FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING – STAGE III

EEE395 ELECTRICAL INSTALLATION TECHNOLOGY A

FINAL EXAMINATION – PENSTER 1, 2015

INSTRUCTIONS TO STUDENTS

1. *You are allowed 10 minutes Extra reading time during which you are NOT to write*
2. *Two hours only is the time allocated for candidates to do this examination paper*
3. *Begin each answer on a fresh page and use both sides of the sheet.*
4. *Write your candidate-number at the top of each attached sheet.*
5. *Insert all written foolscaps, graph paper, drawing, etc. in their correct sequence and secure with string.*
6. *For all sheets of paper on which rough/draft work has been done, cross it through and you MUST ATTACH to your answer scripts.*
7. *Write clearly the number(s) of the question(s) attempted on top of each sheet.*
8. *ANSWER All QUESTIONS.*
9. *Show all workings where necessary.*
10. *Do not use programmable calculators, especially the ones that do the conversion of number systems.*
11. *AS/NZ 3000: 2007 STANDARD WIRING RULE BOOK IS ALLOWED*
12. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM.***

SECTION A (30 MARKS) MULTIPLE CHOICE QUESTIONS

Question 1. (2 marks)

Who made the most contribution to the electrical industry?

1. (A) Nikola Tesla
2. (B) Mikhail Dolivo-Dobrovolsky
3. (C) George Westinghouse
4. (D) All of the above people

Question 2. (2 marks)

Briefly explain what is "Hot rock" technology?

1. (A) Conventional power stations need boilers to produce steam to drive generators.
2. (B) The use of steam produced from water heated naturally underground.
3. (C) It is a geothermal energy that exists in hot rocks producing steam five kilometers below the earth surface in Rotorua, NZ, is being retrieved to drive generators.
4 (D) It is a geothermal energy being developed in South Australia where the high thermal energy that exists in rock some three kilometers below the earth's surface is being retrieved to produce steam to drive generators.

Question 3. (2 marks)

Describe how CETO wave power works.

1. (A) Not environmentally friendly, it will gradually pollute the sea. Its energy is limited to 75 kVA as maximum power output.
2. (B) CETO converter units act as buoys and moored to the seabed and converts wave energy to electric energy.
3. (C) CETO converter unit's acts as hydraulic high-pressure pumps that convert the kinetic energy in high-pressure seawater thus turning the blades of a turbine attached to the generator onshore. CETO converters are moored to the seabed at the depths of 15 to 50 meters.
4. (D) CETO wave power converters produces electricity that are collectively connected to the CETO output onshore.

SECTION A (Cont...)

Question 4. (6 marks)

List the configurations of low voltage supply to consumers.

1. (A) 240Va.c. two wire
2. (B) 240Va.c. three wire
3. (C) 415V a.c. three wire
4. (D) 240/415Va.c. three wire
5. (E) 240/415Va.c. four wire

Question 5. (2 marks)

What is the purpose of health and safety regulations in the workplace?

1. (A) Applying safe working practices
2. (B) Implementing our social values – no one goes to work to be injured or killed.
3. (C) Exploit codes of standard and regulations
4. (D) To maintain a safe work environment

Question 6.0 (2 marks)

What precaution should a rescuer takes first?

1. (A) Observe the victim who is shock
2. (B) Rush in quickly and pull the victim out
3. (C) Rescuers should not put themselves at any risk
4. (D) Call the ambulance

Question 7. (2 marks)

List one of the steps an employer should take to ensure a safe and healthy workplace.

1. (A) Identify hazards
2. (B) maintain a safe work environment
3. (C) undertake safety training
4. (D) do not expose others and yourself to health risk

SECTION A (Cont...)

Question 8.0 (4 marks)

State any two electrical safety alert.

1. (A) Do not work live
2. (B) Isolate only the protective device for the circuit you are working on.
3. (C) To identify isolation, it is vital to rely on switchboard markings
4. (D) If there is a possibility to draw cables into an enclosure you think it is safe, and then continue to draw the cables.
5. (E) Follow all isolation and lockout hazard control.

Question 9. (6 marks)

State three of the reasons for using an earth system.

1. (A) Shock hazard
2. (B) Electrically initiated fire
3. (C) Voltage stability
4. (D) Non-functional earth
5. (E) Touch current
6. (F) Accelerate the rise in touch voltage

Question 10. (2 marks)

Determine the type of circuit breaker that is suitable for protection against high fault current limiting of incoming supplies, large feeders and load switching?

1. (A) ELCB
2. (B) RCD
3. (C) MCCB
4. (D) ACB

SECTION B (40 MARKS) BRIEF ANSWERS & WRITE DOWN WIRING RULE CLAUSES.

Question 1. (3 marks)

Determine why a larger earth conductor is selected over that which is required by the Wiring Rules, Table 5.1

Question 2. (3 marks)

Select the minimum size of copper earth conductor for a three-phase circuit with 120 mm^2 copper active conductors.

Question 3. (3 marks)

Briefly explain why is it permitted to have an earth conductor smaller than the circuit active conductors when they both carry the same current when a fault occurs.

Question 4. (7 marks)

Describe the three rules for safety that must be observed when the outbuilding has it own main switchboard.

Question 5. (5 marks)

Briefly explain the function of the following insulation layers that are used for protection in class II equipment:

1. Basic insulation

2. Supplementary insulation

Question 6. (3 marks)

Identify and explain the risk of differences in potential that can arise from currents in the earth resulting from such events as faults in the supply network, lightning discharge and the like. How can equipotential bonding reduces the risk?

Question 7. (6 marks)

In an installation, the breakdown of insulation between neutral and conductive parts, or an open circuit or poor connection in the PEN conductor can result in the earth acting as the return path for the load current instead of the neutral, without an immediate indication of the fault. Therefore list three safety alert rules that an electrician should follow in order to maintain the earth connection to mass earth.

SECTION B (Cont....)

Question 8. (6 marks)

Earth system plays a major role in protection against electric shock, prevention of damage by electrically initiated fires and the functioning of some equipment. Briefly explain the three most common earth and protection scheme the International Electro-technical Commission (IEC) approves as listed below.

1. The TN-S earth system

2. The TN-C earth system

3. The TN-C-S earth system

Question 9. (4 marks)

Determine the two main causes of electrical fires?

SECTION C (30 MARKS) CALCULATIONS

Question 1. (20 marks)

Determine the maximum demand, the size and the type of the main cable supplying the house which is buried directly under ground 20 meters away from the supply pillar-box and determine the required depth of the cable. A single phase 230 V supply the installation that comprises of:

1. 23 lighting points
2. 2 × 15 A plug socket outlets
3. 6 single and 10 double outlets
4. 10 kW range
5. 4.8 kW controlled-load water heater
6. 4 × 300 W floodlights in swimming pool area

SECTION C (Cont....)

Question 2. (10 marks)

Protection against earth faults.

Impedances in the earth fault-loop are:

$Z_{AB\ (0.15\Omega)}$, $Z_{BC(0.19\ \Omega)}$, $Z_{CD(2.00\ \Omega)}$, $Z_{DE(0.19\ \Omega)}$, $Z_{EF(0.15\ \Omega)}$. Touch voltage across $Z_{DE\ (PE)}$.

A final sub-circuit is protected by a C-type circuit breaker. Determine:

1. Impedance of the fault path, the magnitude of the fault current and the touch voltage (6 marks)

2. Is there any possibility that the touch voltage would increase? Please explain. (2 marks)

3. The power supply to the appliance is supplied through a socket outlet what would be the prescribed time? (2 marks)

THE END