

## **ANNEX A SURVEY QUESTIONS**

### **Part I General Information**

My age is:

- a) <18 years
- b) 18-25 years
- c) 26-40 years
- d) 46-65 years
- e) >65 years

My gender is:

- a) Female
- b) Male

My participation in the project was as:

- a) Faculty
- b) Student

In case I am a student, my level of studies during the completion of the design process was:

- a) Second year student
- b) Third year student
- c) Fourth year student
- d) Fifth year student
- e) Graduate

If I am a faculty, my highest level of education is:

- a) Graduate
- b) Master
- c) Doctorate

My discipline is:

- a) Architecture
- b) Civil Engineering
- c) Mechanical Engineering
- d) Electrical Engineering

The number of real building design projects in which I had participated before participating in the present project:

- a) none

- b) 1-5 projects
- c) 6-20 projects
- d) 20-50 projects
- e) More than 50 projects

In how many processes of integrative or interdisciplinary design I had participated before participating in the present project:

- a) none
- b) 1-3 projects
- c) 4-6 projects
- d) 7-10 projects
- e) More than 10 projects

## **Part II Experience in the Project**

During the project I learned new knowledge about other disciplines

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree

As a result of my experience in the project, I now feel more able to interact with professionals from other disciplines

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree

The work environment in the project with the team members was always comfortable for me

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree

My opinion is that each professional must respect the limits of his discipline

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree

e) Strongly agree

If I study more about another discipline, I will be able to communicate better with the professionals of that discipline

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree

If I study more about another discipline I can make suggestions on how to solve the problems of that discipline to professionals in that discipline.

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree

Rate the ease of interaction with the following disciplines (1 means that the interaction is easier and 4 that is more difficult)

- a) Civil Engineering \_\_\_\_
- b) Electrical Engineering \_\_\_\_
- c) Mechanical Engineering \_\_\_\_
- d) Architecture \_\_\_\_

### **Part III Knowledge Questions in Area: Construction (CO)**

A) Fundamental Questions

1. What are the prerequisites to start a construction?

- a) Construction plans, construction permit, budget, works program
- b) Qualified personnel, property title, logbook
- c) Sources of financing, bonds of good compliance

2. Example of construction plans of a building are:

- a) Architectural plans, plans of installations: electrical, hydraulic, mechanical, structural plans, plans of special installations
- b) Workshop plans, topographic plans, location plans
- c) Plant distribution plan, schematic plans

3. What is the correct order of the following preliminary activities? \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_

- a) Collection of materials, preliminary works, tracing and leveling
- b) Preliminary works, tracing and leveling, collection of materials
- c) Tracing and leveling, collection of materials, preliminary works

4. What elements are part of the direct cost of a construction project?

- a) Equipment, personnel, material
- b) Equipment, financing, personnel
- c) Material, personnel, guarantee of good work

5. Which of the following units represents the stress in a structure equivalent to force on surface?

- a) kJ/mol, kN, psi, bar, kg
- b) Mpa, kg/cm<sup>2</sup>, ton/m<sup>2</sup>, kN/m<sup>2</sup>
- c) lb/m, W/K.m, kg/m

6. What types of load have a greater impact on a building and affect structural safety?

- a) Dynamic loads, static load, wind load
- b) Live loads, dead loads, seismic loads
- c) Temperature loads, accidental loads

7. What calculation parameters intervene in the structural safety of a building?

- a) Resistance, rigidity, deformation
- b) Compression, traction, cutting
- c) Shortening, failure, ductility

8. How can structural resistance be defined?

- a) Ability of the structure to resist deformation
- b) Ability of a structure to resist the passage of heat
- c) Capacity of a load bearing structure

9. How can structural rigidity be defined?

- a) Property of the structure to oppose deformation
- b) Ability of a structure to resist the passage of heat
- c) Capacity of a load bearing structure

B) Applications questions (for experimental group only)

10. Which of the following statements is true?

- a) The mixed system that uses skull type brick, is a system of reinforced masonry
- b) The concrete block system is a confined masonry system
- c) The wooden system can function as a loading wall system or as a frame

11. What factor depends on the strength of the wood?

- a) Growth rings
- b) Moisture, orientation of the fiber
- c) Fire treatment

12. In a field of low resistant performance, which is the most convenient system for foundations in the construction of a light building.

- a) Deep foundations
- b) Surface foundations
- c) Foundation slab

13. What does the architectural program contain?

- a) Spaces, areas, number of users, furniture, specifications in spaces, schedule of uses
- b) Owner's needs, regulations
- c) Climatic conditions in the components of the project

14. What is the ideal orientation of a building on its longest façade in the latitude of El Salvador (13.49°)?

- a) North-South
- b) Northeast-Southwest
- c) East-West

15. What is the ideal order of the following activities of the integrative design process?

- a) Base model for energy simulation, OPR, BOD, executive project
- b) Executive project, site study, optimized loading model
- c) Site study, OPR, BOD, architectural program, initial model, iterative simulation process, optimized loading model, executive project development

16. What input data does the architectural design require for the development of the executive project?

- a) Geometry in plan, height between each floor, definition of the type of use of the spaces
- b) The architectural program, topography, optimized design blueprint, simulation result
- c) The facade area, the roof area, floor load capacity

17. What input data does the structural calculation require to start the architectural design?

- a) The architectural program, virtual models of the building, topography
- b) The front area, the roof area, floor load capacity
- c) Plan geometry, height between each floor, definition of the type of use of the spaces

18. What input data does the structural calculation require in the building design project?

- a) The preliminary design, soil load capacity, physical characterization of materials
- b) The architectural program, virtual models of the building, topography
- c) The requirements of the owner, materials and soil laboratory results

19. What input data does hydraulic design and calculation require?

- a) The architectural program, virtual models of the building, topography
- b) Topography, supply and drainage points and data, preliminary design, architectural program
- c) façade area, floor load capacity, architectural program

20. What are the levels of exposure to moisture in wood?

- a) 5 levels, under cover without exposure, under cover with exposure, in the open without contact with the ground, in the open in contact with the ground, in contact with water
- b) 3 levels, in contact with water, in the open air without contact with the ground, under cover without exposure
- c) 1 level, in contact with water

#### **Part IV. Questions about Knowledge in Area: Electrical Systems (ES)**

A) Fundamental Questions

21. Of the following sentences about renewable energy sources and specifically about solar energy, which is false:

- a) Solar energy has a high impact on the environment
- b) This resource is inexhaustible
- c) An inverter is required to convert the DC power to AC power

22. When we talk about electrical energy, we are talking about the power that a device consumes or generates in a time interval. Then, the unit used for the measurement of energy is:

- a) kW/h
- b) kWh
- c) kW

23. When designing a residential or commercial electrical installation in El Salvador, which regulations are used to perform the calculations?

- a). SIGET Agreement 192-E-2004
- b) US Code NFPA
- c) NEC (US Electrical Code)

24. What do we call a connection in an electrical installation?

- a) To the connection point of the user with the utility company
- b) To the power circuit of the air conditioning system

c) To the outputs of sockets located in the bathrooms

25. The basic components that can be mentioned in an electrical installation are:

- a) Connection, electrical panels, outlets and luminaires
- b) Connection, current meter, electrical outlets
- c) Connection, secondary boards, power meter

26. When we talk about an electrical circuit we refer to:

- a) Set of cables and equipment linked to the same protection device
- b) It is the spark that is produced by joining the phase with the neutral
- c) We are referring to the electrical board

27. The material of the electrical conductors used in most residential electrical installations is:

- a) Copper
- b) Aluminum
- c) Aluminum reinforced with ACSR steel

28. When we need to install an electrical protection to a single-phase circuit of 120 V, the constructive characteristic of the thermo-magnetic to be used in the electrical panel must be of how many poles:

- a) One pole
- b) Two poles
- c) Three poles

29. If by chance in an electrical circuit we accidentally join or join the metallic ends of two conductors, the result we would obtain would be:

- a). Short circuit
- b) Overload
- c) Ground fault

30. When referring to single phase voltage for residential or commercial installations, we are talking about the measured value between phase and neutral and that value according to local regulations should be:

- a) 120 V
- b) 110 V
- c) 220 V

B) Applications questions (for experimental group only)

31. To obtain the largest generation of the NZEB solar system, the building should be oriented as follows:

- a) Horizontal panels and the building oriented East-West
- b) Horizontal panels and the building oriented North-South
- c) We recommend the inclination of the panels according to the latitude of the site and the building oriented North-South

32. A method to guarantee the lowest consumption of electrical energy in the luminaires and thus be able to achieve the objective of the NZEB is:

- a) Install the least amount of LED luminaires
- b) Install LED luminaires and their control should be a simple switch
- c) Install LED luminaires and luxmeter sensors to ensure that the combination of natural lighting plus artificial lighting is what is established by the general law of risk prevention in workplaces

33. For our project, electrical, data (internet) and voice (telephony) systems must be installed. So to ensure the proper functioning of these systems, the pulling of the cables in the pipes must be done:

- a) All in the same channel
- b) The systems must be separated, but the electrical channel must go above the data/voice channel
- c) The systems must be separated, but the channeling can go above the data/voice channeling

34. Our project requires the use of batteries to store electrical energy and the best place to locate them should be:

- a) The outside because they generate a lot of noise
- b) The outside because gases emanate that are harmful to human health and need ventilation
- c) The outside, because of structural capacity

35. The structural framework of our project is 100% wood and using the NEC as a reference allows us to pull TNM-type wire without channeling. So, if we needed to use channeling, what would we be winning?

- a) Provide mechanical protection to electrical conductors
- b) Confine any heat problem or sparks caused by insulation failure
- c) All of the above

36. MP Service made us the donation of LED type luminaires at 240 V. For the installation of the luminaire the quantity and the name of the wires (wires = electrical conductor) that should come out of the electrical board are:

- a) 3 threads; 2 phases and 1 neutral
- b) 3 threads; 1 phase, 1 neutral and 1 ground
- c) 3 threads; 2 phases and 1 ground

37. The structural framework of our project is 100% wood, then the third conductor that carry the circuits (green color) or rather the grounding conductor serves when there is a fault in the equipment, will its installation be necessary?

- a) False
- b) True

38. A risk is an environmental or human condition whose presence or modification can produce an accident or an occupational disease. Then, in the bathroom and outside of the NZEB, the electrical outlets to be installed must have the following characteristic:

- a) Electrical outlet with ground fault protection = GFCI
- b) Electrical socket with arc fault protection = AFCI
- c) Electrical outlet with short circuit protection

39. The following requirements: dry place, easy access and away from other facilities such as water and telephone/data should be taken into account for the installation of \_\_\_\_\_ in the NZEB:

- a) Electric board
- b) Electrical outlets
- c) Luminaires

40. In the NZEB there will be a control room that is where the electrical panels, measuring equipment, dataloggers, etc. will be. So, the need to have a control room is due to the following needs:

- a) Have connection/disconnection means for each circuit
- b) Have means of protection for each circuit
- c) Locate the elements mentioned above in one place.

#### **Part V. Questions about Knowledge in Area: Energy (E)**

##### **A) Fundamental Questions**

41. Which heat transfer mechanism is most important for a roof covering in the tropics?

- a) Conduction
- b) Radiation
- c) Convection

42. Examples of heat sources for a building are:

- a) People, lighting, ventilation
- b) Solar radiation, equipment, air conditioning
- c) People, Solar radiation, Luminaires

43. What air conditioning equipment is generally more efficient?

- a) Window
- b) Package
- c) Split

44. Which of the following is not a thermal load unit?

- a) Btu
- b) Tons of refrigeration
- c) Watts

45. Which method is more effective to protect a window from solar radiation?

- a) Curtains
- b) Overhangs and fins
- c) Low emissivity windows

46. What is the element of the refrigeration cycle that can be inside the building to cool the space?

- a) Compressor
- b) Condenser
- c) Evaporator

47. In general, energy efficiency can be defined as:

- a) (desired entry)/(required exit)
- b)  $100\% - (\text{inefficiencies } (\%))$
- c) (Energy production)/(Energy input)

48. The following is what we know as thermal mass:

- a) Mass (kg)
- b) Mass (kg)  $\times$  Specific heat (kJ/kgK)
- c) Mass (kg)  $\times$  Specific heat (kJ/kgK)  $\times$  Density (kg/m<sup>3</sup>)

49. The following photovoltaic solar systems are used in isolated areas of the electricity grid:

- a) Connected to the grid
- b) Self-consumption
- c) Island type

50. Thermal insulation in roofs reduces the following heat transfer mode:

- a) Conduction
- b) Convection
- c) Radiation

B) Applications questions (for experimental group only)

51. The balance of net zero energy is reached when comparing:

- a) The energy generated annually and the energy consumed annually
- b) The annual energy bill must be equal to zero

c) The energy purchased from the network and the energy sold to the network

52. The balance of net zero energy proposed in the project:

- a) It excludes the energy of the vehicle since it is powered by a battery
- b) Includes the energy of the vehicle
- c) Assumes that the vehicle is loaded exclusively by day

53. A Vestibule has the following function:

- a) Minimize the infiltration of outside air
- b) Provide greater structural safety to the building
- c) Allow the location of air injectors

54. Fan-coil units are used in the project for this reason:

- a) Provide greater efficiency
- b) Distribute the air conditioning better in the Showroom because of the double height
- c) Meet LEED requirements in noise reduction

55. The following simulation was not carried out in the project:

- a) Thermal comfort simulation
- b) Energy simulation
- c) Noise simulation

56. The designed project does not include the following energy efficiency technology:

- a) Insulated glass
- b) CO<sub>2</sub> sensors
- c) VOC sensors

57. The following is false about Inverter air conditioning technology:

- a) It produces less noise than other conventional technologies
- b) It has greater EER than other technologies
- c) Regulates the volume of air circulated in space

58. The following is an essential entry for an energy simulation:

- a) Installation voltage
- b) Wind speed in the locality
- c) Holidays

59. In energy simulations, the percentage of error expected to be obtained with respect to the actual measurements is less than or equal to:

- a) 10%

b) 7%

c) 5%

60. Which of the following factors affects less the annual energy balance of our designed project?

a) Orientation of the solar system

b) Consumption of miscellaneous equipment

c) Efficiency of the air conditioning system

**Part VI Open Questions:**

Which experiences did you like the most about participating in the project?

What experiences did you like least about participating in the project?

What suggestions would you make to improve the design process?

What is the limit of what a professional from another discipline can do in my discipline?

END OF THE INSTRUMENT

WE APPRECIATE YOUR PARTICIPATION A LOT.