Fayoum University
Faculty of Engineering
Department of Civil Engineering

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

Date: Tuesday 17 January 2017
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*.

10P	Q.1.	Derive the elastic center equations used to calculate the redundant forces X_1, X_2 and X_3 at the elastic center of frame with axis of symmetry and third degree of statical indeterminacy.
20P	Q.2.	Use the Moment Distribution Method and the advantage of symmetry to draw the B.M.D for the frame shown in **Fig. 1** under the illustrated loads. Four cycles are enough to achieve accurate results. The girders have double inertia of that of columns.
15P	Q.3.	**Figure 2** shows the new design of girder **ab** (a member of frame shown in Fig. 1). The new girder **ab** has non-prismatic section as shown in b **Fig. 2**. Use the Column Analogy Method to find the fixed-end-moments (M_a & M_b) due to applied uniform distributed load W=4 t/m and concentrated load of 12 t at mid-span. Also, find the stiffness at **b** and carry-over-factor from **b** to **a**. Compare your results with that of prismatic member.
11P	Q.4.	The steel frame shown in **Fig. 3** 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+... +... x + ... y) to get correct B.M.D.
7P	Q.5.	Without calculations, show ***clearly and briefly (in one page)*** the main steps (no-sway solution and sway corrections), forces F_{ij}, sway factors K_j and the equations required to find the B.M.D. of the frame shown in **Fig. 3** using the Moment Distribution Method.
15P	Q.6.	Use the slope deflection equations to find the rotations at the four points a, b, c and d, and to draw the B.M.D. for the beam shown in **Fig. 4** due to the illustrated loads. Use the resulted rotation values to give schematic drawing for the deformed shape of the beam.