ARCH 631. Assignment #7

Date: 10/9/12, *due 11/1/12* *Worth 25 pts.*

Problems:

1. Complete text problem 11.1 on page 459:

11.1 A spherical balloon has a radius of 12 in. and a thickness of 0.05 in. The balloon is blown up with an internal pressure of 100 lb/in.^{2} What are the membrane stresses developed in the surface of the skin of the balloon?

Answer: T = 600 lb/in, f = 12,000 lb/in^2

2. Complete text problem 12.7 on page 483. *Note: Include the concrete dead load when the density of concrete is 150 lb/ft^3. Also, the answer should be T = 1,007,283 lb.*

12.6 A rigid reinforced concrete shell having a spherical radius of 200 ft is cut off at an angle of $\phi = 35°$. The shell thickness is 3 in. Assume that the unit weight of the shell material is 150 lb/ft^3 and that the shell carries a live load of 60 lb/ft^2. Draw force-distribution diagrams of the type illustrated in Figure 12.7. Indicate numerical values.

12.7 Assume that a tension ring is used in conjunction with the shell described in Question 12.6. What is the magnitude of the force developed in the ring?

Answer: T = ~~1,660,063~~ lb.

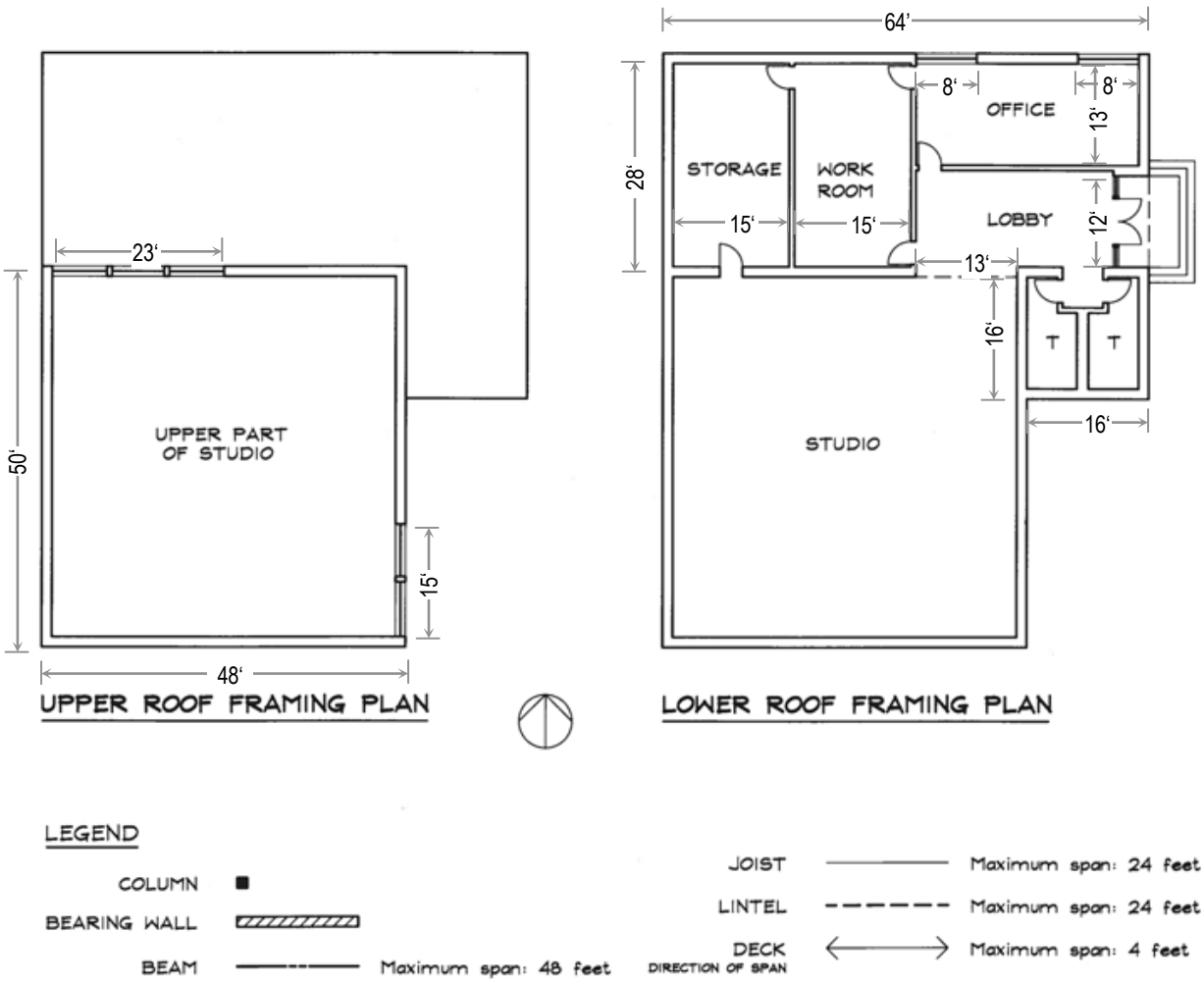
3. For the reinforced concrete shell of Problem 2, determine the meridional and hoop forces at the base of the shell.

Answer: N_ϕ = 10,720 lb/ft, N_θ = 5254 lb/ft

4. Develop an upper-level and lower-level roof framing system over the floor plan of the small Art Studio shown. Your design should be structurally sound, efficient, and accommodate all programmed conditions and requirements. Show the layout of columns and/or load-bearing walls, the placement of beams and lintels, and the location of all roof joists. Indicate the span direction of decking with an arrow.

PROGRAM REQUIREMENTS

- The soils and foundation system are adequate for all loads, including seismic and wind.
- Use structural steel sections for columns, beams, and open-web joists.
- All portions of the roof framing are flat and do not extend beyond the limits of the walls or roof lines shown.
- The Studio roof height is 14 feet; all other areas have a roof height of 9 feet.
- The structure must accommodate the continuous high windows shown along the north and east walls of the upper Studio.
- Columns may be located within walls, but not within windows.
- Any wall shown on the floor plans may be designated as a bearing wall.
- Lintels are required at all openings in bearing walls.
- The Studio must remain column-free.
- Show only lower roof framing on lower level plan and only upper roof framing on upper level plan.



5. Determined the maximum moments (positive and negative) for a beam of 65 ft with a distributed load of 70 lb/ft for *a*) the optimal support location with one overhang and *b*) the optimal support location with two overhangs (*see section 6.4.1*).

Answer: *a)* $M_1 = M_2 = 12{,}717$ lb-ft, *b)* $M_1 = M_2 = 6{,}211$ lb-ft

6. The gulf coast of the United States (along Texas, Louisiana & through to Florida) can experience strong wind gusts from large wind speeds, sometimes due to hurricanes. Identify two other regions of the United States with basic wind speeds (3-second gust) of 130 miles per hour at 33 ft above ground for Exposure C category that are not in special wind regions.

7. Describe vortex-shedding and the problems it causes tall structures.

8. In 1974 the Texas panhandle (western portion) experienced a 4.5 magnitude earthquake which caused cracking in plaster (intensity V). What does the magnitude and intensity tell you about the energy and damage from the ground acceleration? How does the Texas earthquake compare to the 6.3 (strong) magnitude earthquake in Java, Indonesia in May of 2006 where more than 127,000 houses were destroyed and an additional 451,000 were damaged in the area, with the total loss estimated at approximately 3.1 billion U.S. dollars?

9. In the aftermath of national and international disasters, infrastructure management and hazardous response has been a major focus of research and funding. How does this concern relate to architectural considerations other than structural performance?