Tanta University	Department of Electrical Power and Machines Engineering	Faculty of Engineering

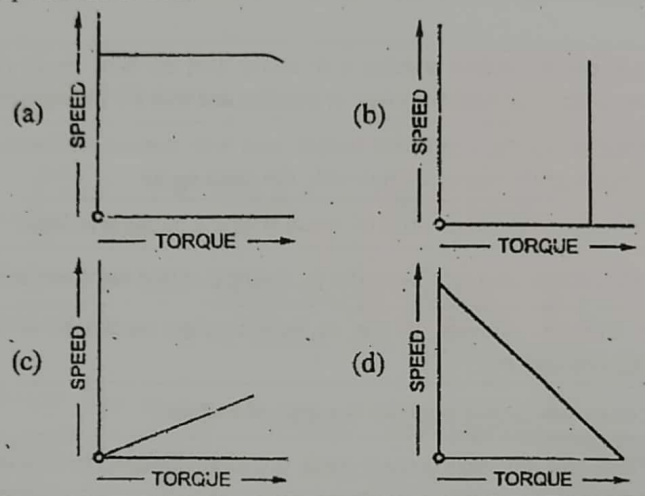
Final Exam – Second Term 2021/2022		
2nd Year: Electrical Power and Machines Engineering	**Time: 3 hours**	**Marks: 120**
Date: Sunday: June 12, 2022	**Course: Electric Machines (1)**	**Code: EPM2208**

The exam in FOUR pages

Question one [30 Marks]

[a] Choose the correct answer for the following statements. **It is sufficient to write down the question number followed by your choice** in your answer sheet: *[15 Marks]*

1.	The armature resistance in case of lap wound armature having Z conductors each conductor of length l meters, cross-sectional area A, m^2, resistivity ρ, and P-poles will be			
	(a)	$\rho \frac{l}{A} \frac{Z}{P^2}$	(b)	$\rho \frac{l}{A} Z$
	(c)	$\rho \frac{l}{A} Z P$	(d)	$\rho \frac{l}{A} Z P^2$
2.	The commutator pitch for simplex lap winding is			
	(a)	+1	(b)	-1
	(c)	+1 or -1	(d)	average pitch
3.	The emf induced in a conductor of machine driven at 600 rpm, the peak value of flux density is 1.0 Wb/m^2, diameter of machine 2.0 m and length of machine 0.30 m is			
	(a)	41.83 V	(b)	29.58 V
	(c)	9.42 V	(d)	18.84 V
4.	A 4-pole dynamo with wave wound armature has 51 slots containing 20 conductors in each slot. The induced emf is 357 V and the speed is 8500 rpm. The flux per pole will be			
	(a)	3.5 mWb	(b)	1.2 mWb
	(c)	14 mWb	(d)	21 mWb
5.	The commutating flux produced by interpole must be proportional to			
	(a)	armature current	(b)	field current
	(c)	both armature and field currents	(d)	none of the above
6.	If the load current and flux of a dc motor are held constant and voltage applied across its armature is increased by 5%, the speed of the motor will			
	(a)	increase by 5%	(b)	reduce by 5%
	(c)	remain unchanged	(d)	depends on other factors
7.	A series motor is working drawing a load current of 1A from the lines. If now the load is reduced such that the current drawn is reduced by 50%, the speed of the machine (neglecting the saturation and armature resistance) would be			
	(a)	unchanged	(b)	reduced by 50%
	(c)	reduced by 100%	(d)	increased by 100%
8.	A dc shunt motor having unsaturated magnetic circuit runs at 1000 rpm with rated voltage. If the applied voltage is half of the rated voltage, the motor will run at			
	(a)	2000 rpm	(b)	1000 rpm
	(c)	750 rpm	(d)	500 rpm
9.	What happens to the speed when the flux is reduced by 10% in a 200 V dc shunt motor having an armature resistance of 0.2 Ω carrying a current of 50 A and running at 960 rpm prior to weakening of field. The total torque may be assumed constant. Neglect losses.			
	(a)	1250 rpm	(b)	1060 rpm
	(c)	920 rpm	(d)	576 rpm
10.	A 240 V dc series motor takes 40 A when giving its rated output at 1500 rpm. Its resistance is 0.3 Ω. The			

	value of resistance which must be added to obtain rated torque at 1000 rpm is (a) 6 Ω (b) 5.7 Ω (c) 2.2 Ω (d) 1.9 Ω
11.	If the armature of a dc motor is supplied from a constant current source, and its field from a constant voltage source, then the torque-speed characteristic of the motor will be 
12.	In a differentially compounded dc motor, if the shunt field gets suddenly opened, the motor will (a) first stop and then run in opposite direction as a series motor (b) run as a series motor, but at slower speed in the same direction (c) run a series motor in the same direction at high speed (d) not work
13.	When the direction of power flow in a differentially compounded motor reverses, it will operate as a (a) cumulatively compounded generator (b) differentially compounded generator (c) series motor (d) shunt motor
14.	A dc shunt motor is driving a mechanical load at rated voltage with normal excitation. If the load torque is increased to double of the normal one, the speed of the motor will (a) become half (b) become double (c) increase slightly (d) decrease slightly
15.	If the back emf in a dc motor disappears suddenly, the motor will (a) stop (b) burn (c) run at very high speed (d) run at very low speed

[b] State true (√) or false (×) and correct the false statements. **It is sufficient to write down the question number followed by your choice** in your answer sheet: ***[15 Marks]***

1.	The speed of a dc motor will decrease to an extremely low value when the field winding gets disconnected while in normal operation.
2.	When a cumulatively compounded long shunt dc motor runs as a generator, it will operate as a differentially compounded generator.
3.	Series dc motor has a better speed regulation than the cumulative compound motor.
4.	If the external resistance, used for starting the dc motor, is left in the armature circuit, it would cause the operating speed of the motor to be increased.

5.	No-load losses in a dc machine consist only of the friction losses.
6.	The starting torque of a dc series motor is more than that of a dc shunt of the same rating.
7.	While controlling the speed of a dc shunt motor, the applied voltage should be varied to achieve a constant torque drive.
8.	It is necessary to ensure, before starting a dc motor, that the field circuit is closed, and starting resistance is at minimum value to develop higher torque at starting and restrict armature current to a safer value.
9.	A dc shunt motor is driving a constant torque load with normal excitation. If the field current is halved, then the motor will run slightly higher than double the rated speed.
10.	Negative speed regulation means drop of speed with the increase in load.
11.	Torque-armature current characteristic of a dc motor is called the mechanical characteristic.
12.	If a dc series motor is allowed to run at light loading condition, its speed will become lower than the compounded type dc motor.
13.	The emf induced in a dc motor opposes the applied voltage.
14.	The generated emf and armature current are in the same direction in case of dc motors.
15.	In a dc motor, energy conversion would not have been possible but for production of back emf in the armature.

Question Two [30 Marks]

a) A dc shunt motor is mechanically connected to a constant-torque load. When the armature is connected to a 120 V dc supply, it draws an armature current of value 10 A and runs at 1800 rpm. The armature resistance is $R_a = 0.1\ \Omega$. Suddenly, the filed circuit is opened and the flux drops to the residual flux, which is only 5% of the original flux. ***[15 Marks]***

(i) **Determine** the value of the armature current immediately after the field circuit is opened (i.e., before any speed change happens while the motor is still runs at 1800 rpm).

(ii) **Determine** the final change of the speed at which the motor will run after the field circuit is opened.

b) A dc series motor draws 5 amperes at starting and develops 5 N.m torque when connected to a 5 V dc supply. The series motor is mechanically coupled to a load. It draws 10 amperes when connected to a 120 V dc supply and drives the load at 300 rpm. Assume magnetic linearity. ***[15 Marks]***

(i) **Determine** the torque developed by the motor.

(ii) **Determine** the value of the external resistance required to be connected in series with the motor.

Question Three [30 Marks]

a) **Explain,** with all necessary equations and figures, the voltage buildup in a shunt DC generator. **What** if a shunt generator is started and no voltage builds up? **What** could be wrong? **[15 Marks]**

b) A separately excited DC generator is rated at 172 kW, 430 V, 400 A, and 1800 r/min. The magnetization curve is shown in Figure 1. This machine has the following characteristics: $R_A = 0.05\ \Omega, R_F = 20\ \Omega, R_{adj} = 0\ to\ 300\ \Omega, V_F = 430\ V, N_F = 1000$ turns per pole. **[15 Marks]**

(i) If the variable resistor R_{adj} in this generator's field circuit is adjusted to 63 Ω and the generator's prime mover is driving it at 1600 r/min, **what** is this generator's no-load terminal voltage?

(ii) **What** would its voltage be if a 360-A load were connected to its terminals? Assume that the generator has compensating windings.

(iii) **What** would its voltage be if a 360-A load were connected to its terminals, but the generator does not have compensating windings? Assume that its armature reaction at this load is 450 A • turns.

(iv) **What** adjustment could be made to the generator to restore its terminal voltage to the value found in part (i)?

(v) **How much** field current would be needed to restore the terminal voltage to its no-load value? (Assume that the machine has compensating windings.) **What** is the required value for the resistor R_{adj} to accomplish this?

Question Four [30 Marks]

a) **Explain**, with all necessary equations and figures, **how** a diverter resistor makes it possible to realize all the voltage characteristics of cumulatively compounded DC generator? **[15 Marks]**

b) The magnetization curve for a shunt DC generator is shown in Figure 2. This curve was taken at a speed of 1800 r/min. The generator is rated at 6 kW, 120 V, 50 A, and 1800 r/min. Its field circuit is rated at 5A. The data of the machine: $R_A = 0.18\ \Omega, R_F = 20\ \Omega, R_{adj} = 0\ to\ 40\ \Omega, N_F = 1000$ turns/pole. The shunt field resistor R_{adj} is adjusted to 10 Ω, and the generator's speed is 1800 r/min. **Plot the curve then**: **[15 Marks]**

i. **What** is the no-load terminal voltage of the generator?

ii. Assuming no armature reaction, **what** is the terminal voltage of the generator with an armature current of 20 A? 40 A?

iii. Assuming an armature reaction equal to 300 A•turns at full load, **what** is the terminal voltage of the generator with an armature current of 20 A? 40 A?

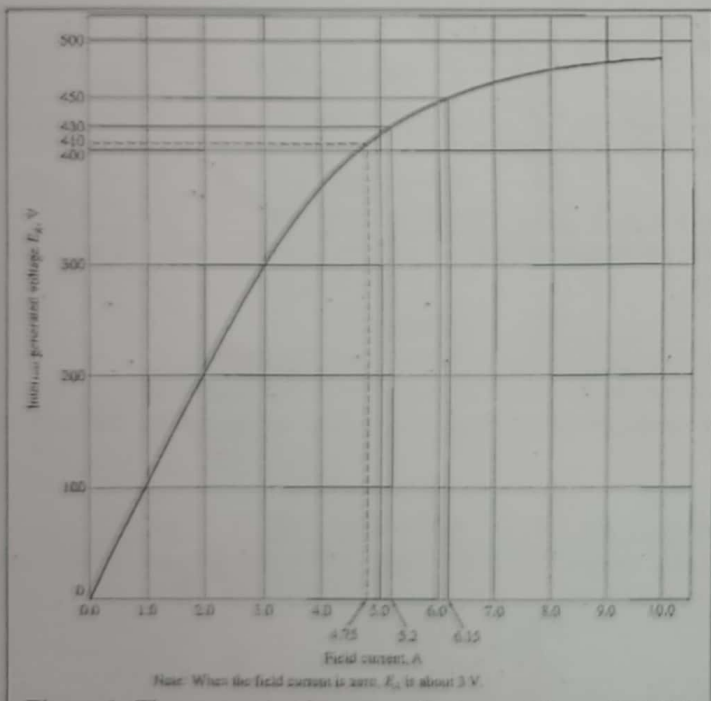


Figure 1. The magnetization curve for separately excited DC generator at 1800 r/min.

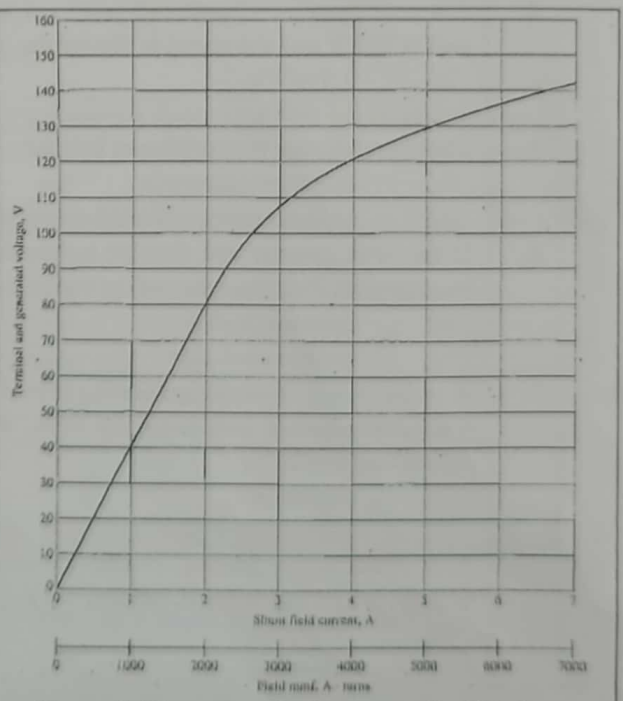


Figure 2. The magnetization curve for DC shunt generator.

With Best Regards

Dr. Abdelsalam Ahmed & Dr. Mohamed Gamal Hussien

Tanta University	Physics and Engineering Mathematics Department **FINAL EXAM**	Faculty of Engineering
Date: **June 15th, 2022** (2nd term)	Year: **2nd Year Power Eng. and Electrical Machines Dep.** Course Title: **Engineering Mathematics III(B)**	Total Marks: **85**
Allowed time: **3 hours**	Course Code: **PME2209**	No. of pages: **2**

Please answer the following questions:

Question (1) **(45Marks)**

(a) Evaluate the following integrals

(a-1) $I = \int_0^{2\pi} \frac{1}{(2+\cos\theta)^2}\, d\theta$

(a-2) $I = \int_{2+i}^{6+8i} e^{4z}\, dz$, along any open contour C.

(b) Suppose that $\Phi(z) = \phi(x,y) + i\,\psi(x,y) = e^x \cos y + i\, e^x \sin y$ represents the complex potential, in volts, for some electrostatic configuration.

(b-1) Use the complex potential to find the complex electric field at $x = 1$ and $y = 1/2$ (meter).

(b-2) Obtain the complex electric field at the same point by first finding and using the electrostatic potential $\phi(x,y)$.

(b-3) Assuming the configuration lies within a vacuum, find the components D_x and D_y of the electric flux density vector at $x = 1$ and $y = \frac{1}{2}$. In m.k.s. units, the permittivity $\varepsilon = 8.85 \times 10^{-12}$ for vacuum.

(b-4) What are the values of ϕ and ψ at $x = 1$ and $y = 1/2$?

(c) Find the principal value of $\left[e\left(-1-\sqrt{3}\,i\right)\right]^{3\pi i}$.

(d) Given $\Gamma(1.25) = 0.9064$, evaluate the following integral $\int_0^{\frac{\pi}{3}} \frac{\left(\cos\left(\frac{3\theta}{2}\right)\right)^{-\frac{1}{2}}}{4-4\cos(3\theta)}\, d\theta$.

(e) Find all z values such that $\tanh z = 2$.

Question (2) **(40Marks)**

(a) Obtain the series solution of the following differential equation around $x_0 = 0$

$$x^2y'' + (x^2 - 2x)y' + 2y = 0$$

(b) Prove Cauchy-Goursat theorem; $\oint_C f(z)dz = 0$, for any analytic function $f(z)$ on a simple closed contour C.

(c) Let C denotes the positively oriented boundary of the square whose sides lie along the lines $x = \pm 2, y = \pm 2$. Evaluate each of the following integrals

(c-1) $I = \oint_C \frac{z}{2z+1}\, dz$ (c-2) $I = \oint_C \frac{\cos z}{(z^2+8)}\, dz$

Please, consider page 2/2

(d) use the identities; $\frac{d}{dx}(x^{-k}J_k) = -x^{-k}J_{k+1}$ *and* $\frac{d}{dx}(x^k J_k) = x^k J_{k-1}$, to prove that

$$\frac{d}{dx}(xJ_k(x)J_{k+1}(x)) = x\left[J_k^2(x) - J_{k+1}^2(x)\right].$$

(e) Express graphically the set of values for z with $|z| + Re(z) \leq 1$.

Best of Luck *Dr. Ali Mehrez*

Tanta University

Department: Elec. Power and Machines Engineering
Total Marks: 120 Marks

Faculty of Engineering

Title: Electric power engineering (2)	**Course Code: EPM2207**	**Year: Second year**
Date: 19/6/2022	**Allowed time: 3 hr**	**No. of Pages: (2)**

Answer the following questions

Problem number (1) (40 Marks)

a) A small network has an admittance matrix as shown. Draw the single line diagram of the network. Eliminate nodes 1 and 2 from the network and write the new admittance matrix. Draw the impedance diagram of the network after node elimination.

$$Y_{BUS} = j\begin{bmatrix} -8 & 4 & 3 & 2 \\ 4 & -5 & 3 & 0 \\ 3 & 3 & -10 & 4 \\ 2 & 0 & 4 & -5 \end{bmatrix}$$

b) A 15000 kVA, 8.5 kV three-phase generator (G) having a reactance of 20% is connected through a delta-star transformer to a high-voltage transmission line having a total series reactance of 50 Ω. At the load end of the line is a star– star step-down transformer. Both transformer banks are composed of single-phase transformers connected for three-phase operation. Each of the three transformers composing each bank is rated 6667 kVA, 10-100 kV, with a reactance of 10%. The load, represented as impedance, is drawing 10000 kVA at 12.5 kV and 90 % power factor lagging. Draw the one-line diagram and mark base kV in the three parts of the system. Then draw the impedance diagram showing all impedances in per unit. Choose a base of 10000 kVA, 12.5 kV in the load circuit. Determine the voltage at the terminals of the generator.

Problem number (2) (20 Marks)

a) A three-phase, 50 Hz transmission line has the following parameters per phase: resistance = 12 Ω, inductance = 63.69 mH and capacitance = 1.06 μF. The line supplies a balance load of 50 MW at 132 kV and 0.8 lagging power factor. Using the nominal T-method, calculate the ABCD constants of the line. Using a suitable scale, draw the combined receiving-end and sending-end power circle diagram and find the sending end voltage, current, and complex power. Calculate the Transmission line efficiency and voltage regulation.

b) Explain in details the main required steps to determine the general ABCD constants experimentally.

c) A series capacitor bank is to be installed at the midpoint of the 300-mile line. The ABCD constants for 150 mile of line are: A=D=0.9534∟0.3, B=90.33∟84.1 Ω and C=0.001014∟90.1. The ABCD constants of the series capacitor: A=D=1∟0, B=146.6∟-90 Ω and C=0. Determine the equivalent ABCD constants of the series combination of the line

Problem number (3) **(30 Marks)**

a) Aided with suitable sketches, show the main differences between series and parallel capacitance for voltage regulation improvement. **(8)**

b) Compare between automatic voltage regulator, tap changing transformer and capacitance for voltage control in TL. **(8)**

c) A motor having a consumption of 150 kW is connected with a load of 250 kW having a lagging power factor of 0.7. If the combined load has a power factor of 0.9 lagging. What is the value of the leading kVA supplied by the motor and at what power factor is it working? **(8)**

d) Derive the condition of the optimal correction of power factor? **(6)**

Problem number (3) **(30 Marks)**

a) What are the main Types of HVDC Transmission and mention the advantages of HVDC Transmission? **(6)**

b) Explain the importance of the following components that are related to the underground cables: Metallic sheath and armoring. **(8)**

c) Explain how you can obtain the capacitance of 3-core cables experimentally. **(8)**

d) A single-core lead sheathed cable is graded by using three dielectrics of relative permittivity 5, 4 and 3respectively. The conductor diameter is 2 cm and overall diameter is 8 cm. If the three dielectrics are worked at the same maximum stress of 40 kV/cm, find the safe working voltage of the cable. What will be the value of safe working voltage for an ungraded cable, assuming the same conductor and overall diameter and the maximum dielectric stress? **(8)**

Good Luck

Course Examination Committee

Dr. Samir Dawoud **Dr. Eman Gaber**

Tanta University

Electrical Power and Machines Program/ Department

Faculty of Engineering

Course Title	Power Electronics (1)	Academic Year 2022/2023 Final Exam	Course Code	EPM2209
Year/ Level	2nd Year			
Date	26 June 2022	No. of Pages (2)	Allowed time	3 hrs

Remarks: (Answer the following questions, Clarify your answers with the suitable sketches as you can Total Marks: 75 Marks)

Question Number (1) (25 Points)

a) Choose the correct answer(14 Points)

1. Which statement is true for latching current?
a) It is related to conduction process of device.
b) It is related to turn off process of the device.
c) It is related to turn on process of the device

2. Which semiconductor power device out of the following, is not a current triggering device?
a) MOSFET b) Triac c) Thyristor d) G.T.O

3. Which one of the following statements is TRUE for an ideal power diode?
a) Reverse recovery time is non zero and reverse saturation current is zero
b) Forward voltage drop is zero and reverse saturation current is non zero
c) Forward voltage drop is non zero and reverse recovery time is zero
d) Forward voltage drop is zero and reverse recovery time is zero

4. For an SCR, dv/dt protection is achieved through
a) RC across SCR b) RL in series with SCR c) L across SCR d) L in series with SCR

5. During forward blocking state, a thyristor is associated with -
a) large current, low voltage b) medium current, large voltage
c) low current, large voltage d) low current, medium voltage

6. Which one is most suitable power device for high frequency (>100 KHz) switching application?
a) Power MOSFET b) BJT c) Schottky diode d) None of These

7. RC snubber circuit is used to limit the rate of
a) Conduction period b) Rise of current in SCR c) Rise of voltage across SCR

8. A freewheeling diode is connected across an inductive load is to.....
a) reduce the PRV b) restore conduction angle on phase c) avoid negative reversal voltage drop

9. In AC voltage regulator, TRIACS cannot be used for a
a) R-L Load b) Resistive load c) Back emf load d) Inductive load

10. In a three phase (50Hz) full converter, the ripple frequency in output voltage?
a) 50 Hz b) 100 Hz c) 150 Hz d) 300 Hz

11. In which of the following choppers do the voltage and current remain negative?
a) Type-A b) Type-E c) Type-C d) Type-D

12. In which of the following both frequency and voltage can be controlled?
a) Inverter, cyclo-converter and ac voltage controller b) Inverter and cyclo-controller
c) Cyclo-converter and ac voltage controller d) Inverter and ac voltage controller

13. The peak inverse voltage, in case of a bridge rectifier, for each, the diode is: (where Eo = Peak value of input voltage).
a) E_o b) $2E_m$ c) $3E_m$ d) $4E_m$

14. A three-phase diode bridge rectifier is fed from a 400 V RMS, 50 Hz, three-phase AC source. If the load is purely resistive, then peak instantaneous output voltage is equal to
a) 400 V b) $\sqrt{2} \times 400$ c) $400/\sqrt{2}$ d) $\sqrt{2}/400$

b) A delayed full-wave rectified sinusoidal current has an average value equal to half its maximum value. Find the delay angle θ. (4 Points)

c) In a 1φ, half wave controlled rectifier if the input voltage is 400 sin314t, what is the average output voltage for a firing angle of 60°. (3 Points)

d) In a 3-φ semi converter for firing angle less than or equal to 60°, what will be the conduction of the wheeling diode. (5 Points)

Question Number (2) (13 Points)

a) Compare in table between the single-phase half-wave rectifier, center-tap rectifier, and full-wave rectifier, in terms of (9 points)

a) Circuit	b) Efficiency	c) Ripple factor
d) TUF	e) Components	f) PIV

b) Explain why it is better to use single-phase semiconverter for resistive load rather than full converter. (2 points)

c) Among the single phase controlled converters, choose the best converter which is suitable for one quadrant, two quadrants, and four quadrants. (2 points)

Question Number (3) (17 Points)

a) Explain the reason for needing the single phase series converter. (2 points)

b) Single-phase series semiconverter is used to feed a resistive load of 20 Ω. The supply voltage is 220 V and $N_p:N_s$ = 2:1. If the average output voltage is 75 % of maximum average voltage, determine: (a) the converters delay angles; (b) average and rms value of output voltage; (c) the average and rms value of output current; (d) the average and rms value of thyristors currents; (e) the rectifier efficiency and ripple factor of input current; (f) the transformer utilization factor and input power factor. (15 points)

Question Number (4) (20 Points)

a) For three phase full converter sketch the waveforms of output voltage at 75 degrees for resistive load and highly inductive load. (5 points)

b) A three phase semiconverter is operated from three-phase Y-connected 380V, 50 Hz supply and load resistance is 30 Ω. If it is required to obtain an average output of 63 % from the maximum possible average of output voltage, calculate: (a) the converter delay angle; (b) average and rms output currents; (c) the average and rms SCR currents; (d) rectifier efficiency, transformer utilization factor and input power factor. (10 points)

c) Give a brief discussion about the basic methods of power factor improvements. (5 points)

End of questions ...

Examination Committee: *Dr. Eman Gaber* *Dr. Mahmoud F. Elmorshedy*

كلية الهندسة

قسم هندسه القوى الميكانيكيه

جامعة طنطا

اسم المقرر	التقارير الفنية	امتحان دور يونيو للعام الجامعي ٢٠٢٢/٢٠٢١	كود المقرر	
			الفرقة	الثانية كهرباء قوى
زمن الامتحان	٢ ساعات	عدد صفحات الامتحان (١)	تاريخ الامتحان	2022/06/29م
الاجابه بترتيب الأسئلة.			درجه الامتحان: ٥٠ درجه	

السؤال الاول:

ا- اذكر اهم الاخطاء التي تتعلق بصياغة التقرير؟

ب- اذكر أهمية التقارير المكتوبة.

ج- اذكر امثله للتقارير الهندسية.

د- لماذا تتم كتابة الاستنتاجات والتوصيات؟

السؤال الثاني: ضع علامة صح او خطأ

1- المقدمة يجب الا تحتوي على نتائج أو توصيات أو تفاصيل للدراسة. ( )
2- تزداد أهمية المقدمة كلما تنوع القراء المحتملين للتقرير. ( )
3- المقدمة هي الجزء الأ كبر من التقرير ويشتمل على عدة عناصر تختلف حسب طبيعة التقرير أو البحث.( )
4- في النتائج والمناقشة يمكن استخدام الجمل الفعلية في مناقشة النتائج وخاصة الفعل الماضي كما يستخدم الفعل المضارع في استعراض الحقائق المجردة أوعند عرض المبررات. ( )
5- الخلفية تعطى القارئ معلومات ليست ضرورية لفهم الموضوع. ( )
6- تشمل التوصيات تقديم اقتراحات عن البحوث التي يمكن أ ن تجري في المستقبل. ( )

السؤال الثالث:

ا- عرف كل من:

الدراسة – الرسالة – الخطاب.

ب- ماهي التقارير الهندسية، مع ذكر امثلة.

ج- ما هي أهداف كتابة التقارير؟

د- اذكر انواع التقارير من حيث: موضوعاتها – الجهة الصادرة اليها.

السؤال الرابع:

ا- ما اهم الخطوات التي يجب اخذها في الاعتبار عند استخدام الجمل في التقارير؟

ب- طبق مثالا عمليا لما تعلمته بكتابة (صفحة العنوان – المحتويات) في كتابة تقرير فني عن زياره لمعاينة معده ما.

انتهت الاسئلة

لجنة الممتحنين: د./ محمد إبراهيم الحضري