of concrete? Discuss its properties. Describe different methods of proportioning concrete.

15

(b) Answer the following:

(i) Differentiate between open-graded and dense-graded bituminous construction.

5

(ii) What are the general requirements of a bituminous mix?

5

(iii) Write the purpose of tie bars and dowel bars in joints of cement concrete pavement.

5

(c) What are the different types of machinery required at civil construction project? Discuss the factors which influence the performance of an earth-moving machinery.

20
3. (a) पत्थर को भवन-निर्माण कार्य हेतु उपयुक्त बनाने के लिए उस पर क्या-क्या परीक्षण किए जाने चाहिए, उनको निम्नांकन पर लिखिए। पत्थर के ड्रेसिंग का क्या अर्थ है? धराव ड्रेसिंग के लिए क्या तीव्रता है?

Enumerate the tests to which a stone should be subjected for making it fit for building construction purposes. What is meant by dressing of stone? What are the advantages of quarry dressing?

(b) एक चंक्र (ट्रेवर्स) के निम्नांकित दिए गए आंकड़े से CD भूजा की लम्बाई ज्ञात कीजिए, यदि चंक्र किन्तु A, D तथा E एक सीधी लाइन में स्थित हों:

From the following data of a traverse, compute the length CD, if traverse stations A, D and E are in a straight line:

<table>
<thead>
<tr>
<th>भूजा</th>
<th>लम्बाई (म)</th>
<th>दिशाकोण</th>
<th>धारण</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>110</td>
<td>83° 12'</td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>165</td>
<td>30° 41'</td>
<td></td>
</tr>
<tr>
<td>CD</td>
<td>—</td>
<td>346° 06'</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>212</td>
<td>16° 18'</td>
<td></td>
</tr>
</tbody>
</table>

(c) निम्नांकित का उत्तर दीजिए:

Answer the following:

(i) एक यातायात रोटेरी के संवर्धन में व्यवस्था कोण (वीलिंग ऐंगल) और व्यवस्था लम्बाई की संख्या में व्याख्या कीजिए।

Briefly explain the weaving angle and weaving length with reference to traffic rotary.

(ii) संपूर्ण चौराहों हेतु यातायात टांग के अभिव्यक्ति के लिए विवरण दिए जाने वाले विभिन्न कारक क्या हैं? चौराहों पर यातायात टांग का उपयोग करते हुए वाहनों की गति कैसे नियंत्रित की जा सकती है, रेखांश की सहायता से संख्या एस संख्या में इसकी व्याख्या कीजिए।

What are the various factors to be considered in the design of traffic islands for channelized intersections? Briefly explain, with the help of sketch, how speed of vehicles can be controlled by using traffic islands at intersections. 5+5=10

4. (a) सिकियत इक्कैनियरी परियोजना के कार्यक्रम-निर्धारण से आप क्या समझते हैं? कार्यक्रम-निर्धारण के क्या फायदे हैं?

What do you mean by scheduling of a Civil Engineering project? What are the advantages of scheduling? Discuss the classification of scheduling. 15
(b) A 3° curve on a main BG track was required.

(i) The maximum permissible speed on the curve as 80 km/hr;

(ii) Allowable cant deficiency as 7.5 cm;

(iii) Weighted average may be used as the equilibrium speed of trains.

Using the following details of trains running on a 3° main BG curve track, determine (i) equilibrium cant for equilibrium speed and (ii) length of transition curve to be adopted:

<table>
<thead>
<tr>
<th>Speed (in km/hr)</th>
<th>No. of trains</th>
<th>Speed (in km/hr)</th>
<th>No. of trains</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>3</td>
<td>55</td>
<td>12</td>
</tr>
<tr>
<td>65</td>
<td>6</td>
<td>45</td>
<td>18</td>
</tr>
</tbody>
</table>

Assume—

(1) maximum permissible speed on the curve as 80 km/hr;

(2) allowable cant deficiency as 7.5 cm;

(3) weighted average may be used as the equilibrium speed of trains.

\[ 7.5 + 7.5 = 15 \]

(c) The following data were entered in a level book, where some entries were omitted (marked with x). Find out the missing data and apply checks:

<table>
<thead>
<tr>
<th>Station</th>
<th>BS (in m)</th>
<th>IS (in m)</th>
<th>FS (in m)</th>
<th>Rise (in m)</th>
<th>Fall (in m)</th>
<th>RL (in m)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.285</td>
<td>x</td>
<td></td>
<td>0.020</td>
<td>x</td>
<td>232.460</td>
<td>BM 1</td>
</tr>
<tr>
<td>2</td>
<td>1.650</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>x</td>
<td>2.105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>x</td>
<td></td>
<td>1.960</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2.050</td>
<td>x</td>
<td>1.925</td>
<td></td>
<td>0.300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>232.255</td>
<td>BM 2</td>
</tr>
<tr>
<td>7</td>
<td>1.690</td>
<td>x</td>
<td></td>
<td>0.340</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2.865</td>
<td>2.100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>233.425</td>
<td>BM 3</td>
</tr>
</tbody>
</table>
5. (a) List the methods available for estimation of runoff in catchments. In detail, explain the rational method used for estimation of runoff in urban catchments.

(b) Define duty and delta. Derive a relationship between duty and delta. Using this relation, find delta for a crop with base period of 100 days. The duty of the crop is 432 ha/cumec.

(c) Explaining the objectives of river training, discuss the methods used for river training.

(d) A town with population of 1 lakh is supplied with 150 lpcd of water. The chlorine required for disinfection was found to be 0.28 mg/l and residual chlorine required was 0.2 mg/l. Estimate the chlorine dose and quantity of bleaching powder required per year (in kg/year), if available chlorine in bleaching powder is 30%.

(e) Explain the importance of COD/BOD ratio while designing the treatment options for COD/BOD ratio of 1, 3 and 6, and justify the selection of treatment units.
6. (a) A 20 cm well penetrates 30 m below the static water level. Water is pumped at the rate of 1800 lpm, and the drawdown in the wells is observed as 1.2 m and 0.6 m. The observation wells are 12 m and 36 m from the well. Determine—
   (i) the transmissibility of the aquifer;
   (ii) the drawdown in the pumped well taking \( R \) as 300 m;
   (iii) the specific capacity of the well.

(b) Describe the methods used for determining mean depth of precipitation in catchments when point rainfall data are available.

(c) The following data are collected to determine irrigation requirement. The water application efficiency is 65% and consumptive use coefficient in the growing season is 0.8. Find evapotranspiration and irrigation requirement:

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean monthly temp. (°C)</th>
<th>Monthly % sunshine (hr)</th>
<th>Effective rainfall (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>18</td>
<td>7.20</td>
<td>2.6</td>
</tr>
<tr>
<td>December</td>
<td>15</td>
<td>7.15</td>
<td>2.8</td>
</tr>
<tr>
<td>January</td>
<td>13.5</td>
<td>7.30</td>
<td>3.5</td>
</tr>
<tr>
<td>February</td>
<td>14.5</td>
<td>7.10</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Design and sketch the shape of an ogee spillway using the data given below:

Upstream head of water, \( H = 20 \) m

Shape of upstream face = 1:1.5 (H:V)

\[ k = 1.939, \quad n = 1.81 \]

Design the water main to supply water from reservoir to a city with a population of 5 lakhs. Assume per capita demand as 270 lpd and peak factor as 1.8. Also, find the hydraulic gradient at which the main is to be laid. Take, velocity of flow as 1.2 m/s and \( C_H = 110 \).

Using the data pertaining to Activated Sludge Process (ASP) given below, determine—

(i) efficiency;

(ii) volume of aerator;

(iii) hydraulic retention time (HRT);

(iv) volumetric loading.

Wastewater flow = 20 MLD

BOD in settled wastewater = 200 mg/l

Effluent BOD required = 15 mg/l

\( F/M \) ratio = 0.2

\( MLSS = 3000 \) mg/l
8. (a) 5% तुळसेला अपशिष्ट जल का BOD परीक्षण किया गया एवं निम्नलिखित प्रश्न रिकॉर्ड किए गए:

<table>
<thead>
<tr>
<th>समय</th>
<th>DO (म्ग/ल)</th>
</tr>
</thead>
<tbody>
<tr>
<td>प्रारंभ में</td>
<td>3.6</td>
</tr>
<tr>
<td>अपशिष्ट जल में</td>
<td>0.8</td>
</tr>
<tr>
<td>जल विद्युत के 5 दिनों के बाद</td>
<td>0.7</td>
</tr>
<tr>
<td>$k_{20}$</td>
<td>0.12/दिन</td>
</tr>
</tbody>
</table>

जात कीजिए—
(i) अपशिष्ट जल का BOD;
(ii) अंतिम BOD.

5% दिल्ली वातावरण जल को BOD परीक्षण किया गया एवं निम्नलिखित प्रश्न रिकॉर्ड किए गए:

<table>
<thead>
<tr>
<th>समय</th>
<th>DO (म्ग/ल)</th>
</tr>
</thead>
<tbody>
<tr>
<td>प्रारंभ में</td>
<td>3.6</td>
</tr>
<tr>
<td>जल में</td>
<td>0.8</td>
</tr>
<tr>
<td>जल बाद में 5 दिनों बाद</td>
<td>0.7</td>
</tr>
<tr>
<td>$k_{20}$</td>
<td>0.12/दिन</td>
</tr>
</tbody>
</table>

Determine—
(i) BOD of wastewater;
(ii) ultimate BOD.

(b) उष्णकटिबंधीय तापमान के निकलने वाले प्रमुख संयंत्रों के प्रदूषकों को वर्णित कीजिए। उष्णकटिबंधीय तापमान के प्रदूषकों को वर्णित कीजिए।

Describing the major categories of pollutants generated by thermal power plants, discuss the environmental impacts of thermal power plants.

(c) प्रारंभ अरेख की मदद से नागरिक ठोस क्षेत्र प्रबंधन में शामिल विभिन्न तकनीक की व्याख्या कीजिए।

With the help of flow diagram, explain various elements involved in municipal solid waste management.

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