Tanta University

Renewable Energy Engineering Program

EPM518 FINAL EXAM

Faculty of Engineering

Course Title: Distributed Generation Units	**Total Marks:** 40 Marks	**Year:** 5th Level
Date: Thursday, 08 June 2023 (Second Semester)	**Allowed time:** 2 hours	**No. of pages:** (2)

Answer the following questions..... Assume any missing data..... Answers should be supported by sketches.

Question-1 — Mark: 10

a. **Explain** the definition Distributed Generation (DG) units and **classify** their types according to the technology and according to power factor.

b. With proper sketches and equations, **explain** how the DG units can be used to improve the voltage profile of distribution systems.

c. **Analyse** the protection blinding and false tripping issues in DG-integrated distribution systems.

d. **Discuss** the technical, economic, environmental, and social advantages of employing DG units

Question-2 — Mark: 15

a. Fig. 1 shows a simple distribution network. It consists of two radial feeders, each with 10 MW of capacity, that feed busbar B. A constant load of 10 MW is connected to B. The Forced outage rate (FOR) of the two feeders is given in the table below. Additionally, consider a 10 MW DG source with an availability factor of 71.5%. Calculate the expected number of hours in which the load experiences troubles for two cases mentioned below, then comment on the results.

(i) without DG integration

(ii) with DG integration

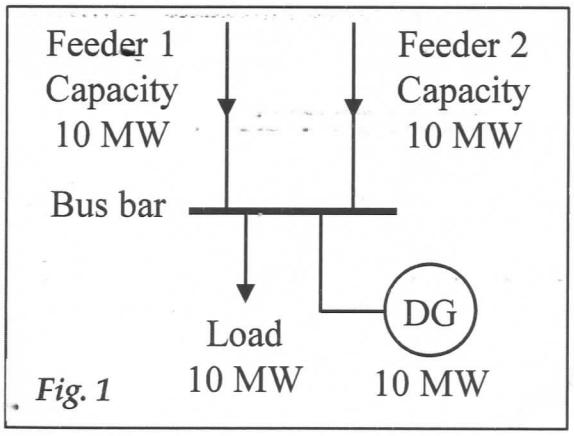


Fig. 1

Equipment	FOR (forced outage rate)
Feeder 1	0.04
Feeder 1	0.04

b. **Describe** the framework of optimal location and sizing of DG units in distribution systems.

c. **Classify** the different challenges that hinder the spread of integrating DG units and then **discuss in detail** the environmental challenges of DG units.

Please turn over

Question-3 **Mark: 15**

a. *Consider a distribution network in Fig. 1 consisting of a radial feeder that has two loads (D1 and D2 at points A and B, respectively) and a DG unit embedded at point C. The power demanded by the loads is supposed to be constant and equal to 200 kW. The power delivered by the DG is 400 kW. The distance between A and B is the same as the distance between B and C. The distance between T and A is twice the distance between A and B. The capacity of each of the sections is equal to 1000 kW. Impedances for sections AB and BC are 0.001 p.u. The impedance on TA is twice that of AB and BC. Assume that voltages are constant and that losses have a negligible effect on flows. Choose base power of 100kVA.*

(i) ***Calculate*** *the percentage of active power losses reduction due to DG integration.*

(ii) ***Discuss*** *the impact of DG if the loads D1 and D2 are increased to 700 kW each.*

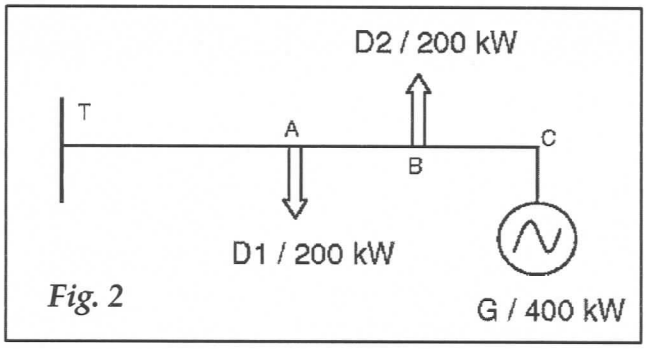


Fig. 2

b. ***Explain*** *the impact of climatic and orographical on the site selection process of solar and wind energy systems.*

c. ***Define*** *the microgrid (MG) energy system. With respect to MGs classification segments and using clear schematic diagrams,* ***compare in brief*** *between:*

1- *Autonomous and grid-connected modes of operation.*

2- *AC, DC, and hybrid AC/DC configurations.*

d. ***Discuss*** *the approach of optimal planning and assessment of hybrid solar/wind/diesel/battery microgrid for stand-alone applications.*

End of Questions

With our best wishes

Dr. Kotb Mohamed & Dr. Eman Gaber

Tanta University

Department: Electrical Power & Machines
Programme: Electrical Energy
Total Marks: (40) Marks

Faculty of Engineering

Course Title: Power Generation from Renewable Sources (II)
Date: 29.05.2023
Allowed time: (3) hrs.
Course Code: EPE483
No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… arrange your answer booklet)

Use graphs and examples whenever you have a chance during your answer

Question No. 1 : (10) Marks

a) Draw a block diagram of a fuel cell and explain how it can be employed in automotive applications.

b) Based on the hydrodynamic model of the point absorber wave energy converter, design maximum power point tracking system. HINT: The electrical and mechanical resonance principle should be illustrated in detail.

Question No. 2 : (10) Marks

A fuel cell battery is to be used in a satellite power supply. It must deliver a steady 2 kW at 24 V for 1 week. The mass of the cell must be the minimum possible. The fuel cell manufacturer has a design with the following characteristics:

- Open-circuit voltage: 1.10 V,
- Internal resistivity: $92\times10^{-6}\ \Omega.m^2$,
- Cell mass: 15 kg per m^2 of active electrode area.
- There is a linear relationship between V_L and I_L.

a) **How** many cells must be connected in series?

b) **What** is the total mass of all fuel cells in the battery?

Question No. 3 : (10) Marks

An industrial ship is travelling from China to Europe with a roof area of $62\times330\ m^2$. The driving motors are 1 MW and operate all day, the lighting loads are 150 kW, 8 hr per day and other loads are 350 kW which operates 10 hr per day. Knowing that the DC loads represents 25% of these loads.

a) **Design** a hybrid renewable energy system for supplying these loads, consists of PV, FC, battery storage system and Diesel generator. The battery storage system should be designed for feeding lighting and other loads.

b) **Draw** the block diagram for this system taking into consideration the following:

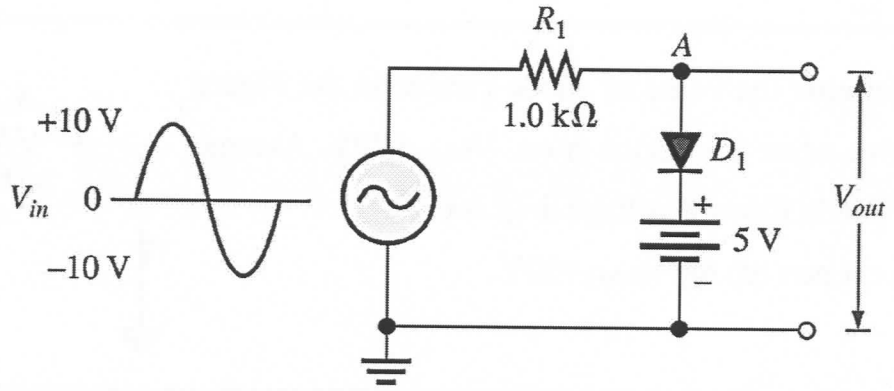
- The DC- bus voltage is 600 V and the AC- bus voltage is 380 V.
- Battery voltage is 48 V, 300 Ah.
- PV module needs are of 1.6 m^2 with 250 W, 151 V.

Tanta University	Electronics and Electrical Communications Engineering Dept.			Faculty of Engineering	
Course	Electronics	old	2022/2023	Total Marks	40
Date	27/5/2023		No. of Pages (2)	Time	3 hrs

Question Number (1) **(10 Points)**

a) Explain **with diagram** the main difference between **SCR and SCS**

b) Determine the output voltage wave form for the circuit shown below

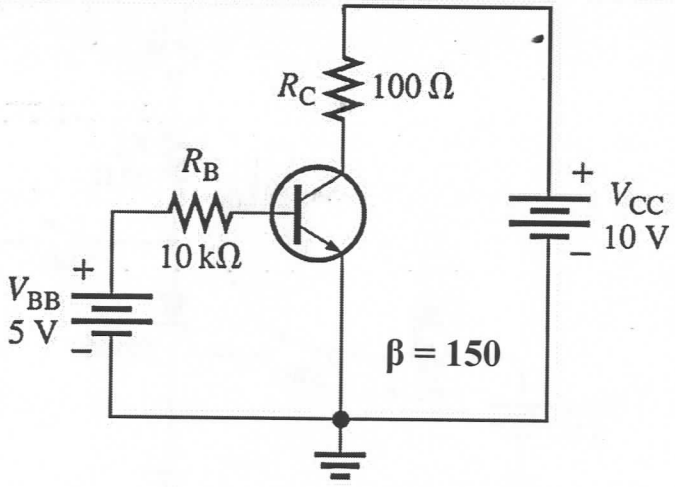


Question Number (2) **(10 Points)**

For the circuit shown in below, determine the following:

a) I_B,Ic,I_E,V_{BE} and V_{CE} **assume β = 150**

b) Determine whether or not the transistor is in saturation assume VCEsat =0.2V



Question Number (3) **(10 Points)**

(a) Draw the internal structure of the MOSFET transistor and **explain the channel formation process.**

(b) Determine the drain current (I_D) for an N- MOSFET , assume :
VGS = 0.9V , VD = 1.4 V, μnCox = 100 μA/V2, W/L = 50, and V_{TH} = 0.6 V.

(c) Repeat for VGS = 0.4V **and comment.**

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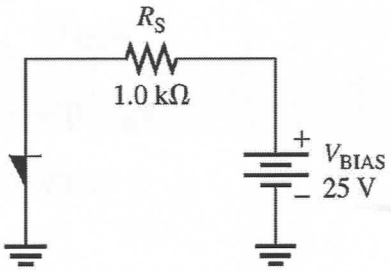
(d) Determine the value of anode current in the Figure shown when the device is on. $V_{BR(F)}$ =20V. Assume the Diode forward voltage drop is 0.9 V.

(e) Repeat part (d) for $V_{BR(F)}$ =30V.



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Question Number (4) **(10 Points)**

(a) Explain **with a diagram** how an **SCS** can be turned **on** and **off**.

(b) Sketch **only** the symbol and the transistor equivalent model of the **triac**.

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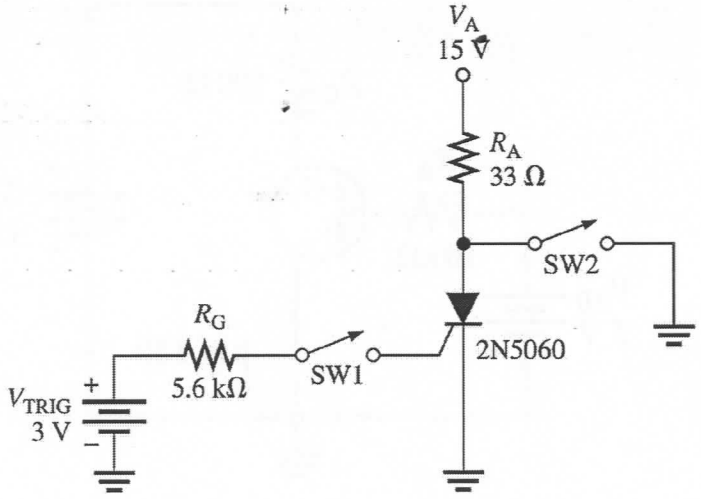
(c) Determine the **gate trigger current** and the anode current when the switch, SW1, is momentarily closed. Assume **V_{AK} =0.9 V and V_{GK} =0.7 V and I_H = 5mA**



With my best wishes *Dr / Nessim Mahmoud*