3-day Timber Frame Design and Joinery Decisions course

I. Timber Frame terminology
II. Overview of the design process
    A. Developing a program with a client
    B. Steps in designing a house
        1. List activities to take place in the house
        2. List site requirements
        3. Decide on construction materials and techniques to be used
        4. Analyze personal spaces and dimensions for each activity
        5. Determine budget
        6. Combine above to come up with schematic floor plan/design
        7. Apply structural grid
    C. 10 factors in timber frame design
        1. Floor plan
        2. Architectural style
        3. Raising method
        4. Structural engineering
        5. The wood
        6. Aesthetics
        7. Enclosure system
        8. Other systems (mechanicals, foundation, etc.)
        9. Joinery and cutting methods; tools
        10. Budget
    D. Construction drawings and dimensioning for timber framing
III. Designing the frame as a system
    A. Bracing
    B. Enclosures
IV. Wood Science
    A. Timber Grading
    B. Design values for strength, stiffness, shear, etc.
    C. Shrinkage
V. Sizing joists, beams, rafters

A. Different load conditions
B. Shear and Moment diagrams
C. Effects of beam notching

VI. Column design

VII. Joinery Design
A. Floor joists
B. Girt-to-post
C. Braces
D. Reactions at the plate (rafter thrust)
E. Scarf joints

VIII. Pegging design

Classroom lectures would be interspersed with exercises. These would include sizing the beams and joinery for a sample frame. Another exercise would be structural visual grading of timbers (we would need 3-4 sample timbers).

3-day Roof Geometry course.

Day 1:

I. Historical background and terminology
A. Various types of roofs where complex geometry occurs: hips, valleys, dormers, prows
B. Regular versus irregular plan and pitch
C. Typical dormer, hip and valley rafter components, parameters and terms.

II. Alternative methods of figuring complex roofs with advantages and disadvantages
A. Strings and bevel gauge and ladders
B. Scribing
C. Rafter square tables; only for regular roofs
D. Calculators, trig
E. Computer (SketchUp, CAD)
F. Hawkindale angle spreadsheet

III. The developed drawing method: where it comes from
A. Examples: France, Germany, Japan, early American pattern books
B. Mechanical drawing & stereotomy: the art of representing objects in section, elevation and plan in order to cut them out.

IV. Basics of roof triangles

A. Plan view
B. Rise and Run
C. Distilling everything down to right triangles

V. Regular roof plan and triangles developed
   A. Construct common rafter elevation to get plumb and level cuts
   B. Use similar triangle principles to get jack rafter length
   C. Construct hip rafter elevation to get plumb and level cuts
   D. Use above triangles to get roof surface triangle which in turn gives top cut angles
   E. Introduce “tangent” concept as hinge to develop *unbacked* hip rafter triangle; this is the same angle as the “Side Cut of Hip or Valley” table on rafter square

VI. The “kernel”: putting all these triangles together on a single drawing; how hip and valley kernels differ

VII. Backing angles: why use them and how to draw them

Day 2:

Construct 8:12 regular plan hip roof model
Construct 9:12 octagon hip roof with purlin

Day 3:

VIII. Irregular plan, irregular pitch roof triangles developed; step-by-step script provided
   A. Construct common rafter elevation to get plumb and level cuts
   B. Use similar triangle principles to get jack rafter length
   C. Construct hip rafter elevation to get plumb and level cuts
   D. Use above triangles to get roof surface triangle which in turn gives top cut angles
   E. Introduce “tangent” concept as hinge to develop *unbacked* hip rafter triangle; this is the same angle as the “Side Cut of Hip or Valley” table on rafter square

IX. Shifting the hip or valley centerline to keep the side heights equal; a simple graphical way to determine amount of the shift

X. How to determine the circular saw bevel on a compound cut; it can’t measured on the rafter surface until it is graphically projected