| Enrolme    | : UPES  |  |   |   |        |                      |    |
|------------|---|--|---|---|--------|----------------------|----|
|            |   |  |   | · · · · · · · · · · · · · · · · · · ·   |        |                      |    |
|            |   |  |   | ROLEUM AND ENERGY STUDIES   |        |                      |    |
| D          | • •   |  |   | er Examination, May 2019  |        | <b>x</b> 7 <b>x</b>  |    |
| -          |   | me: B. Tech. Civil Engine<br>: Design of Formwork  | ering   |   | neste  | er : VI<br>: 03 h    |    |
|            | Course Name : Design of Formwork Time<br>Course Code : CEEG 318 Max. M  |  |   |   |        |                      |    |
| Nos. of    |   | : CEEG 518<br>: 5  |   | Ivia  | X. IVI | arks: 100            |    |
| 1105. 01   |   |  | IESTI   | ONS ARE COMPULSORY  |        |                      |    |
|            | <b>1</b> 1  |  |   | SECTION A   |        |                      |    |
|            | ALL Q   | UESTIONS ARE COMP  |   | RY AND EACH QUESTION CARRI  | ES 4   | MARKS                |    |
| S. No.     |   | -  |   | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~   |        | Marks                | CO |
| Q 1        | State 7   | True/ False for the following  | g stater  | nents:  |        |                      |    |
|            |   |  |   | are: shells, domes, folded plates, coo  | ling   |                      |    |
|            |   | towers, tunnels, etc.  |   |   |        |                      |    |
|            | b. Traditional slab and beam formwork is characterized by less labor and time efficient operation.  |  |   |   |        |                      | CO |
|            |   |  | -   | 00  |        |                      |    |
|            | c. Various factors in achieving economy in column formwork are-location, orientation, shape, size, varying percentage of steel, and avoiding projections. |  |   |   |        |                      |    |
|            | b   |  |   |   |        |                      |    |
| Q 2        |   | the following:   | 15 0300   | because forms are assembled at the grou   | una.   |                      |    |
| <b>X</b> - | 1 Julie II  |  |   |   |        |                      |    |
|            | C   |  | S.  |   |        |                      |    |
|            | <b>S.</b>   | COLUMN A   |   | COLUMN B  |        |                      |    |
|            | 5.<br>NO.   | COLUMN A   | NO  | COLUMN B  |        |                      |    |
|            | NO.   |  | NO  |   |        |                      |    |
|            |   | COLUMN A Long span bridges   | NO  | Silos, bins, shafts, cores, bridge piers,   |        |                      |    |
|            | NO.   | Long span bridges  | NO<br>·<br>A  | Silos, bins, shafts, cores, bridge piers, caissons, etc.  |        | 4                    | CO |
|            | NO.   |  | NO  | Silos, bins, shafts, cores, bridge piers,   |        | 4                    | CO |
|            | NO.   | Long span bridges<br>Vertical slipform is used<br>for  | NO<br>·<br>A  | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements   | 7      | 4                    | CO |
|            | NO. 1 2   | Long span bridges<br>Vertical slipform is used   | NO<br>·<br>A<br>B                                     | Silos, bins, shafts, cores, bridge piers, caissons, etc.  | 7      | 4                    | CO |
|            | NO. 1 2   | Long span bridges<br>Vertical slipform is used<br>for  | NO<br>·<br>A<br>B                                     | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar  | 7      | 4                    | CO |
|            | NO. 1 2 3   | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form  | NO<br>·<br>A<br>B<br>C                                | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.  |        | 4                    | CO |
|            | NO. 1 2   | Long span bridges<br>Vertical slipform is used<br>for  | NO<br>·<br>A<br>B                                     | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined  |        | 4                    | CO |
|            | NO.<br>1<br>2<br>3<br>4   | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form<br>Curb  | NO<br>·<br>A<br>B<br>C<br>D                           | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined<br>together to form a large shutter panel.   |        |                      | CO |
| Q 3        | NO.<br>1<br>2<br>3<br>4<br>What i   | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form<br>Curb<br>is tunnel form system? State                                | NO<br>·<br>A<br>B<br>C<br>D<br>e the tw               | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined<br>together to form a large shutter panel.<br>vo advantages of tunnel form system.   |        | 2+2 =4               | CO |
| Q 3<br>Q 4 | NO.<br>1<br>2<br>3<br>4<br>What i   | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form<br>Curb<br>is tunnel form system? State                                | NO<br>·<br>A<br>B<br>C<br>D<br>e the tw               | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined<br>together to form a large shutter panel.   |        | 2+2 =4<br>2+2 =      | СО |
| Q 4        | NO.<br>1<br>2<br>3<br>4<br>What is  | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form<br>Curb<br>is tunnel form system? State<br>s flying form system? State | NO<br>A<br>B<br>C<br>D<br>the tw                      | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined<br>together to form a large shutter panel.<br>vo advantages of tunnel form system.<br>o disadvantages of flying form system. |        | 2+2 =4<br>2+2 =<br>4 |    |
|            | NO.<br>1<br>2<br>3<br>4<br>What is<br>What is   | Long span bridges<br>Vertical slipform is used<br>for<br>Large area wall form<br>Curb<br>is tunnel form system? State<br>s flying form system? State | NO<br>A<br>B<br>C<br>D<br>the tw<br>the tw<br>nain co | Silos, bins, shafts, cores, bridge piers,<br>caissons, etc.<br>Girder and slab arrangements<br>Inside shutter is fixed, aligned correctly<br>and supported by suitable props. Curb<br>reinforcement is fixed and a starter bar<br>is welded with the cutting edge.<br>Gang form, prefabricated panels joined<br>together to form a large shutter panel.<br>vo advantages of tunnel form system.   |        | 2+2 =4<br>2+2 =      | СО |

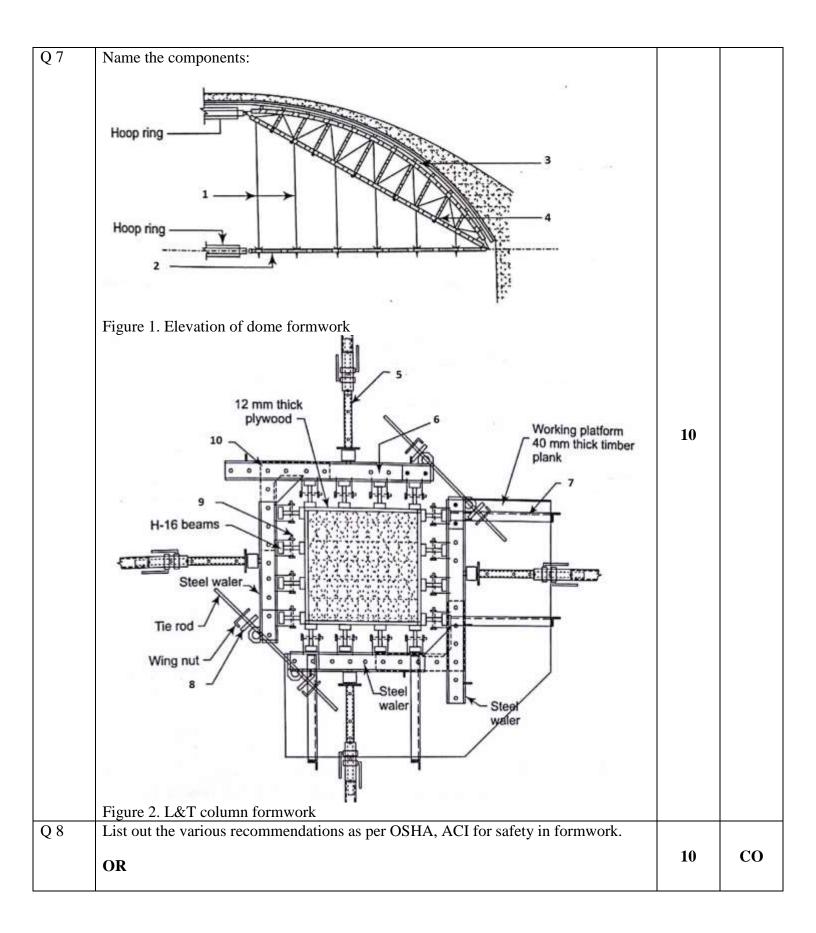
| Q 6 | ALL QUESTIONS ARE COMPULSORY AND EACH QUESTION CARRIES 10 Draw a qualitative diagram for the conventional wall formwork. Also, name all | MARKS<br>6+4        |    |
|-----|---|---------------------|----|
|     | components.   | =10                 | CO |
| Q 7 | Name the components:  | =10<br>1x 10=<br>10 |    |
|     | Figure 1. Typical formwork for heavy beam   |                     |    |

|      | Figure 2. Folded plate formwork   |            |    |
|------|---|------------|----|
| Q 8  | List out the various recommendations as per OSHA, ACI for safety in formwork. <b>OR</b> List out the various reasons for formwork failure.  | 10         | СО |
| Q 9  | <ul> <li>Sequence the following: a) determine the height of the column. b) select appropriate permissible stress and section properties. c) determine the material available for sheathing, yokes, and batten. d) estimate the load. e) compute the lateral pressure. f) determine the largest cross-sectional dimension of the column. g) select the sheathing material. h) determine the stud spacing.</li> <li>Discuss the reasons for case study of failure of cantilever portion of pier cap and deck slab failure.</li> </ul> | 6+4<br>=10 |    |
|      | SECTION-C<br>ATTEMPT ANY TWO QUESTIONS AND EACH QUESTION CARRIES 20 M   | IARKS      |    |
| Q 10 | Check the adequacy of wall formwork for the following details and data:<br>12 mm thick plywood is used, H-16 beam @ 210 mm c/c distance has been used as<br>studs, ISMC 100 double walers back to back with 50 mm gap has been used @ 1000<br>mm c/c distance, and 16 mm tie rod @ 1000 mm c/c with yield stress 250 MPa has<br>been used.  | 20         | СО |

| 1.                  | For concrete pressure by us  | sing CIRIA me  | ethod                                     |  |
|---------------------|--|--|---|--|
|                     | a. D, weight density of co   | -  |   |  |
|                     | b. R, rate of rise = $1 \text{ m/h}$   |  |   |  |
|                     | c. Temperature of concret  | e = 25  °C   |   |  |
|                     | d. H, vertical form height   |  |   |  |
|                     | e. h, vertical pour height =   |  |   |  |
|                     | f. Shape constant = $1$  |  |   |  |
|                     | g. Concrete constituent fa   | ctor = 0.45  |   |  |
| 2.                  | For 12 mm plywood  |  |   |  |
|                     | a. Allowable moment carr   | rying capacity   | = 0.2 kNm/ m                              |  |
|                     | b. Allowable shear = $6.2$ k   | $\kappa N/m$   |   |  |
|                     | c. Permissible $EI = 1.1 \text{ kN}$   | Jm²∕ m   |   |  |
|                     | d. Permissible deflection =  | = 0.8 mm   |   |  |
| 3.                  | For H-16 beam  |  |   |  |
|                     | a. Depth of H-16 beam =  | 160 mm   |   |  |
|                     | b. Flange of H-16 beam =   | 65 mm  |   |  |
|                     | c. Allowable moment carr   | rying capacity   | = 3 kNm                                   |  |
|                     | d. Allowable shear = $6 \text{ kN}$  | 1  |   |  |
|                     |  |  |   |  |
|                     | e. Permissible $EI = 145 \text{ k}$  | Nm <sup>2</sup>  |   |  |
|                     | <ul><li>e. Permissible EI = 145 k</li><li>f. Permissible deflection =</li></ul>  |  |   |  |
| 4.                  |  | = 3.33 mm  | 07  |  |
| LC-CS-CA            | f. Permissible deflection =  | = 3.33 mm  | 07<br>Shear Force                         | Deflection   |
| LC-CS-CA            | f. Permissible deflection =<br>For ISMC 100 see details f  | = 3.33 mm<br>from IS 800:20<br>Bending   | 101115-011 20111                          | Pl <sup>3</sup>  |
| SL No.              | f. Permissible deflection =<br>For ISMC 100 see details f  | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment                                 | Shear Force                               | $\delta = \frac{Pl^3}{3EI}$                              |
| SI. No.             | f. Permissible deflection =<br>For ISMC 100 see details f  | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment                                 | Shear Force                               | $\delta = \frac{Pl^3}{3EI}$                              |
| SL No.              | f. Permissible deflection =<br>For ISMC 100 see details f  | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl                       | Shear Force<br>V = P                      | Pl <sup>3</sup>  |
| SL. No.<br>1.       | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition   | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl                       | Shear Force                               | $\delta = \frac{Pl^3}{3EI}$ $Pl^3$                       |
| Sl. No.<br>1.       | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition   | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl<br>$M = \frac{Pl}{4}$ | Shear Force<br>V = P                      | $\delta = \frac{Pl^3}{3EI}$ $Pl^3$                       |
| SI. No.<br>1.       | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>For simply supported beam with | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl<br>$M = \frac{Pl}{4}$ | Shear Force<br>V = P                      | $\delta = \frac{Pl^3}{3EI}$ $Pl^3$                       |
| SI. No.<br>1.<br>2. | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition   | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl<br>$M = \frac{Pl}{4}$ | Shear Force<br>V = P<br>$V = \frac{P}{2}$ | $\delta = \frac{Pl^3}{3EI}$ $\delta = \frac{Pl^3}{48EI}$ |
| SL No.              | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>For simply supported beam with | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl<br>$M = \frac{Pl}{4}$ | Shear Force<br>V = P<br>$V = \frac{P}{2}$ | $\delta = \frac{Pl^3}{3EI}$ $\delta = \frac{Pl^3}{48EI}$ |
| SI. No.<br>1.<br>2. | f. Permissible deflection =<br>For ISMC 100 see details f<br>Loading condition<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>P<br>$\downarrow$<br>1<br>For simply supported beam with | = 3.33 mm<br>from IS 800:20<br>Bending<br>Moment<br>M = Pl<br>$M = \frac{Pl}{4}$ | Shear Force<br>V = P                      | $\delta = \frac{Pl^3}{3EI}$ $\delta = \frac{Pl^3}{48EI}$ |

|      | Sl. No.   | Loading condition   | Bending<br>Moment  | Shear Force  | Deflection  |              |  |
|------|---|---|--|--|---|--------------|--|
|      | 4.<br>  |   | M = Pa   | V = P  | $\delta = \frac{Pa}{6EI} \times \left(\frac{3l^2}{4} - a^2\right)$  |              |  |
|      | ea<br>5.<br>↓   | wo point loads of magnitude<br>ach. Span = I<br>w<br>I  | $M = \frac{wl^2}{8}$   | $V = \frac{wl}{2}$   | $\delta = \frac{5wl^4}{384EI}$  |              |  |
|      | 6.<br>▲   | or simply supported beam wi<br>.D.L. Span of length <i>l</i><br>w<br><i>i</i><br><i>l</i><br><i>l</i><br><i>l</i><br><i>i</i><br><i>l</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i><br><i>i</i> | $M = \frac{wl^2}{8}$   | $V = \frac{5wl}{8}$  | $\delta = \frac{wl^4}{185El}$   |              |  |
|      | be<br>le<br>7.<br>↓<br>Fc   | eam with U.D.L. Equal span of $l$<br>w<br>$l \uparrow l \uparrow l \uparrow l$<br>or continuous beam with U.D   | of $M = \frac{wl^2}{10}$ .L.   | $V = \frac{5wl}{8}$  | $\delta = \frac{wl^4}{145EI}$   |              |  |
|      | le<br>8.<br>↑<br>Co<br>sp   | ver its full length. Equal span<br>ngth <i>l</i> .<br>w<br>t t t t t t<br>ontinuous beam more than 3<br>bans with U.D.L. over its full<br>ngth. Span of length <i>l</i> .   | $M = \frac{wl^2}{10}$ As can be note   |  | $\delta = \frac{wL^4}{145El}$ expression remains the y spaced supports.   |              |  |
| Q 11 | Design the<br>of 3 m. A<br>as question<br>100 mm 2<br>for timber<br>N/mm <sup>2</sup> . N | e formwork for a columplywood of 12 mm theon 10). Timber of cross X 150 mm, and 150 mm r = 7 N/mm <sup>2</sup> , permiss Aild steel tie rod of 16   | ickness is availa<br>ss sections 50 n<br>m X 150 mm is<br>ible shear stress<br>5 mm diameter | ble (take the j<br>nm X 100 mr<br>available. Pe<br>s for timber =<br>is available. I | X 400 mm, and a height<br>permissible values same<br>n, 100 mm X 100 mm,<br>rmissible bending stress<br>= 0.8 N/mm <sup>2</sup> , E = 7700<br>Dead load of concrete = | 18+2 =<br>20 |  |
|      |   | $R = 2.5 \text{ m/h}, T = 15^{\circ}0$<br>a neat diagram for fir  |  |  |   |              |  |
| Q 12 | question 1<br>thickness<br>beams. Th  | 10) and CT410- props<br>of 150 mm. H-16 be  | (having capacite<br>eams are to be<br>mwork is 2.0 kN  | ity of 14 kN)<br>used as the<br>N/m <sup>2</sup> with 25                             | ns (see properties from<br>as a staging for a slab<br>secondary and primary<br>% additional for impact  | 18+2 =<br>20 |  |
|      |   |   |  |  |   |              |  |

| Name:             |         |   |           |  |             |    |  |  |  |  |
|-------------------|---------|---|-----------|--|-------------|----|--|--|--|--|
| Enrolme           | ent No: |   |           | UPES   |             |    |  |  |  |  |
|                   |         | UNIVERSITY O                                  | F PETI    | ROLEUM AND ENERGY STUDIES  |             |    |  |  |  |  |
| D                 |         |   |           | r Examination, May 2019  |             |    |  |  |  |  |
| -                 |         | me: B. Tech. Civil Engine                     | -         | Seme   |             |    |  |  |  |  |
| Course            |         | : Design of Formwork                          |           | Time   | : 03 l      |    |  |  |  |  |
| Course<br>Nos. of |         | : CEEG 318<br>: 5                             |           | Max.   | Marks : 100 |    |  |  |  |  |
| 1105.01           |         |   | UFSTI     | ONS ARE COMPULSORY   |             |    |  |  |  |  |
|                   |         | ISTRUCTIONS: ALL Q                            |           | SECTION A  |             |    |  |  |  |  |
|                   | ALL Q   | <b>UESTIONS ARE COMP</b>                      |           | RY AND EACH QUESTION CARRIES                                       | 4 MARKS     |    |  |  |  |  |
| S. No.            |         |   |           |  | Marks       | СО |  |  |  |  |
| Q 1               | State 7 | True/ False for the followin                  | g staten  | nents:   |             |    |  |  |  |  |
|                   | a.      |   |           | unnel are: curb, invert, wall, and arch.                           |             |    |  |  |  |  |
|                   | b.      |   |           | vork is characterized by labor intensive ar                        |             |    |  |  |  |  |
|                   |         | time consuming operation                      |           |  | 4           | CO |  |  |  |  |
|                   | с.      |   |           | nomy in column formwork are number                                 | of          |    |  |  |  |  |
|                   | d       | repetition and steel formw                    |           | work   |             |    |  |  |  |  |
| Q 2               |         | Table form is a part of fly<br>the following: | ing torn  | IWOIK.   |             |    |  |  |  |  |
| Q 2               | materi  |   |           |  |             |    |  |  |  |  |
|                   | S.      | COLUMN A                                      | S.        | COLUMN B   |             |    |  |  |  |  |
|                   | NO.     |   | NO.       |  |             |    |  |  |  |  |
|                   | 1       | Cutting edge                                  | Α         | Used for high rise structure: jump                                 |             |    |  |  |  |  |
|                   | 2       | Climbing formula                              | В         | form   | 4           | СО |  |  |  |  |
|                   |         | Climbing formwork                             | Б         | Assists the caisson in sinking below<br>the ground or river bottom |             |    |  |  |  |  |
|                   | 3       | Short span bridges                            | C         | Canal lining, tunnel inverts, highway                              |             |    |  |  |  |  |
|                   |         | Short spun ondges                             |           | projects, etc.   |             |    |  |  |  |  |
|                   | 4       | Horizontal slipform is                        | D         | Simple slab arrangements   |             |    |  |  |  |  |
|                   |         | used for                                      |           |  |             |    |  |  |  |  |
| Q 3               | What i  | s tunnel form system? State                   | e the two | o disadvantages of tunnel form system.                             | 2+2 =<br>4  | СО |  |  |  |  |
| Q 4               | What i  | s flying form system? State                   | e the two | o advantages of flying form system.                                | 2+2 =<br>4  | СО |  |  |  |  |
| Q 5               | What i  | s slipform? What are the m                    | nain con  | ponents of horizontal slip form? For which                         | -           |    |  |  |  |  |
| _                 |         | res horizontal slipform is u                  | sed.      |  | =4          |    |  |  |  |  |
|                   |         |   |           | SECTION B  |             |    |  |  |  |  |
|                   | ALL Q   | UESTIONS ARE COMP                             | ULSOF     | RY AND EACH QUESTION CARRIES                                       | 10 MARKS    |    |  |  |  |  |
| Q 6               | Draw    | a qualitative diagram for                     | the con   | nventional slab formwork. Also, name a                             |             | СО |  |  |  |  |
|                   | compo   | 10 CO   |           |  |             |    |  |  |  |  |



|      | List out the various reasons for formwork failure.  |            |    |
|------|---|------------|----|
| Q 9  | What measures should be adopted to achieve economy in column formwork construction?         Discuss the reasons for case study of toppling of prestressed girder during construction at a major bridge on Banganga River.   | 6+4<br>=10 |    |
|      | SECTION-C<br>ATTEMPT ANY TWO OUESTIONS AND EACH OUESTION CARDIES 20 M   |            |    |
| Q 10 | ATTEMPT ANY TWO QUESTIONS AND EACH QUESTION CARRIES 20 M<br>Check the adequacy of wall formwork for the following details and data:   | IAKKS      |    |
|      | <ul> <li>12 mm thick plywood is used, H-16 beam @ 250 mm c/c distance has been used as studs, ISMC 100 double walers back to back with 50 mm gap has been used @ 1200 mm c/c distance, and 16 mm tie rod @ 1200 mm c/c with yield stress 250 MPa has been used.</li> <li>The following data is also available:</li> </ul>   |            |    |
|      | <ul> <li>5. For concrete pressure by using CIRIA method</li> <li>h. D, weight density of concrete = 25 kN/m<sup>3</sup></li> <li>i. R, rate of rise = 1 m/h</li> <li>j. Temperature of concrete = 25 °C</li> <li>k. H, vertical form height = 6.15 m</li> <li>l. H, vertical pour height = 6 m</li> </ul>   |            |    |
|      | <ul> <li>m. Shape constant = 1</li> <li>n. Concrete constituent factor = 0.3</li> <li>6. For 12 mm plywood</li> <li>e. Allowable moment carrying capacity = 0.2 kNm/ m</li> <li>f. Allowable shear = 6.2 kN/ m</li> <li>g. Permissible EI = 1.1 kNm<sup>2</sup>/ m</li> <li>h. Permissible deflection = 0.8 mm</li> <li>7. For H-16 beam</li> <li>g. Depth of H-16 beam = 160 mm</li> <li>h. Flange of H-16 beam = 65 mm</li> <li>i. Allowable moment carrying capacity = 3 kNm</li> <li>j. Allowable shear = 6 kN</li> <li>k. Permissible EI = 145 kNm<sup>2</sup></li> <li>l. Permissible deflection = 3.33 mm</li> <li>8. For ISMC 100 see details from IS 800:2007</li> </ul> | 20         | СО |

| SL No.  | Loading condition   | Moment<br>M = Pl      | Shear Force<br>V = P                      | nu3  |      |
|---------|---|-----------------------|---|--|------|
| 1.      | P   | M = Pt                |   | $\delta = \frac{Pl^3}{3EI}$  |      |
|         | 1   |                       |   | in hanson  |      |
| 2.      | Ŷ   | $M = \frac{Pl}{4}$    | $V = \frac{P}{2}$                         | $\delta = \frac{Pl^3}{48EI}$   |      |
|         | 1/2 1/2   |                       |   | and the second second  |      |
|         | For simply supported beam with concentrated load <i>P</i> at its centre                             |                       |   |  |      |
| 3.      | Ļ   | $M = \frac{Pab}{l}$   | $V = \frac{Pa}{l}$                        | $\delta = \frac{Pb}{El} \times \left(\frac{l^2}{16} - \frac{b^2}{12}\right)$ |      |
|         |   |                       |   | - Hate is  |      |
|         | $\operatorname{Span} = l = a + b$   |                       |   |  |      |
| Sl. No. | Loading condition   | Bending<br>Moment     | Shear Force                               | Deflection   |      |
| 4.      | $ \begin{array}{c} P & P \\ \downarrow & \downarrow \\ \uparrow^{a} & {}^{a} \end{array} $          | M = Pa                | V = P                                     | $\delta = \frac{Pa}{6EI} \times \left(\frac{3l^2}{4} - a^2\right)$           |      |
| 5.      | Two point loads of magnitude P<br>each. Span = l<br>W   | .2                    | val                                       | e 194  |      |
|         | For simply supported beam with  | $M = \frac{wl^2}{8}$  | $V = \frac{an}{2}$                        | $\delta = \frac{5wl^4}{384EI}$   |      |
| 6.      | U.D.L. Span of length <i>l</i>  | $M = \frac{wl^2}{8}$  | $V = \frac{5wl}{wl}$                      | $\delta = \frac{wl^4}{185EI}$  |      |
|         | Two span uniformly supported  | $M = \frac{1}{8}$     | 8   | 0- <u>185E</u> I   |      |
|         | beam with U.D.L. Equal span of length <i>l</i>  |                       |   |  |      |
| 7.      |   | $M = \frac{wl^2}{10}$ | $V = \frac{5wl}{8}$                       | $\delta = \frac{wl^4}{145EI}$  |      |
|         | For continuous beam with U.D.L.<br>over its full length. Equal span of<br>length <i>l</i> .         |                       |   |  |      |
| 8.      |   | $M = \frac{wl^2}{10}$ | $V = \frac{5wl}{8}$                       | $\delta = \frac{wL^4}{145EI}$  |      |
| -       | Continuous beam more than 3<br>spans with U.D.L. over its full<br>length. Span of length <i>l</i> . |                       | d from above, the o<br>than three equally | expression remains the spaced supports.                                      |      |
|         |   |                       | . 250                                     | 350 mm, and a height   | 18+2 |

|      | as question 10). Timber of cross sections 50 mm X 100 mm, 100 mm X 100 mm, 100 mm X 150 mm, and 150 mm X 150 mm is available. Permissible bending stress for timber = 7 N/mm <sup>2</sup> , permissible shear stress for timber = 0.8 N/mm <sup>2</sup> , E = 7700 N/mm <sup>2</sup> . Mild steel tie rod of 16 mm diameter is available. Dead load of concrete = $26 \text{ kN/m}^3$ , R = 2m/h, T = 15°C, C <sub>w</sub> XC <sub>c</sub> = 1 (use ACI formula). Also draw a neat diagram for final design with proper detailing. |              |  |
|------|--|--------------|--|
| Q 12 | Design a slab formwork using 12 mm plywood, H-16 beams (see properties from question 10) and CT410- props (having capacity of 16 kN) as a staging for a slab thickness of 150 mm. H-16 beams are to be used as the secondary and primary beams. The live load on the formwork is $2.0 \text{ kN/m}^2$ with 35 % additional for impact (w.r.t live load). The formwork load is $0.4 \text{ kN/m}^2$ .<br>Also draw a neat diagram for final design with proper detailing.   | 18+2 =<br>20 |  |