Maximum Marks: 60

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

1(a) Determine the degree of kinematic and static indeterminacy for the structure shown in Fig. 1 (i)-(iii).

![Structure Diagram](image1)

Fig. 1

1(b) Find the fixed end moments and draw bending moment and shear force diagram for the beam shown in Fig. 2. The support B rises by 1 cm. Take $E=200$ Gpa and $I=10,000 \text{cm}^4$. Use Mohr's theorem.

![Beam Diagram](image2)

Fig. 2

OR

1'(b) Analyse the continuous beam as shown in Fig. 3 and draw the bending moment diagram.

contd...
The support A sinks by 10mm and support B rises by 20mm. Use three moment equations method (Claypon's theorem). Take $E = 210\text{GPa}$ and $I = 10,000\text{cm}^4$. 

![Fig. 3](image)

2 Analyse the frame as shown in Fig. 4 and draw bending moment diagram using Moment Distribution Method. The support B sinks by 10mm and the support C rises by 20mm. Take $E = 200\text{GPa}$, $I = 10^8\text{mm}^4$.

![Fig. 4](image)

3 Using unit load method analyse the truss as shown in Fig. 5 and determine the total vertical deflection if the point under consideration is joint C. Take $E = 200\text{ GPa}$; $A_c = 30\text{cm}^2$ and $A_t = 50\text{cm}^2$. Define $A_5 \& A_6$.

![Fig. 5](image)

OR

[contd.. 3-]
3. Determine the force in the member BC for the frame as shown in Fig.6. All the members have same cross sectional area.

Fig. 6

4(a) An unsymmetrical three hinged parabolic arch is loaded as shown in Fig.7. Find the reactions at the support and draw BMD. Also find normal thrust and radial shear at a section 4m from the right hand support.

Fig. 7

4(b) An un-stiffened suspension cable carries a uniformly distributed load of 10kN/m over a span of 30m as shown in Fig.8. The suspension cable is supported on frictionless rollers fixed at to the piers. The cable is inclined at 30° to the horizontal. One pier is 4.5m below the other and the maximum dip at the lowest point is 3m below the lower pier. Calculate (a) maximum and minimum tension in the cable and (b) the horizontal and vertical force at each pier.

cont'd... 4
4'(a) Prove that under self weight the shape of the cable is catenary and its length is

\[ S = \frac{H}{w} \sinh \frac{wx}{H} \]

4'(b) The cable of a suspension bridge has a span of 100m and a central dip of 10m. Each cable is stiffened by a girder hinged at the ends and at the middle. A dead load of 20kN/m acts on the whole girder and a live load of 30kN/m of length 20m moves over the girder. Determine the maximum tension in the cable when the live load is situated on the left hand half of the stiffening girder such that the right hand end of the live load is just over the central hinge. Also draw the shear force and bending moment diagram for the girder.
1. Find the fixed end moments and draw BM and SF diagram for the beam as shown in Fig 1. Also find deflection at C. Use Mohr’s theorem. Take $E = 200\text{GPa}$, $I = 8000\text{ cm}^4$.

![Fig. 1](image-url)

2. Analyse the continuous beam as shown in Fig.3 and draw BMD using Slope Deflection Method if the support B sinks by 10mm. Take $E = 200\text{GPa}$, $I = 10,000\text{cm}^4$. Cond... 2.
Using unit load method analyse the truss as shown in Fig. 4 and determine the total vertical deflection of joint C. Take $E=200\text{GPa}$; Cross sectional area of $AB$ is $100\text{mm}^2$ and of $AC$ and $BC$ is $150\text{mm}^2$ each.

OR

Find the force in the member $DA$ of the truss as shown in Fig. 5 due to a load of $10\text{kN}$ applied horizontally at A. The member $AB$, $BC$ and $CA$ have cross sectional area as ‘2a’ and the member $DA$, $DB$ and $DC$ have area of cross section ‘a’.
4(a) Derive the relation for horizontal thrust in two hinged parabolic arch considering the effect of bending, rib shortening, yielding and temperature.

4(b) A light cable with negligible weight is suspended between two points 300m apart horizontally with the right support 12m higher than the left. Four vertical gravity loads of 400kN, 200kN, 400kN and 1200kN (from left to right) centred between the supports and spaced 60m apart horizontally. If the larger sag is 24 m, Calculate (a) the sag at each applied load (b) the maximum cable tension and (c) the unstressed length of the cable.

OR

4'(a) A uniformly distributed load of 50 kN/m covers left half of the span of a two hinged parabolic arch of span 36 m and central rise 8 m. Considering effect of bending and rib shortening, find the horizontal thrust. Take $E_c = 210\text{GPa}$, $A_c = 1000\text{cm}^2$, $I_c = 600,000\text{cm}^4$.

4'(b) The three hinged stiffening girder of a suspension bridge of span 130m is subjected to the point loads of 240kN and 300kN at distances 25m and 80m from the left end. Find the Shear force and bending moment for the girder at a distance of 40m from the left end. The supporting cable has a central dip of 12m. Find also the maximum tension in the cable.
For a steady laminar flow in a horizontal circular pipe, derive an expression for the shear stress at any radial distance from the axis and pressure drop along the pipe in the term of boundary shear stress.

A pipe of 25 cm diameter carries air at an average velocity 8 m/s. Calculate the friction factor and boundary shear stress assuming the flow to be fully rough – turbulent.

Take \( \rho =1.22 \text{ kg/m}^3 \), \( \nu =1.5 \times 10^{-5} \text{ m}^2/\text{s} \), \( k=0.50 \text{ mm} \).

Obtain an expression for the scale of a model which must satisfy both the laws proposed by Reynold and Froude.

OR

Discuss Prandtl’s mixing length theory and derive an expression for total shear stress in turbulent flow.

Two tanks containing an oil of \( \rho =950 \text{ kg/m}^3 \) and \( \mu =8\times10^{-2} \text{ Pa.s} \) are connected by a 15cm diameter pipeline of length 200m. Calculate the maximum difference in the elevation in the oil surfaces that can exist while maintaining laminar flow in pipe.

Develop a dimensionless expression for terminal velocity of a small sphere falling in liquid based on the principle of dimensional analysis.

A thin rectangular plate 3 m long and 12 m wide is towed through water (\( \nu =1.5\times10^{-6} \text{ m}^2/\text{s} \)) at 1.0 m/s velocity. Determine the total drag force on both sides of the plate and also shear stress at trailing edge of the plate.
2(b) Describe variation of $C_D$ with Reynolds number for a cylinder. Explain deformation and form drag with neat sketch.

OR

2'(a) A circular cylinder 1.0 m in diameter and 10 m long is rotated at 300 rpm with its axis perpendicular to the air stream having velocity of 10 m/s. Determine (i) circulation (ii) lift (iii) position of stagnation points (iv) lift coefficient and (v) rotational speed of the cylinder if it has a single stagnation point.

2'(b) Explain the terms: (i) Laminar sub layer (ii) alternate vortex shedding (iii) Boundary layer separation (iv) Nominal boundary layer thickness

3 Discuss the significance of Water Hammer phenomenon.

Discuss various stages of a water hammer pressure wave in pipeline as well as the factors influencing velocity of pressure wave. Two pipes each of length $L$ and diameters $D_1$ and $D_2$ are arranged in parallel; the loss of head when a total quantity of water $Q$ flows through them being $h_1$. If the pipes are arranged in series the loss of head is $h_2$ for the same discharge. If $D_1=2.0 \ D_2$, find the ratio of $h_1$ and $h_2$.

4(a) Derive an expression of hydraulic efficiency for a Pelton wheel turbine. Draw a neat sketch for a centrifugal pump indicating suction and delivery arrangement and explain briefly its working principle.

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

Net head = 100 m; Speed = 800 rpm; Power output= 500 kW; Hydraulic efficiency= 94%; Overall efficiency= 85%; Flow ratio= 0.15; Breadth to diameter ratio= 0.1; Inner diameter to outer diameter ratio= 0.5; $K= 0.95$ and velocity of flow remains constant throughout and the flow is radial at exit.
2016-17
B.E. (CIVIL) VI SEMESTER EXAMINATION
TRANSPORTATION ENGINEERING
(ECE-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. Questions M.M.

1(a) Discuss steps for practical design of super elevation. Also mention the minimum and maximum values of super elevation. (06)

1(b) Calculate the length of transition curve for a design speed of 90 kmph at horizontal curve of radius 300 m. Assume other data if required. (06)

OR

1'(a) Why extra widening of pavement is required on horizontal curves? Obtain an expression for extra widening of highway pavement provided on curves. (06)

1'(b) A valley curve is formed by a descending grade of 1 in 25 meeting an ascending grade of 1 in 30. Design the length of valley curve for a speed of 80 kmph. Assume C = 0.6 m/sec³. (06)

2(a) The specific gravities and weight proportions for aggregate and bitumen are as under for preparation of Marshal Mix Design. The volume and weight of one marshal specimen was found to be 475 cc and 1100 g.

<table>
<thead>
<tr>
<th>Item</th>
<th>Agg-1</th>
<th>Agg-2</th>
<th>Agg-3</th>
<th>Agg-4</th>
<th>Bitumen</th>
</tr>
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<tr>
<td>Weight (g)</td>
<td>825</td>
<td>1200</td>
<td>325</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>Sp. Gr.</td>
<td>2.63</td>
<td>2.51</td>
<td>2.46</td>
<td>2.43</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Find percent air voids, percent volume of bitumen, voids in mineral aggregate (VMA) and voids filled with bitumen (VFB). (06)

2(b) Discuss in detail about Highway Research Board classification system to classify subgrade soil. (06)

OR

2'(b) What are the various tests for judging the suitability of road stones for pavement construction? Discuss any one of them in detail. (06)
3 Discuss the steps for design of flexible pavements as per IRC:37-2012 recommendations. (12)

4(a) Explain in brief any two of the following:
(i) Gauge of railway track (ii) Creep of rail (iii) Left Hand turn out

4(b) Discuss the functions and desirable qualities of good sleepers used in Indian Railway Track. Define sleeper density and determine the number of sleepers required for 2.5 km long broad gauge railway track having sleeper density of (n+4).

OR

4'(a) Define hauling capacity and mean tractive effort of Locomotive. With the aid of neat sketch, explain the functioning of hump yard.

4'(b) Explain briefly the different types of railway stations. Differentiate between junction and terminal railway stations.

5(a) Explain any two of the following:
(i) Approach zone (ii) Corrections for basic runway length (iii) Orientation of runway

5(b) What do you understand by basic runway length? The runway lengths of an airport for landing and take-off at sea level in standard atmospheric conditions are 5.0 km and 3.5 km respectively. The airport site has an elevation of 260 m and reference temperature of 27°C. Determine the actual runway length required at the airport site for effective runway gradient of 0.35%.
2016-17
B.E.(CIVIL) VI SEMESTER EXAMINATION
DESIGN OF STEEL STRUCTURES
(ECE-318N)

Use of IS-800 and Steel tables allowed      Time: 2hour      Maximum marks: 60
Assume suitable data if required

1(a) Determine the shape factor from first principles for circular section of diameter 'D'.
1(b) A Tie member of a truss consists of double angle section of dimensions 80mm \times 80mm \times 8mm welded on the opposite side of a 12mm thick gusset plate as shown below. Design a fillet weld. Axial tension in the member is 200 kN.

OR

1'(a). Determine the value of collapse load for a fixed beam subjected to uniformly distributed load over the entire span..
1'(b). Find the safe load P carried by the joint as shown in figure below. M20 bolts of grade 4.6 are provided at a pitch of 80mm and gauge distance of 100mm. The thickness of the flange is 6.1mm and that of the bracket plate is 8mm. Take e = 200mm.
2(a) List the factors affecting the choice of section for compression members.
2(b) Explain block shear failure using diagram.
2(c) Determine the block shear strength of an angle of a roof truss ISA 100×100×10mm connected by 5#20mm diameter bolts subjected to a combination of dead load, live load and wind load. Use $E250$ ($Fe410W$). $A$.

3(a) Explain the role of vertical stiffeners and longitudinal stiffeners in a plate girder (Use diagram).
3(b) A 30m long simply supported welded plate girder carries a uniformly distributed load of 75kN/m (excluding its self weight) and is subjected to two concentrated loads of 900kN each at quarter points of span. Assume the girder to be supported laterally throughout the span. Take the width of the support as 500mm.

The section of plate girder is as following:
Flanges 540mm×25mm
Web 2100×12mm

Design end bearing stiffener. Check of bearing strength of stiffener as per Clause 8.7.5.2 is not required. Use and list the relevant clauses.

OR

3'(b) For the data given above design the load bearing stiffener. Check of bearing strength of stiffener as per Clause 8.7.5.2 is not required. Use and list the relevant clauses.

4. Design a channel section purlin for an industrial building to support a galvanized corrugated iron sheet roof. Given that

Span of truss = 20m
Height of truss = 5m
Spacing of trusses = 4.5 m centre to centre
Weight of roofing material = 171 N/m²
Live load = 0.4 kN/m²
Wind load = 1.2 kN/m²
Spacing of purlins = 1.4 m