# **Question Paper**

Exam Date & Time: 20-Apr-2018 (09:30 AM - 12:30 PM)



### MANIPAL ACADEMY OF HIGHER EDUCATION

#### INTERNATIONAL CENTRE FOR APPLIED SCIENCES FOURTH SEMESTER B.S. (ENGG) END-SEMESTER THEORY EXAMINATIONS APRIL - 2018 DATE: 20 APRIL 2018 TIME: 9:30AM TO 12:30PM Structural Analysis [CE 242]

Marks: 100

Duration: 180 mins.

## Answer 5 out of 8 questions. Assume any missing data suitably.

## Answer any five out of eight questions.

- <sup>1)</sup> State and prove Mohr's first theorem with neat sketch. (10) <sup>A)</sup>
  <sup>B)</sup> For the given beam determine slope at A, deflection C. (10) take I= 50 x 10<sup>-6</sup> m<sup>4</sup> and E= 204x10<sup>6</sup> kN/m<sup>2</sup> <sup>I)</sup> kN/m <sup>A</sup> <sup>C</sup> <sup>3m</sup> <sup>B</sup> <sup>State and derive castglion's first and second theorem. (10)</sup>
  - A) B)
- Using unit load method, find the vertical and horizontal (10) deflection of the free end of the lamp post shown in figure. Take E=  $204 \times 10^6$  kN/m<sup>2</sup> and I<sub>1</sub>=2I<sub>2</sub>= 80 x 10<sup>-6</sup> m<sup>4</sup>.

6m B I2 C

- A three hinged parabolic arch of 40m span has abutments at unequal level. The highest point of the arch is 4m above left support and 9m above the right abutment. The arch is subjected to an UDL of 15kN/m over its entire horizontal span. Find the radial shear, normal thrust, bending moment at 8m from the left support and draw BMD.
- B) Analyse the given fixed beam shown in figure using consistant deformation method. Take EI as constant



- A three hinged arch of span 30m is of rise 4m subjected to <sup>(10)</sup> a point load of 5kN at 4m from the left support. Determine the reaction at the supports, normal thrust and radial shear at section 4m from right support, maximum positive and negative bending moment. Also draw BMD.
- <sup>B)</sup> Analyse the propped cantilever beam as shown in figure <sup>(10)</sup> using minimum strain energy method and draw BMD and SFD. Take EI as constant



5)

A)

4)

A)

Analyse the fixed beam as shown in figure using strain (10) energy method and draw BMD and SFD. Take El as constant



- <sup>B)</sup> Differentiate between determinate and indeterminate <sup>(5)</sup> structures and give examples.
- <sup>C)</sup> With the neat sketch derive strain energy equation due to <sup>(5)</sup> axial load and due to bending.
- <sup>6)</sup> Analyse the frame shown in figure using minimum strain <sup>(20)</sup> energy method. Draw BMD and elastic curve.

(10)



(20)

Analyse the beam shown in figure by slope deflection method with following conditions.

- The end A rotates by  $\theta_A = 1/250$  radians in clock wise direction.
- support B settles by 30mm and Support C settles by 20mm.Draw BMD, SFD, elastic curve. Take EI=764 kNm<sup>2</sup>.



Analyse the beam shown in figure by moment distrubution <sup>(20)</sup> method.Draw BMD, SFD and elastic curve. Perform minimum four cycles.



8)

7)