JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMIMATION FOR THE DEGREE IN SCIENCE IN CONSTRUCTION MANAGEMENT

3RD YEAR 1ST SEMESTER 2022/2023 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TCB 1307

COURSE TITLE: BUILDING SERVICES II Dec22

EXAM VENUE: **STREAM: BSc. CONSTRUCTION MGT**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (Compulsory) 30 marks

1. Explain the following reasons: **(8mks)**
(a) One would prefer to use a ring circuit over a radial circuit.
(b) An electrician uses detailed drawing instead of layout drawing during the construction of a building
(c) A power circuit is always rated higher than an electrical circuit
(d) An electrical engineer designs using an Auto CAD software instead of drawing by hand

2. Design a two-way lighting circuit and describe how it operates. **(4mks)**

3. Assume you are an electrical engineer working for building services company. Explain the tendering process from the initial stages up to when the tender is awarded to the "*least bidder*". Include all the processes involved. **(8mks)**

4. As an expert in building services, extract bill of materials (BoM) from the plan layout of Figure 1.

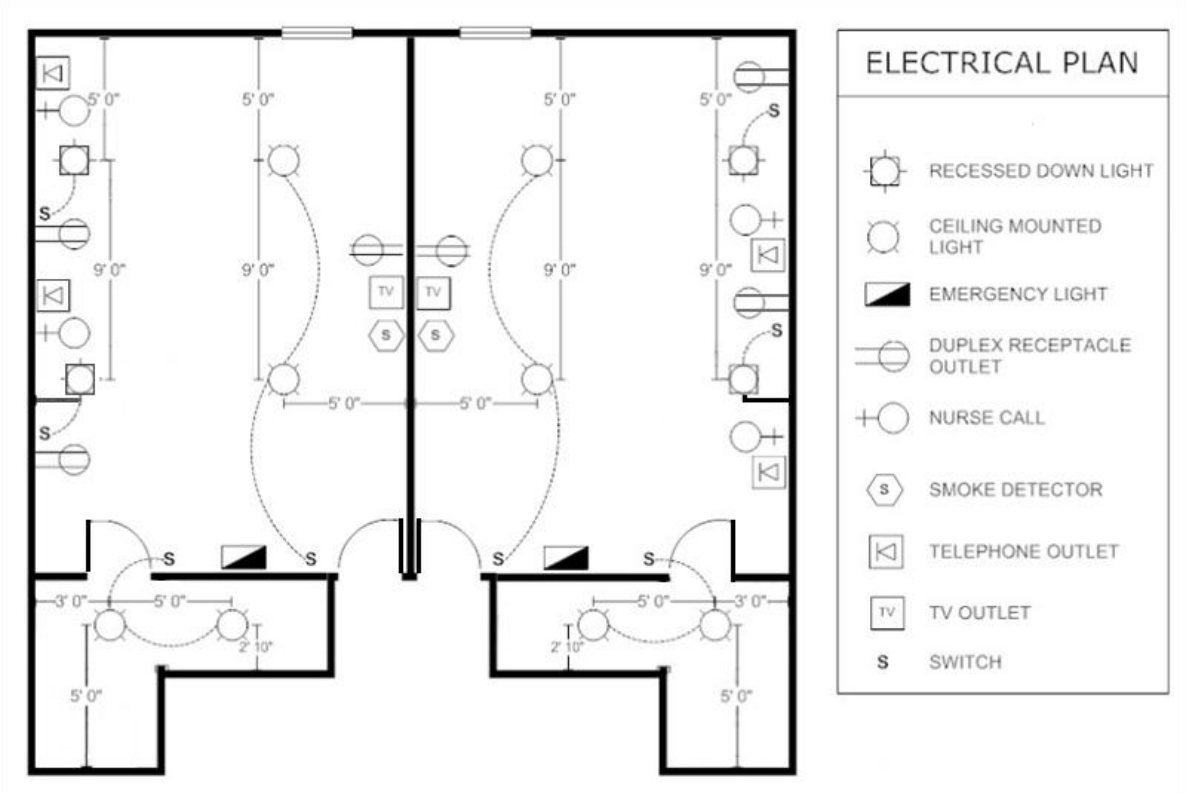

Figure 1: Floor Layout Plan

Prepare a Bill of Quantity (BoQ) from the plan. **(8mks)**

5. Licensed Electricians are required to carry out both **live and dead circuit tests** before commissioning of a project. Explain these two tests. **(2mks)**

QUESTION TWO 20 marks

(a) What is diversity factor for maximum load demand? **(1mk)**

(b) Discuss three methods of applying diversity for the design of an installation. **(3mks)**

(c) The common methods of obtaining the current demand of a circuit is to add together the current demand of all points of utilization and equipment in a circuit. State typical current demand for points of utilization and equipment of the following: (the first one has been done for you) **(3mks)**

	Equipment	**Current Demand**
example	2 amp socket outlets	0.5A assumed demand
i	Domestic Cooker	
ii	Discharge Lighting	
iii	Lighting circuit outlet	

(d) Consider a small guest house with 10 bedrooms, 3 bathrooms, lounge, dining room, kitchen and utility room with the following loads connected to a three-phase supply.

Lighting *3 circuits tungsten lighting – total 2,860 watts*
Power *3X30A ring circuits to 13A socket outlets*
Water heating *1X7 kW shower*
2X3 kW immersion heater thermostatically controlled
Cooking appliances *1X2 kW cooker*
1X10.7 kW cooker

Calculate the total current demand and load spread per phase allowing diversity. The following diversity factors apply: Lighting – 75%, Power – 50%, Water heater – 100%, Cooker – 80%. **(8mks)**

(e) For domestic installations where the load does not exceed 100 amperes, the use of a consumer's control unit is recommended. Consumer's control units are made to BS 1454. Study, interpret and discuss the Consumer's control unit of Figure 2 below. **(5mks)**

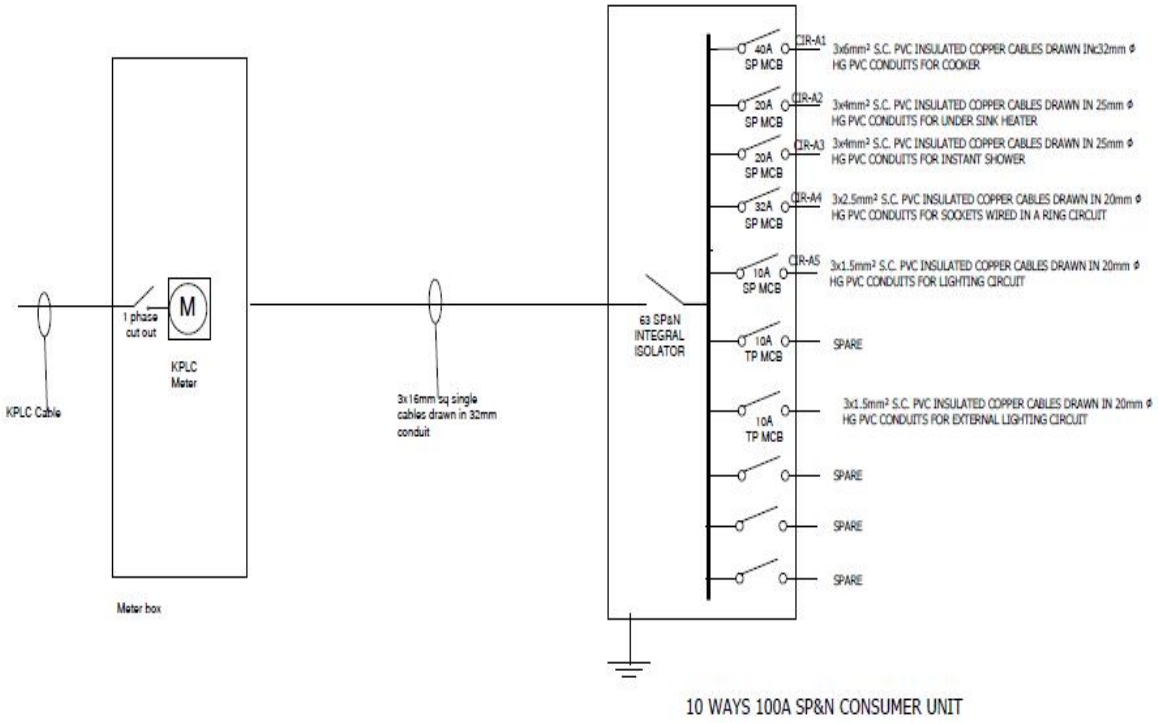

Figure 2

QUESTION THREE 20 marks

(a) Explain any four protection devices for power and lighting circuits. **(4mks)**

(b) By drawing a well label diagram of basic circuit of Residual Circuit Device connected to the load, explain how this device is used to give protection against fire risk and electric shock**.** **(4mks)**

(c) State the three procedures for determining size of cables for single circuits. **(3mks)**

(d) A 240V lighting circuit, consisting of 10X100 Watt tungsten lamps, is wired in PVC insulated single core cable with copper conductors. It is protected by a 5A BS 3036 fuse. The cable is run through an ambient temperature of 35^0C and is grouped with two other lighting circuits, e.g. two phase and two neutral conductors which are of the same size, equally loaded and which are installed in the same conduit system on a wall. Determine the minimum cable size for compliance with the Regulation 523-01. The length of the circuit run and voltage drop are neglected (take C_g=0.7, C_a=0.97 and 1.0mm^2 conductor = 13.5A current-carrying capacity as per the above standard and regulation at 35^0C). **(9mks)**

QUESTION FOUR 20 marks

i. Using well labeled diagrams, explain, in details, the following Earthing of Supplying Systems. **(12mks)**

(a) TT system
(b) TN-S System
(c) TNC-S System

ii. A 20A radial socket outlet circuit is protected by a BS 88 fuse. The circuit is wired using 2.5mm^2 single core PVC cables installed in a 16m length of PVC conduit. A separate protective conductor consisting of a 1.0mm^2 PVC cable is used. Assuming that no rating factors are applicable and that the value of Z_E is given as 0.5 ohms, determine whether the circuit complies with the IEE Regulations. The nominal voltage (U_0) may be taken as 230V.

According to IEE Regulations, I_b Design current of circuit = 20A; I_n Protective device BS 88 fuse = 20A; 2.5mm^2 cable = 24A, maximum Z_s = 1.85 ohms, Resistance/metre for conductors = 25.51 milliohms per metre. Use multiple factor of 1.38. **(8mks)**

QUESTION FIVE 20 marks

I. In details, explain how the following tests can be carried out (**include the name of instrument** to be used for testing and where applicable, use diagrams). **(18mks)**

i. Dead Circuit Tests
a) Continuity Test
b) Polarity Test
c) Earth Electrode Resistance Test
d) Earth Resistance Test
e) Insulation Resistance Test

ii. Live Circuit Tests
a) Functionality test
b) Loop impedance tests (for Ze and Zs)
c) Phase sequence test
d) Testing RCD

II. After carrying out all the tests, an inspection is done by the relevant body(s) before commissioning of a project. State two main reasons why an inspection is done. **(2mks)**