



ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE
FACULTY OF ENGINEERING

SEMESTER II EXAMINATION, 2018/2019 ACADEMIC SESSION

COURSE TITLE: BASIC ELECTRICAL ENGINEERING II

COURSE CODE: GNE 228

EXAMINATION DATE: 16TH JULY, 2019

COURSE LECTURER: ENGR. OSHIN OLA AUSTIN

TIME ALLOWED: 3 HOURS

A handwritten signature in black ink, enclosed within a rectangular box. The signature is stylized and appears to be 'O. O. Austin'.

HOD's SIGNATURE

INSTRUCTIONS:

1. ANSWER ANY 5 QUESTIONS
2. ANY INCIDENT OF MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM SHALL BE SEVERELY PUNISHED.
3. YOU ARE NOT ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS DURING THE EXAMINATION.
4. ELECTRONIC DEVICES CAPABLE OF STORING AND RETRIEVING INFORMATION ARE PROHIBITED.
5. DO NOT TURN OVER YOUR EXAMINATION QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

QUESTION ONE

- a. Explain the conditions for resonance for an RLC series circuit (3 marks)
- b. Find the resonant frequency of a series a.c. circuit consisting of a coil of resistance $12\ \Omega$ and inductance 60mH and capacitance $0.06\mu\text{F}$ as shown in figure 1. (4 marks)
- Find also the current flowing at resonance if the supply voltage is 220V . (3 marks)
- Determine the voltage across the capacitor. (2 marks)

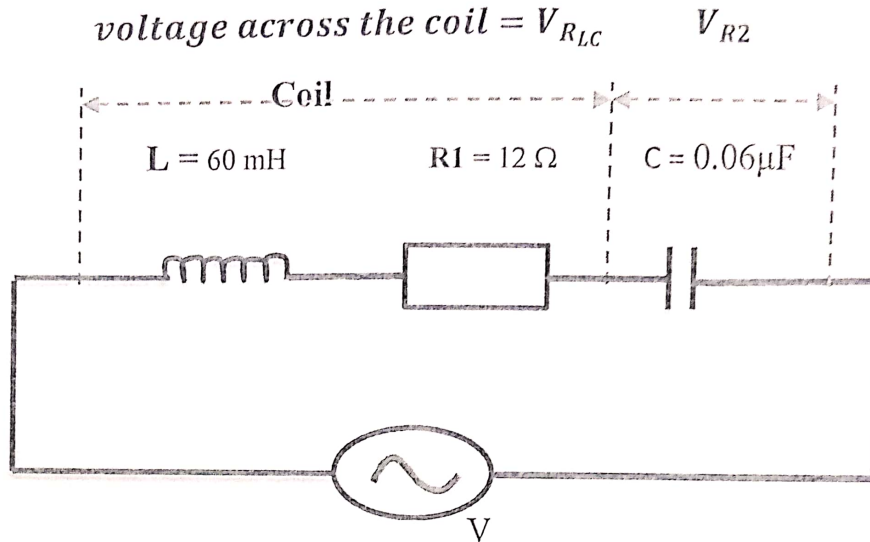


Figure 1: Series a.c. circuit consisting of a coil and capacitor

QUESTION TWO

- a. Explain the following terms: Q-factor, Bandwidth, and Selectivity in an RLC circuit (4.5 marks)
- b. A coil of inductance 0.25H and resistance $50\ \Omega$ is connected in parallel with a $24\mu\text{F}$ capacitor across a 24V D.C variable frequency supply. Determine
- the resonant frequency (2 marks)
 - the current at resonance (2 marks)
 - the dynamic resistance (2 marks)
 - the circuit Q-factor at resonance (1.5 marks)

QUESTION THREE

- a. Explain the condition for resonance for an RLC parallel circuit (3 marks)
- b. A filter in the form of a series L–R–C circuit is designed to operate at a resonant frequency of 6 kHz . Included within the filter is a 25mH inductance and $10.4\ \Omega$ resistance. Determine the bandwidth of the filter. (3 marks)
- c. The power factor of the electric motor in figure 2 is 0.54 .
- Describe the process of increasing the power factor to unity; and
 - determine the current drawn from the source after the correction

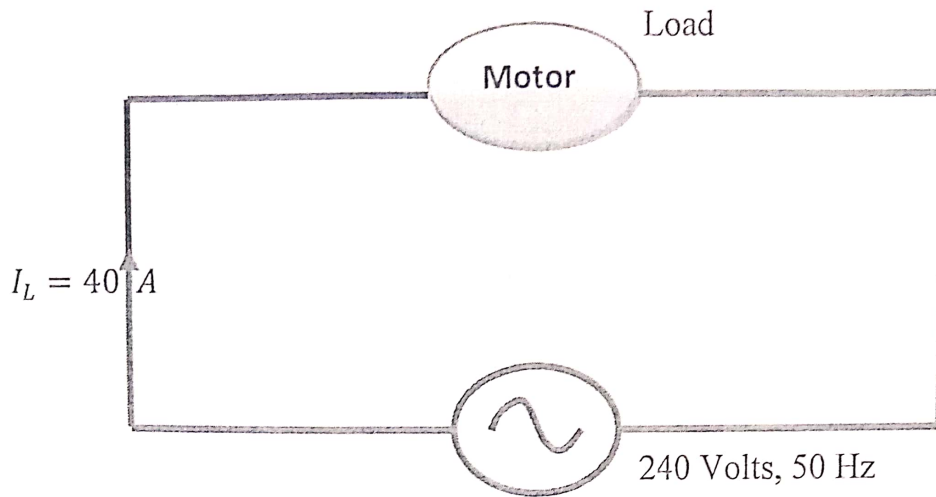


Figure 2: Electric Motor

(6 marks)

QUESTION FOUR

- a. Using suitable A.C power triangle diagram in which the current I lags the applied voltage V by angle ϕ , differentiate between real power, active power and reactive power in an A.C circuit (4 marks)
- b. A 240V, 50Hz single-phase supply feeds the following loads: (i) fluorescent lamps taking a current of 8.4A at a power factor of 0.7 leading, (ii) incandescent lamps taking a current of 5.2A at a power factor of 0.72, (iii) a motor taking a current of 12 A at a power factor of 0.64 lagging.
 - i. Determine the total current taken from the supply and the overall power factor.(3 marks)
 - ii. Find also the value of a static capacitor connected in parallel with the loads to improve the overall power factor to 0.98 lagging. (3 marks)
 - iii. Draw the overall phasor diagram of the circuit after power factor correction (2 marks)

QUESTION FIVE

- a. State four differences between an electrical circuit and a magnetic circuit (4 marks)
- b. Find (i) the total reluctance and (ii) the current, I in the coil needed to produce a flux of 0.64 mWb in the air gap shown in figure 3. The silicon iron magnetic circuit has a uniform cross sectional area of 4 cm^2 and its magnetization curve is as shown on B-H curve in figure 4

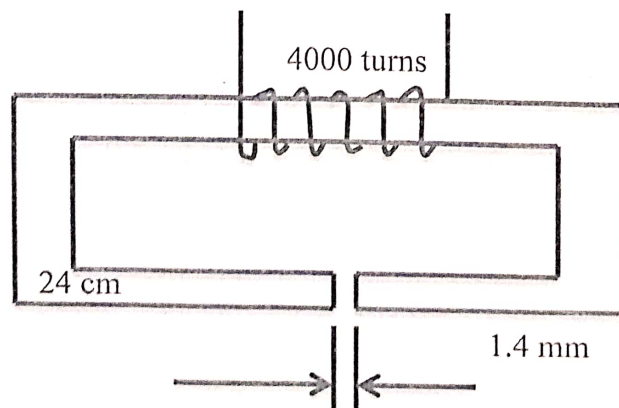


Figure 3: Silicon iron magnetic circuit

(8 marks, 4 marks each)

QUESTION SIX

- a. Using suitable diagrams, explain what you understand by each of the following terms: (a) reverse bias in a PN junction diode (b) forward bias of P-N junction diode (c) contact potential (6 marks, 2 marks each)
- b. Corresponding readings of base current, I_B , and base-emitter voltage, V_{BE} , for a bipolar junction transistor (BJT) are given in the table 1:

Table 1: Corresponding readings of base current, I_B , and base-emitter voltage, V_{BE}

V_{BE} (V)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
I_B (mA)	0	0	0	0	1	3	20	59.5	130

Plot the I_B / V_{BE} characteristic for the device and use it to determine

- (a) the value of I_B when $V_{BE} = 0.68V$ (2 marks)
(b) the static value of input resistance when $V_{BE} = 0.68V$ (2 marks)
(c) the dynamic value of input resistance when $V_{BE} = 0.65V$ (2 marks)

QUESTION SEVEN

- a. Derive an expression for the E.M.F generated in an armature winding (2 marks)
- b. Distinguish between the operations of a generator and a motor (2 marks)
- c. An 8-pole generator has a wave-wound armature with 1200 conductors. The useful flux per pole is 25 mWb. Determine the speed at which the machine must be driven to generate an e.m.f. of 238 V (4 marks)
- d. A 6 -pole, wound armature has 2,400 conductors and a flux per pole of 0.05 Wb. Determine the e.m.f. generated when the machine is running at 720 rev/min. (4 marks)

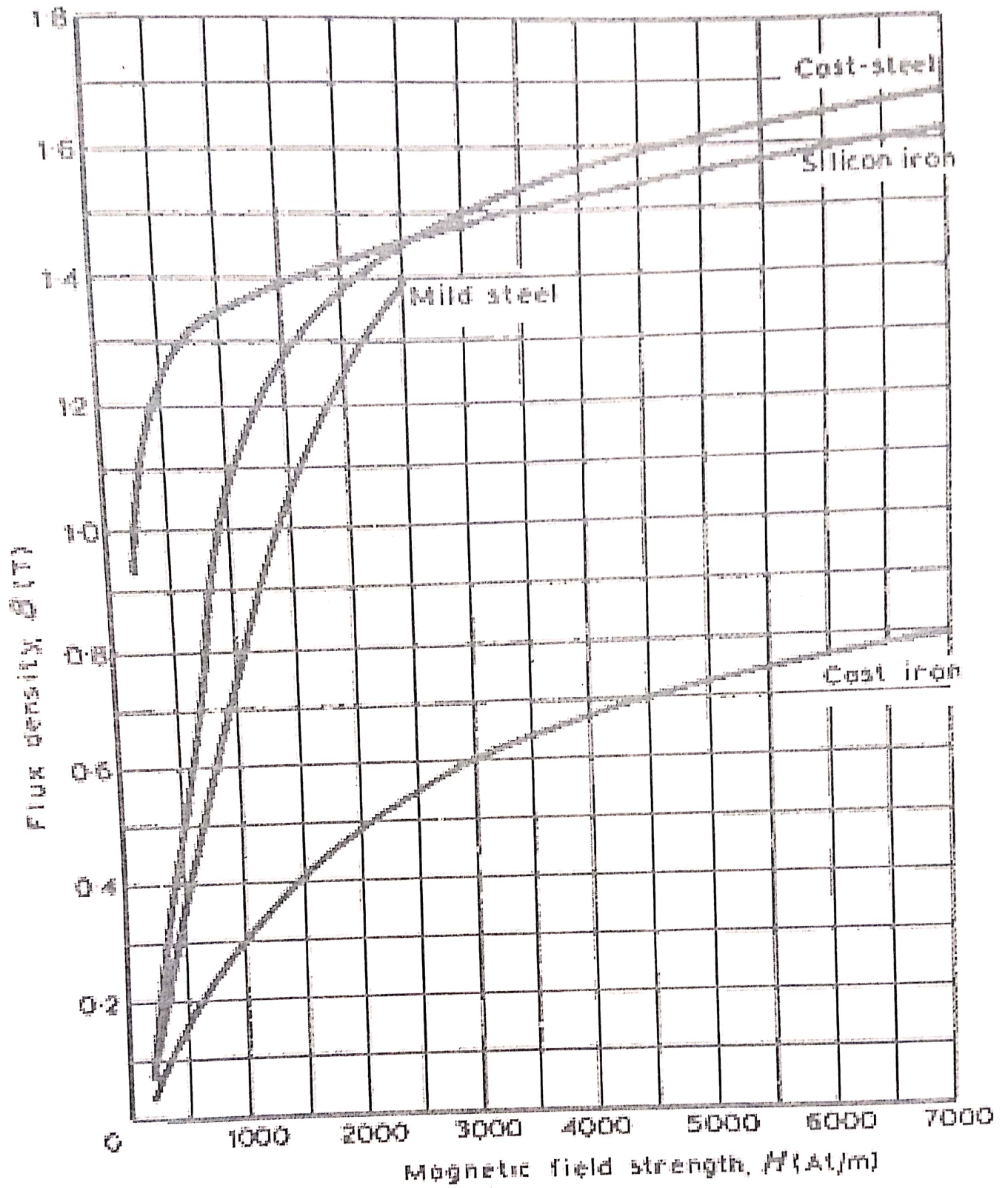


Figure 4: B - H curves for four materials