Fayoum University
Faculty of Engineering
Department of Civil Engineering

Final Exam (3rd Year Civil Eng.)
Structural Analysis & Mechanics III

Date: Tuesday 12 January 2016
Total Grade: 70 Points (70P)

Time: 09:30am – 12:30pm
Instructor: Professor: Mohamed EL-Assaly
Dr. Ahmed M. EL-Kholy, Lecturer

Notes: 1. *Two Aids: Appendices C & D (Ghali Book, Pages 778-783) & Appendix 11.2 (EL-Behairy Book, Pages 42-45).* The aids must be completely clean from any added data.
2. Answer must be neat, specific, and in order. Highlight the main steps and results.
3. Ruler and reasonable scales must be used for drawings and diagrams.
4. Start each question in a new page. Answer each question Q in one ~ two pages *if possible*.

7P	Q.1.	For the shown frame in **Fig. 1**, prove that the distribution factor ***K*** at **a**, for member **ab**, is equal to $S_{ab}/(S_{ab}+S_{ac}+S_{ad})$ where S_{ij} is the rotational stiffness of member ***ij*** at ***i***.
14P	Q.2.	Use the Moment Distribution Method to find and draw the final B.M.D for the beam shown in **Fig. 2** under the illustrated loads. Four cycles are enough to achieve accurate results.
15P	Q.3.	The girder **ab** has a non-prismatic section as shown in **Fig. 3**. Use the Column Analogy Method to find the fixed-end-moments (M_a & M_b) due to applied uniform distributed load W=3 t/m. Compare your result with that of prismatic member; $WL^2/12$. Also, find the stiffness at **b** and carry-over-factor from **b** to **a**.
8P	Q.4.	Considering the symmetry of the frame shown in **Fig. 4**, draw the B.M.D. using the Moment Distribution Method. Use the output of **Q3** to estimate the fixed-end-moments, stiffness and carry-over-factor for the non-prismatic girder of the frame given in **Fig.4**. Note that the moment of inertia value of the frame girder is double that of **Q3** girder. **Hint**: In addition to the advantage of symmetry, the moments transferred to columns may be estimated by joint balance. Two cycles will be enough to get final moments.
11P	Q.5.	The steel frame shown in **Fig. 5** has variable moment of inertia I and is subjected to clock-wise rotation of 0.1 rad. at support **e.** Use the Column Analogy Method to construct B.M.D. for the frame due to the induced rotation. **Hint**: Remember to substitute EI value in the final moment equation ($M_f=M_o+M_i=M_o+\ldots+\ldots x+\ldots y$) to get correct values and correct B.M.D.
15P	Q.6.	The frame shown in **Fig. 6** has variable moment of inertia I. Use the Slope Deflection Method to find and draw the B.M.D. of the frame shown in **Fig. 6** due to concentrated horizontal 3t load at **b**.

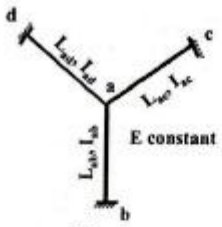

Fig. 1

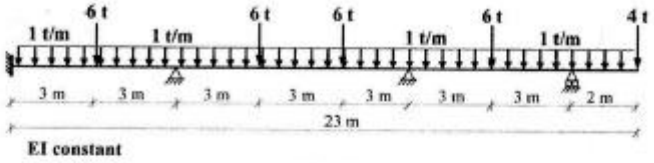

Fig. 2

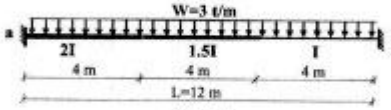

Fig. 3

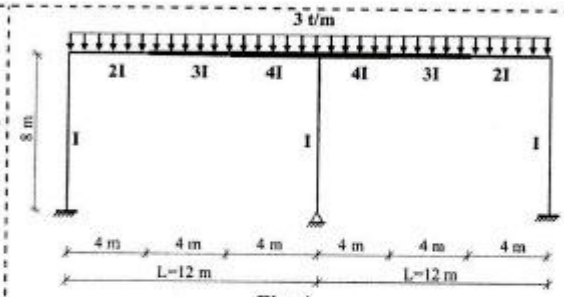

Fig. 4

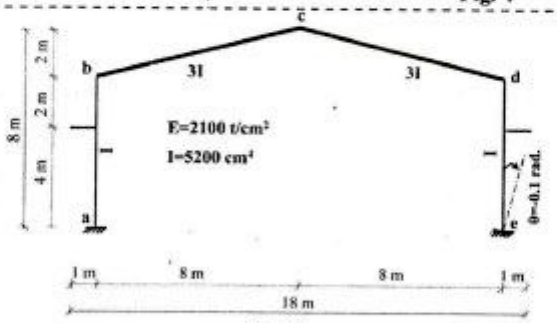

Fig. 5

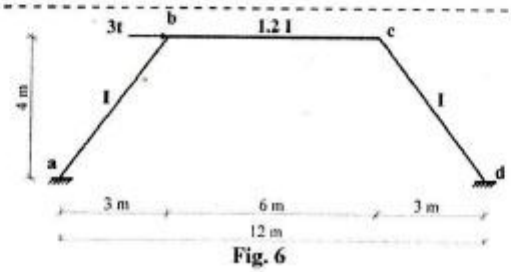

Fig. 6