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**KOLEJ YAYASAN PELAJARAN JOHOR  
FINAL EXAMINATION**

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**COURSE NAME** : TEKNOLOGI ELEKTRIK  
**COURSE CODE** : DEG 1082  
**EXAMINATION** : DECEMBER 2022  
**DURATION** : 2 HOURS

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**INSTRUCTION TO CANDIDATES/  
ARAHAN KEPADA CALON.**

1. This examination paper consists of **ONE (1)** part : / PART A (100 Marks) /  
*Kertas soalan ini mengandungi **SATU (1)** bahagian:* *BAHAGIAN A (100 Markah)*
  
2. Candidates are not allowed to bring any material to examination room except with the permission from the invigilator. The formula was attached at the back question paper. /  
*Calon tidak dibenarkan untuk membawa sebarang bahan/nota ke bilik peperiksaan tanpa arahan/kebenaran daripada pengawas. Rumus dilampirkan di belakang kertas soalan peperiksaan.*
  
3. Please check to make sure that this examination pack consists of: /  
*Pastikan kertas soalan peperiksaan ini mengandungi:*
  - i. Question Paper. /  
*Kertas Soalan.*
  - ii. Answering Booklet. /  
*Buku Jawapan.*

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**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO  
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU**

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This examination paper consists of **9** printed pages including front page  
*Kertas soalan ini mengandungi **9** muka surat termasuk kulit hadapan*

This part contains **FIVE (5)** questions. Answer **FOUR (4)** questions only in the Answering Booklet.

*Bahagian ini mengandungi LIMA (5) soalan. Jawab EMPAT (4) soalan sahaja di dalam Buku Jawapan.*

### QUESTION 1 / SOALAN 1

a) Referring to **Figure 1**, calculate the overall power triangle and the power factor.

Load A: Inductive load, 20kVA, power factor 0.8.

Load B: Capacitive load, -35kVAR, power factor 0.9.

(15 marks/ markah)

b) The power factor of an AC electrical power system is defined by the ratio of the real power absorbed by the load to the apparent power flowing in the circuit.

i) State **three (3)** disadvantages of low power factor.

ii) State **two (2)** methods to improve the power factor correction.

(10 marks/ markah)

a) Merujuk kepada **Rajah 1**, kirakan segitiga kuasa keseluruhan litar serta faktor kuasanya.

Beban A: Beban paruh, 20kVA, faktor kuasa 0.8.

Beban B: Beban pemuat, -35kVAR, faktor kuasa 0.9.

b) Faktor kuasa bagi sistem kuasa elektrik AU didefinisikan sebagai nisbah kuasa aktif yang diserap oleh beban kepada kuasa ketara yang melalui sebuah litar.

i) Nyatakan **tiga (3)** keburukan bagi faktor kuasa rendah.

ii) Nyatakan **dua (2)** kaedah pembetulan faktor kuasa.

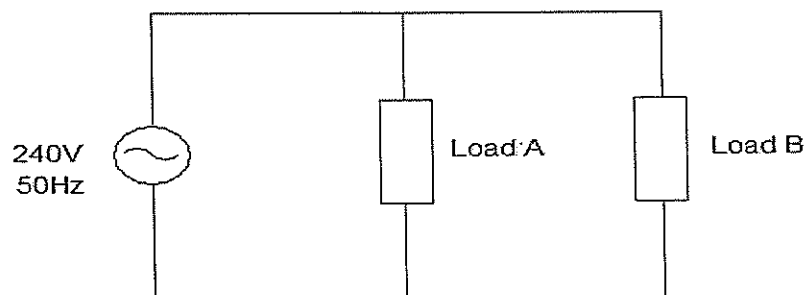


Figure 1/ Rajah 1

## QUESTION 2 / SOALAN 2

- a) Explain the definition of three phase system and give three (3) advantages of three phase system.

(10 marks/ markah)

- b) Figure Q2 show a balanced three phase load having impedance  $15\angle 40^\circ \Omega$ . The three phase delta connected generator supplies voltage 220V. Determine:

- the line current,  $I_T$  for the circuit and the current in each load.
- the active power.
- draw the phasor diagram for all voltage and current parameter.

(15 marks/ markah)

- a) Jelaskan definisi sistem tiga fasa dan berikan tiga (3) kebaikan sistem tiga fasa.

- b) Rajah Q2 menunjukkan beban tiga fasa seimbang mempunyai galangan  $15\angle 40^\circ \Omega$ . Penjana tiga fasa sambungan delta membekalkan voltan 220V. Tentukan:

- arus talian,  $I_T$  bagi litar dan arus dalam setiap beban.
- kuasa aktif.
- lukiskan rajah pemfasa untuk semua parameter voltan dan arus.

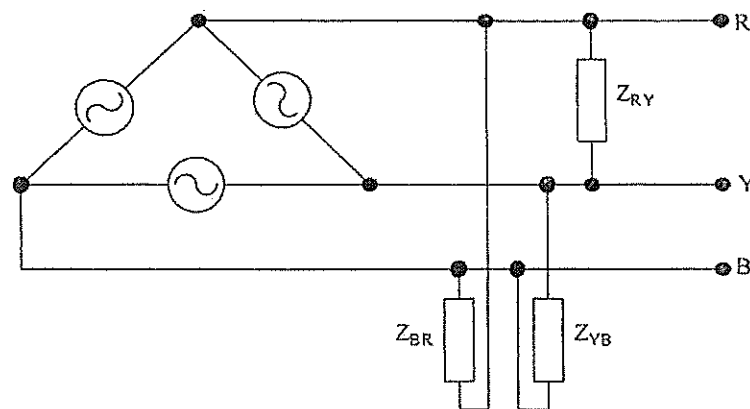


Figure Q2 / Rajah Q2

## QUESTION 3 / SOALAN 3

a) Define the following terms with reference to a magnetic circuit:

- i) electromagnetic force,  $F$ .
- ii) magnetic field strength,  $H$ .
- iii) flux density,  $B$ .
- iv) reluctance,  $S$ .
- v) permeability,  $\mu$ .

(10 marks/ markah)

b)

	Mean length	Cross section area
Cast steel	350mm	$220 \times 10^{-6} \text{m}^2$
Mild steel	450mm	$280 \times 10^{-6} \text{m}^2$

Table Q3

Find the electromagnetic force,  $F$  required to create  $286 \mu \text{Wb}$  for the magnetic circuit in **Figure 3**. Determine also the current,  $I$  if the coil of 500 turns are wound around the magnetic circuit. The magnetization curve is shown in **APPENDIX A**.

(15 marks/ markah)

a) Takrifkan istilah-istilah merujuk kepada litar magnet yang berikut:

- i) daya elektromagnet,  $F$ .
- ii) kekuatan medan magnet,  $H$ .
- iii) ketumpatan fluk,  $B$ .
- iv) enggan,  $S$ .
- v) ketelapan,  $\mu$

b)

	Panjang min	Luas keratan rentas
Keluli tuang	350mm	$220 \times 10^{-6} \text{m}^2$
Keluli lembut	450mm	$280 \times 10^{-6} \text{m}^2$

Jadual Q3

Tentukan jumlah daya gerak magnet,  $F$  yang diperlukan untuk menghasilkan urat daya sebanyak  $286 \mu \text{Wb}$  dalam litar magnet di dalam **Rajah Q3**. Tentukan juga arus,  $I$  jika gegelung yang mempunyai 500 lilitan dililitkan di litar magnet tersebut. Rajah lengkung permagnetan ditunjukkan di dalam **LAMPIRAN A**.

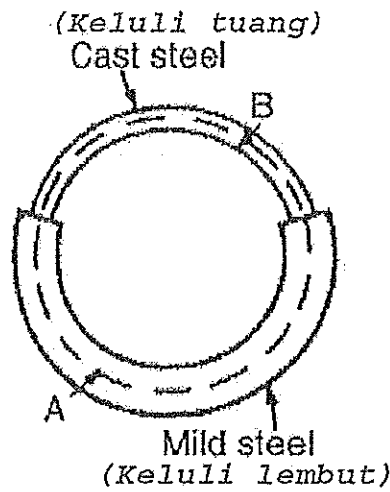


Figure Q3 / Rajah Q3

## QUESTION 4 / SOALAN 4

- a) Explain the definition of a step up transformer and a step down transformer.

(4 marks/ markah)

- b)

	Open circuit test	Short circuit test
V	110V	9.5V
I	1.25A	25A
P	90W	140W

Table Q4

The test data from a single phase 5KVA, 240V/110V transformer is shown in Table Q4. Determine:

- the core loss current  $I_c$ , and the magnetism current  $I_m$ , in the core.
- core loss resistance  $R_c$ , magnetism reactance  $X_m$ , equivalent resistance  $R_{sn}$  and equivalent reactance  $X_{sn}$ .
- equivalent circuit referred to low voltage (LV) side.

(21 marks/ markah)

a) Terangkan definisi bagi pengubah langkah naik dan pengubah langkah turun.

b)

	Ujian litar buka	Ujian litar pintas
$V$	110V	9.5V
$I$	1.25A	25A
$P$	90W	140W

**Jadual Q4**

Data ujian untuk pengubah satu fasa 5KVA, 240V/110V adalah seperti **Jadual Q4**.

Tentukan:

- i) arus kehilangan besi  $I_c$ , dan arus permagnetan  $I_m$ , dalam teras.
- ii) rintangan kehilangan besi  $R_c$ , regangan permagnetan  $X_m$ , rintangan setara  $R_{sn}$  dan regangan setara  $X_{sn}$ .
- iii) litar setara pengubah merujuk ke bahagian voltan rendah (VR).

#### QUESTION 5 / SOALAN 5

- a) A shunt field DC motor has a resistance field of  $160\Omega$ . It is connected to a 240V system. Calculate the armature current if the machine is in operation:
- i) as the generator load current 60A. Also find the value of the induced emf if armature resistance is  $5.5\Omega$ .
  - ii) as the motor load current is 40A. Also find the value of the induced emf if armature resistance is  $5.5\Omega$ .

**(8 marks/ markah)**

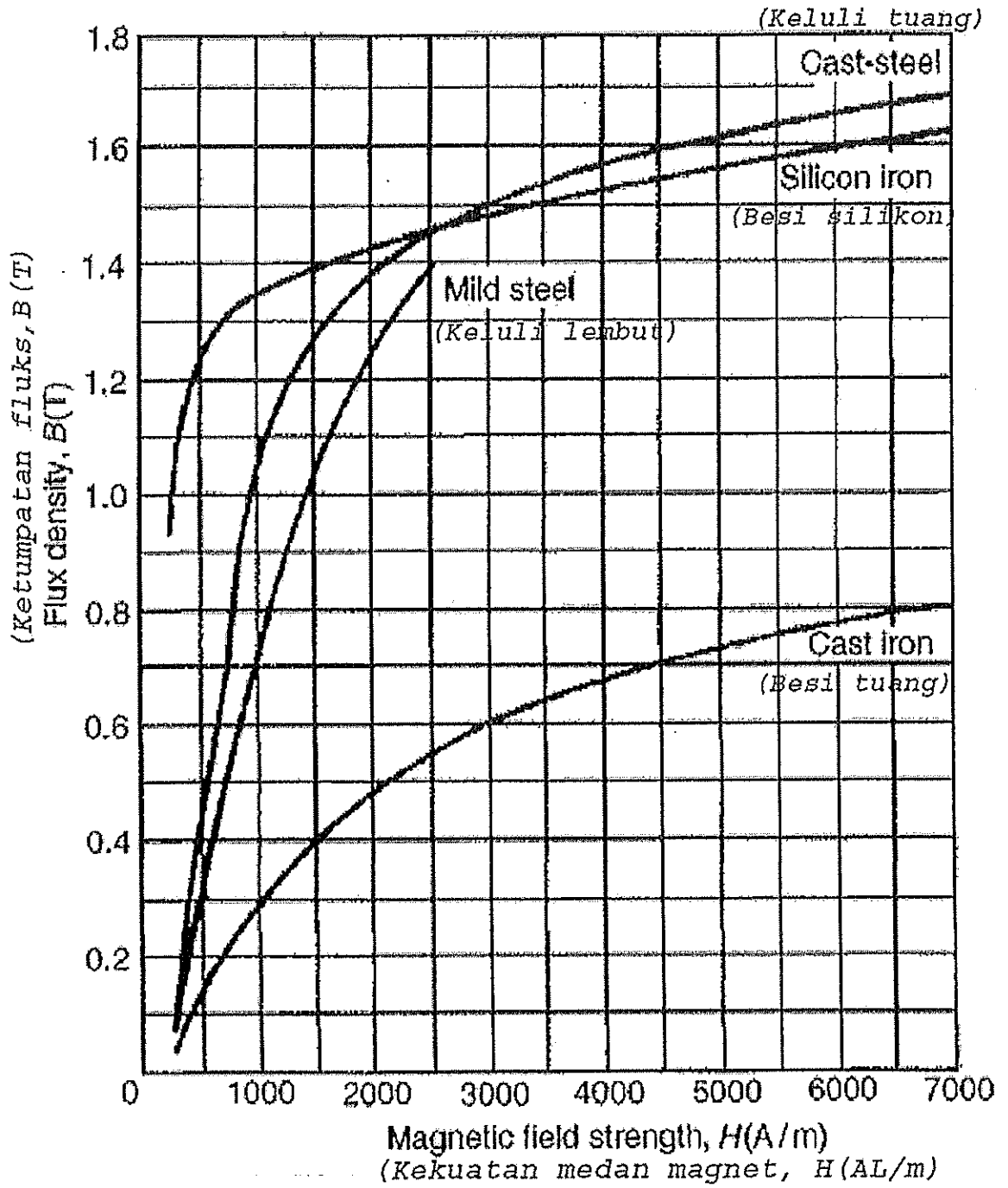
- b) A shunt field DC generator, delivers a terminal voltage of 220V to a resistance load of  $20\Omega$ . The generator has field and armature resistances of  $420\Omega$  and  $5\Omega$  respectively, determine:
- i) the DC generator circuit.
  - ii) the load current.
  - iii) the field current.
  - iv) the power at field.
  - v) the armature current.
  - vi) induced emf at the armature.
  - vii) the total power delivered to the load.

**(15 marks/ markah)**

- c) What is difference between motor and generator?  
(2 marks/ markah)
- a) Suatu mesin AT medan pirau mempunyai rintangan medan  $160\Omega$ . Ia disambungkan kepada sistem yang mengandungi voltan tetap  $240V$ . Kirakan arus angkiran jika mesin beroperasi:
- sebagai penjana dengan arus beban  $60A$ . Carikan nilai dge teraruh apabila rintangan angker adalah  $5.5\Omega$ .
  - sebagai motor dengan arus beban  $40A$ . Carikan nilai dge teraruh apabila rintangan angker adalah  $5.5\Omega$ .
- b) Penjana AT medan pirau membekalkan voltan terminal sebanyak  $220V$  kepada beban perintang sebanyak  $20\Omega$ . Penjana tersebut mempunyai rintangan medan dan angker sebanyak  $420\Omega$  dan  $5\Omega$  masing-masing, tentukan:
- litar bagi penjana AT.
  - arus beban.
  - arus medan.
  - kuasa pada medan.
  - arus angker.
  - dge teraruh pada angker.
  - jumlah kuasa yang dibekalkan kepada beban.
- c) Apakah perbezaan di antara motor dan penjana?

[100 MARKS / MARKAH]

APPENDIX A / LAMPIRANA





## APPENDIX B / LAMPIRAN B

$$V = IZ$$

$$\theta_{lb} = \cos^{-1}\left(\frac{P_{lb}}{V_{lb} \times I_{lb}}\right)$$

$$pf = \frac{P}{S} = \cos\theta_z$$

$$R_c = \frac{V_{lb}}{I_c}$$

$$X_c = \frac{V^2}{X_c}$$

$$X_m = \frac{V_{lb}}{I_m}$$

$$C = \frac{1}{\omega X_c}$$

$$R_{sn} = \frac{P_{lb}}{I_p^2}$$

$$V_T = \sqrt{3}V_F$$

$$Z_{sn} = \frac{V_{lp}}{I_{lp}}$$

$$B = \frac{\phi}{A}$$

$$X_{sn} = j\sqrt{Z_{sn}^2 - R_{sn}^2}$$

$$Dgm, F = Hl = NI$$

$$E = \phi n$$

END OF QUESTION PAPER/ KERTAS SOALAN TAMAT

