Total No. of Printed Pages:2

SUBJECT CODE NO:- P-274
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Civil) Examination MAY/JUNE-2016
Structural Mechanics
(Revised)

[Time: Three Hours] **[Max Marks:80]**

"Please check whether you have got the right question paper."

N.B 1) Solve any three questions from each section A and section B.
2) Use of non-programmable calculator is permitted.
3) Assume any additional suitable data if required and state it clearly.

Section A

Q.1 a) Derive governing differential equations of equilibrium for a three dimensional state of stress in static condition. Hence, derive equilibrium equations for dynamic condition. 07

b) For following three dimensional state of stress, find the body force distribution required for equilibrium; @ point (2, 3,-3). 07

$$\sigma_{xx} = 2x^2y + 3y^2 + xz$$
$$\sigma_{yy} = 4xy + 3x^2y + 2xyz$$
$$\sigma_{zz} = 3xz + yz^2$$
$$\tau_{xy} = 3xy^2 + 2x^2y$$
$$\tau_{yz} = 2yz^2 + 3y^2z$$
$$\tau_{xz} = 2x^2y + 2y^2z + 2z^2.x$$

Q.2 a) What do you understand by invariants of stress tensor? Explain in details. 05

b) For given following state of three dimensional stress find magnitudes of principal stresses, and direction cosines of minor principal plane. $[\sigma_{ij}] = \begin{bmatrix} 60 & 30 & 40 \\ 30 & 80 & 50 \\ 40 & 50 & 40 \end{bmatrix}$ MPa. 08

Q.3 State assumptions made in analysis of thin plates. With usual notations, starting from slope curvature relations derive governing differential equation of thin rectangular plate subjected to transverse load 'q' per unit area "$\nabla^4_{\omega} = \frac{q}{D}$". 13

Q.4 Derive with usual notations, governing differential equation of bending of circular plates. Hence write the solution for circular plate subjected to point load at center with simply supported edge over periphery. 13

Q.5 a) Write in details Navier's solution for governing differential equation of rectangular plate subjected to udl simply supported over all four edges. 09

b) What do you understand by thin plates and thick plates? Explain. 04

Section-B

Q.6 Analyze the continuous beam as shown in figure no 1 using stiffness matrix method and draw BMD and SFD 14

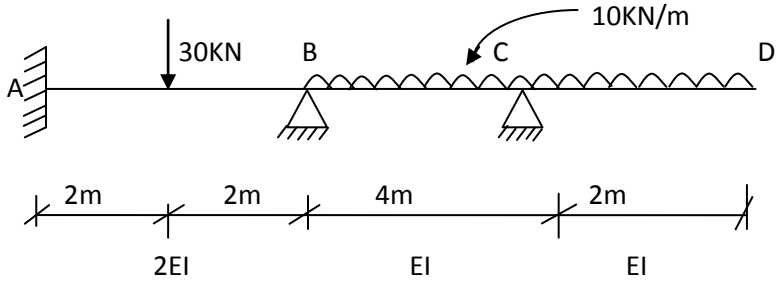

Fig. no 1

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Q.7 Analyze the rigid jointed plane frame as shown in figure 2 using stiffness matrix method and draw BMD for the same. 13

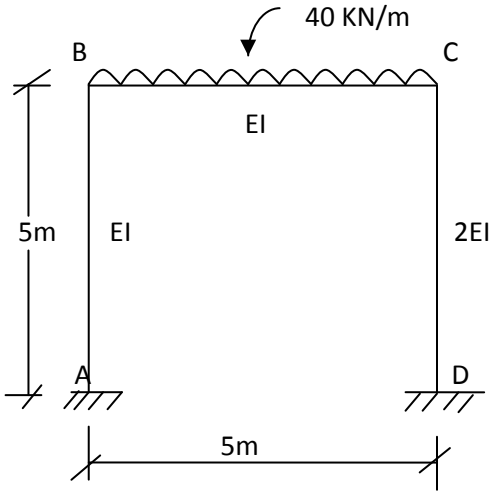

Fig.2

Q.8 a) Differentiate between static and kinematic in determinacy of a structure with example of beam and frame each. 06

b) Differentiate between stiffness matrix method and flexibility matrix method in detail, starting procedure of both. State advantages of stiffness matrix method over flexibility matrix method. 07

Q.9 Explain membrane theory of thin spherical shells and hence derive expressions for the membrane forces in the spherical shells. 13

Q.10 State and explain stepwise procedure adopted in finite element method of structural analysis. Explain what do you understand by one dimensional and two dimensional elements stating that in analysis of which type of structures these elements can be used? 13