2017-18
B. Tech (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
STRUCTURAL ANALYSIS-I
CE-315

Maximum Marks: 60
Credits: 04
Duration: Two hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

1(a) Determine the static and kinematic indeterminacy for the following:

(i) 

(ii) 

(iii) 

1(b) Find the fixed end moments and draw the BMD for the beam shown in Fig.1. Also find deflection at C. Use Mohr’s theorem. Take E = 200 GPa, I = 10000 cm^4

Fig.1

OR

1'(b) Draw BM and SF diagrams for the continuous beam shown in Fig 2 using three moment equation. Take E = 200 GPa, I = 10000 cm^4

Fig.2

Contd...
2. Analyse the frame as shown in Fig. 3 and draw BMD using moment distribution method.

3. Determine the vertical deflection of joint ‘C’ for the truss given in Fig. 4. The cross-sectional area of all members is 500 cm². Take E=260 GPa.

OR

3'. Find the force in the member AD of the truss as shown in Fig. 5. All the members are of same cross-sectional area of 6000 mm². Take E=200 GPa.

4(a). Two parabolic arches have hinges at their outer ends and rests on a common roller as shown in Fig. 6. If EI₀ is same for both arches and l=l₀secθ, determine the horizontal thrust at hinges and draw BMD.

Contd -- 3
4(b) A bridge cable slung between two piers 100m apart carries a load of 20kN/m of span. The support of the piers are at the same level and cable at its lowest point sags 10m below this level. Calculate the maximum value of cable tension. Find the tension in the back stay and pressure on the pier if the cable passes over saddle and back stay is inclined at 30° to the horizontal. If the cable passes over pulley, find the horizontal and vertical pressures on the pier, inclination of the back stay is same.

OR

4'(a) The abutments of a three hinged parabolic arch are at different levels. The left abutment is 3m above the right abutment. The crown is 5m above the left abutment. The span of the arch is 48m. The crown of the arch is 25m away from the left abutment. There is a concentrated load of 150kN at 10m from the left support. A uniformly distributed load of 10kN/m is applied over the length of 23m to the right of the crown upto the right abutment. Determine the reaction components at both supports and shear and normal forces at 20m from the left support.

4'(b) A three hinged suspension girder bridge has a span of 120m and a central dip of 15m. It has to carry a uniformly distributed load of 10 kN/m and a concentrated load of 20kN is placed at a distance of 30m from the right support. Determine the maximum bending moment and shear force at a section 30m from the left hand support.
2017-18
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
ENGINEERING HYDRAULICS I
CE-316

Maximum Marks: 60  Credits: 04  Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.

1(a)  Derive Darcy’s Weisbach equation. Glycerine ($\mu = 1.50$ Pa-s and $\rho = 1260$ kg/m$^3$) flows at a velocity of 5.0 m/s in a pipe. Estimate: (i) the boundary shear stress in the pipe due to the flow (ii) Head loss in a length of 12 m of pipe and (iii) Power expended by the flow in a distance of 12 m. [08]

1(b)  The Power ‘P’ required to drive a propeller is known to depend on the diameter ‘D’ and angular velocity ‘$\omega$’ of the propeller; the density ‘$\rho$’, viscosity ‘$\mu$’ and bulk modulus of elasticity ‘K’ of the fluid; and the free stream velocity ‘V’. Derive the functional relationship for ‘P’ in a dimensionless form. Explain Prandtl mixing length theory for turbulent flow. [07]

OR

1’ Derive an expression for velocity distribution for turbulent flow in pipe. In a fully rough turbulent flow in a 15 cm diameter pipe, the centre line velocity at mid-radius is 2.28 m/s. Find the discharge and the height of the roughness projections. Explain the law of similarities with examples. [15]

2(a)  Explain the variation of $C_0$ with $Re$ in the case of cylinder. A hemisphere dish of 1 m diameter with hollow side upstream at a height of 3 m from the ground

contd...2.
is subjected to a direct uniform wind speed of 15 m/s. Determine the bending
moment developed by the wind at the base level. Assume the kinematic viscosity
and mass density of wind as $1.8 \times 10^{-5}$ m$^2$/s and 1.20 kg/ m$^3$.

2(b) Explain the concept of smooth and rough surfaces with a neat sketch. Obtain [10]
the expression of $\delta/\lambda$, $C_r$ and $C_D$ for laminar boundary layer over a flat plate
with the following velocity distribution

$$u/U=1.5 \left(\frac{y}{\delta}\right)-0.5 \left(\frac{y}{\delta}\right)^3$$

OR

2'(a) Derive an expression for the average drag coefficient for the laminar boundary [12]
layer over a flat plate. Discuss the role of the laminar boundary layer in
classification of the nature of boundaries.

2'(b) Explain the terms: (i) Vortex Shedding (ii) Magnus Effect (iii) Strouhal number [03]

3 (a) Two Reservoirs with a difference in water surface elevation of 10 m are [10]
connected by a pipeline ABC which consists of two pipes of AB and BC joined in
series. Pipe AB is 10 cm in diameter, 20 m long and has a value of $f = 0.02$. Pipe BC
is of 16 cm diameter, 25 m long and has an $f = 0.018$. The junctions with the
reservoirs and between the pipes are abrupt. (i) Calculate the discharge. (ii) What
difference in reservoir elevations is necessary to have a discharge of 15.0 L/s?
Include all minor losses.

(b) Discuss the phenomenon of water hammer. With clear sketches show the
various stages of the water hammer pressure wave.

OR
3' (a) Differentiate between major and minor losses in pipe problems. A compound piping system consists of 1800 m of 50 cm, 1200 m of 40 cm and 600 m of 30 cm diameter pipes of the same material connected in series.

i. What is the equivalent length of a 40 cm pipe of the same material?

ii. What is the equivalent size of a pipe 3600 m long?

If the three pipes are in parallel, what is the equivalent length of a 50 cm pipe?

(a) Discuss the role of water hammer in the design of penstock in hydropower plant.

4(a) Design a Francis turbine runner with the following data:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Items</th>
<th>Data</th>
<th>S.N.</th>
<th>Items</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Net Head</td>
<td>75 m</td>
<td>6</td>
<td>Speed ratio</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>Specific Speed</td>
<td>80</td>
<td>7</td>
<td>Breadth to Diameter ratio</td>
<td>0.10</td>
</tr>
<tr>
<td>3</td>
<td>Power output</td>
<td>400 KW</td>
<td>8</td>
<td>Inner to outer diameters ratio</td>
<td>0.50</td>
</tr>
<tr>
<td>4</td>
<td>Hydraulic Efficiency</td>
<td>94 %</td>
<td>9</td>
<td>K</td>
<td>0.95</td>
</tr>
<tr>
<td>5</td>
<td>Overall Efficiency</td>
<td>85 %</td>
<td>10</td>
<td>Frequency</td>
<td>50 hertz</td>
</tr>
</tbody>
</table>

Velocity of flow remains constant throughout and the flow is radial at the exit.

4(b) Show that the maximum power will be developed in the Pelton Wheel turbine when peripheral velocity is half the jet velocity.

4(c) Define specific speed for pumps and turbines. Explain the principle of a submersible pump.
2017-18
B. TECH. WINTER (VI SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
TRANSPORTATION ENGINEERING
(CE-317)

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No. | Question | M.M.
---|---|---
1(a) | What are desirable properties of subgrade soil? State the significance of any two of them. | [07]
1(b) | Discuss the construction procedure of Water Bound Macadam road. | [08]

OR

1'(a) | What are desirable properties of stone aggregate? Discuss any two of them. | [07]
1'(b) | Enumerate different types of longitudinal joints provided in cement concrete pavement. With the help of neat sketch briefly discuss the expansion and contraction joints without dowel bars. | [08]

2(a) | Derive an expression for Stopping Distance at plains. Calculate the maximum allowable speed on a horizontal curve of radius 350 m, if the maximum allowable value of lateral coefficient of friction is 0.15 and rate of super elevation is 0.07. | [08]
2(b) | Discuss the IRC:37-2001 method for the design of flexible pavement. | [07]

3(a) | Define gauge and wear of railway track. Illustrate the various types of wear of rails with sketches. Briefly explain which type of wear is the most destructive and why? | [07]
3(b) | Explain the functions and necessity of sleepers used in railway track. Describe suitability of pre-stressed concrete sleepers for heavy loads, high speed and electric traction on railways. A broad gauge (B.G) Indian railway track has a sleeper density of (n+6). If the track is laid with rails of length 13.0 m, determine the number of sleepers required for a 6.5 km long railway track. | [08]

OR

contd... 2.
3'(a) What do you understand by creep of rails in a railway track? Discuss the wave action theory propounded for the probable cause of creep. Why the creep anchors are not recommended on the bridge of railway track?

3'(b) Define point and crossing and draw a neat sketch of a right hand turnout. A meter gauge railway track is laid on a curve of 10° and a train with a total weight of 2000 tonnes is passing over it. Determine the magnitude of curve resistance.

4(a) The entry and exit width at the rotary is 10 m. The weaving length of the rotary is 54 m. Table below gives the traffic (PCU/hour) from the four approaches, traversing the rotary. Determine the capacity of the rotary.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Left turn</th>
<th>Straight</th>
<th>Right turn</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>400</td>
<td>700</td>
<td>300</td>
</tr>
<tr>
<td>South</td>
<td>350</td>
<td>370</td>
<td>420</td>
</tr>
<tr>
<td>East</td>
<td>200</td>
<td>450</td>
<td>550</td>
</tr>
<tr>
<td>West</td>
<td>350</td>
<td>500</td>
<td>520</td>
</tr>
</tbody>
</table>

4(b) In airport planning, differentiate between the perspectives of financial planning and economic planning.

OR

4(b') Mention any FOUR of the aircraft control components and their functions.

4(c) Give a summary of all the corrections applied to compute the actual runway length from the basic runway length. Under what condition the gradient correction is applied?

4(d) Discuss the significance of crosswind, tailwind, and headwind components on a runway. If wind is blowing across runway at a speed of 80 kmph and making an average angle of 30° with the runway, compute the Crosswind and Headwind/Tailwind components.
1. A bracket is bolted to a vertical column as shown below. M20 bolts of grade 4.6 are used. Determine the safety of connection if maximum value of factored load $P = 55\, \text{kN}$ which can be carried safely. Given that thickness of web of ISMC 300 is 7.6mm. Use $f_y = 250\, \text{MPa}$ and $f_u = 410\, \text{MPa}$

OR

1'(a) What is the cause of incomplete fusion and undercutting in welds?

1'(b) Two framing angles ISA 150mm $\times$ 150mm $\times$ 10mm are used to make beam (section ISMB350@514.04N/m) to column (ISHM300 @ 618.03N/m) connection. One angle is placed on either side of web of the beam; five bolts of 20mm diameter and grade 4.6 are used to connect the angle legs to the beam web.
Determine the reaction that can be transferred through the joint. Use $f_y=250$ MPa and $f_u=410$ MPa.

[12]

2(a)

Determine the strength in yielding and block shear of a standard angle ISA $100\times100\times8$ mm connected to a 12 mm gusset plate with 7#16 mm diameter bolts. Take $f_y=250$ MPa and $f_u=410$ MPa. (Use Clause 10.2.2 onwards for details of bolted connection).

[7.5]

2 (b)

Determine the size and thickness of a slab base for a column ISHB200 which carries a factored axial compressive load of 1000 kN. The grade of steel is E250 and grade of concrete pedestal is M20.

[7.5]

OR

2’. A laced column consists of 2 ISMC250 placed back to back at a spacing of 160 mm. Length of the column is 5 m and the column is hinged at both ends. Use Fe410 grade steel. The column carries a factored axial load of 1350 kN.

Determine

i. Spacing and size of the single lacing with inclination of lacing as 50° and load carrying capacity of lacing in tension and compression

ii. Design the welded connection of lacing bar with the column section.

[7.5]

3(a)

Explain Tension field action in plate girder.

[3]

3(b)

Design a 24 m welded plate girder using 410 grade steel. The plate girder is subjected to factored bending moment and shear force of 8340 kNm and 1290 kN respectively. The girder is laterally supported through out. Design the cross section for an un-stiffened web. Check for the shear and moment capacity of the section. Use $f_y=250$ MPa and $f_u=410$ MPa.

[12]

4.

Define Shape factor

Determine the collapse load for the portal frame shown below.

[3]