

1521/204

1601/204

MICRO-ELECTRONICS, ELECTRICAL
PRINCIPLES II, ELECTRICAL MAINTENANCE
AND FAULT DIAGNOSIS

June/July 2019

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC
TECHNOLOGY
(POWER OPTION)

MODULE II

MICRO-ELECTRONICS, ELECTRICAL PRINCIPLES II,
ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable electronic calculator;

Intel 8085 instruction set.

*This paper consists of **THREE** sections; **A**, **B** and **C**.*

*Answer **TWO** questions from section **A**, **TWO** questions from section **B** and **ONE** question from section **C**.*

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 7 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: ELECTRICAL PRINCIPLES II

Answer **TWO** questions from this section.

1. (a) State **three** advantages of permanent magnet moving coil instruments. (3 marks)
- (b) Draw a labelled circuit diagram of the series type ohmmeter used in the measurement of resistance. (4 marks)
- (c) (i) Outline **two** factors taken into consideration when measuring precision resistance using the wheatstone bridge.
- (ii) Figure 1 shows a balanced wheatstone bridge circuit. Derive the expression for the unknown resistor R. (7 marks)

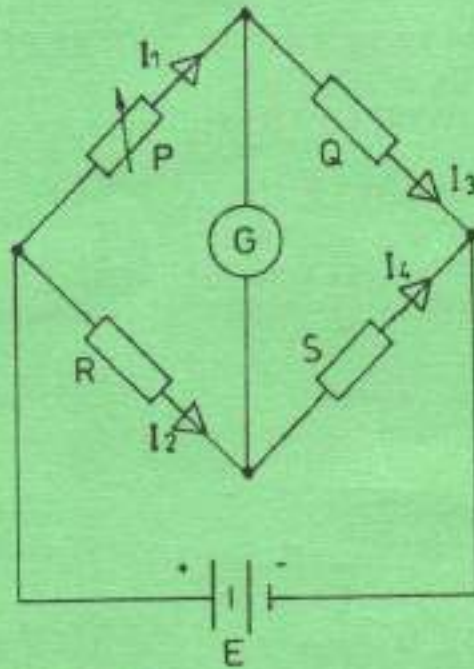


Fig.1

- (d) A moving coil instrument gives full scale deflection of 20 mA when potential difference across its terminals is 120 mV. Determine the shunt resistance for a full scale deflection corresponding to 120 A. (6 marks)

2. (a) With respect to a purely inductive alternating current (a.c) circuit, draw its:
- phasor diagram;
 - graphical representation showing the relationship of reactance, frequency and current. (5 marks)
- (b) (i) Explain the term resonance with respect to a.c circuits.
- (ii) Derive the expression for the Q-factor of an R-L-C series a.c circuit. (9 marks)
- (c) Figure 2 shows a tuned circuit. Determine the:
- resonant frequency (assuming negligible resistance).
 - dynamic impedance. (6 marks)

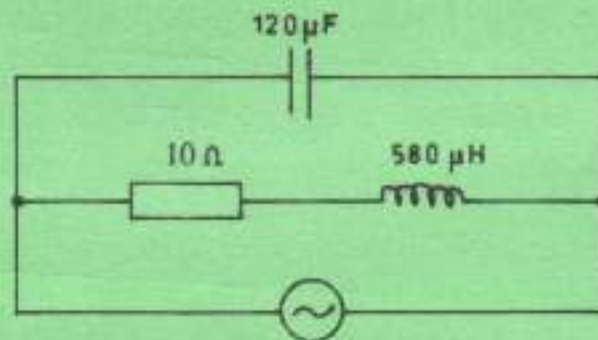


Fig. 2

3. (a) Figure 3 shows an R-C circuit.

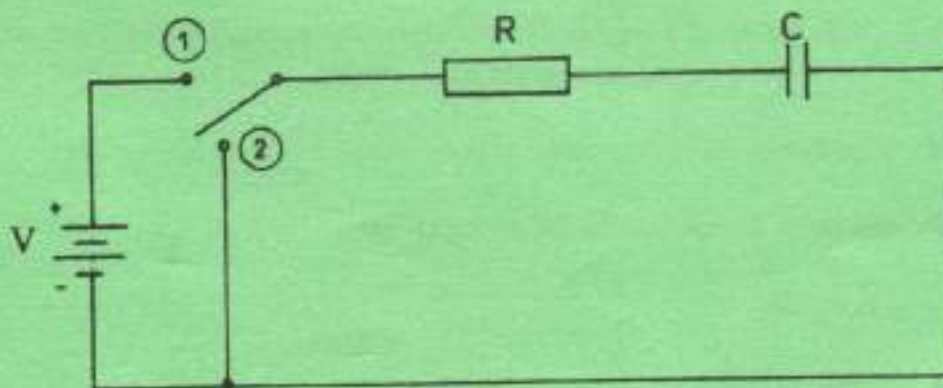


Fig. 3

(i) Explain what happens when the switch is in:

- I. position 2;
- II. position 1.

(Assume the capacitor C is initially charged)

(ii) Derive the expression for the transient current. (7 marks)

(b) Three impedances each of resistance $10\ \Omega$ and inductive reactance $15\ \Omega$ are connected in delta across a three phase, 415 V a.c supply. Determine the:

(i) phase current;

(ii) line current;

(iii) active power. (8 marks)

(c) Draw labelled diagram of a three phase 4 - wire power system with a star connected secondary of a transformer. Indicate the voltages. (5 marks)

SECTION B: ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS

Answer TWO questions from this section.

4. (a) (i) Name **four** common faults in discharge lamp circuits.

(ii) With the aid of a diagram, explain how stroboscopic effect is reduced using a twin lamp circuit on a single phase supply. (12 marks)

(b) List **six** requirements in preventive maintenance. (6 marks)

(c) State **one** cause for each of the following faults:

(i) open circuit;

(ii) burnt cables. (2 marks)

5. (a) State **five** faults associated with alternating current machines. (5 marks)
- (b) Explain **two** tests carried out on a direct current machine that has the following fault symptoms:
- (i) motor starts normally but starter does not remain in hold on position;
- (ii) sparking at the commutator. (8 marks)
- (c) Draw a labelled diagram of a high pressure mercury vapour lamp. (7 marks)
6. (a) Outline the procedure for dismantling a standard electrical machine during maintenance. (6 marks)
- (b) With the aid of a labelled diagram, explain how a short circuit fault is determined on the armature of a direct current machine. (8 marks)
- (c) A single phase start capacitor run induction motor hums and does not start. Outline **three** maintenance checks done to locate the fault. (6 marks)

SECTION C: MICRO-ELECTRONICS

Answer ONE question from this section.

7. (a) With regards to the Intel 8085 microprocessor arithmetic logic unit, state **three**:
- (i) arithmetic operations;
- (ii) logical operation. (6 marks)
- (b) (i) Distinguish between static and volatile memory.
- (ii) State the meaning of the following mnemonics:
- I. ADD;
- II. SUB;
- III. MOV. (5 marks)
- (c) Draw a diagram of the general purpose registers of the Intel 8085 microprocessor. (5 marks)
- (d) Outline the steps involved in performing the fetch operations in microprocessors. (4 marks)

8. (a) Draw a labelled diagram of the general microprocessor architecture of an Intel 8085. (8 marks)
- (b) Explain the principle of operation of the following memories:
- (i) sequential;
 - (ii) read and write;
 - (iii) content addressable memory. (6 marks)
- (c) With respect to the Intel 8085 microprocessor, determine from the following instructions which are the sending and receiving registers:
- (i) MOV A, B;
 - (ii) MOV B, D;
 - (iii) MOV H, B. (6 marks)

OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC
00	NOP	28	DCX H	56	MVI D,M	84	ADD C	AC	XRA H	07	RST 7
01	LXI B,D16	2C	INR L	57	MOV D,A	85	ADD D	AD	XRA L	08	RC
02	STAX B	2D	DCR L	58	MOV E,B	86	ADD E	AE	XRA M	09	—
03	INX B	2E	MVI L,DB	59	MOV E,C	87	ADD H	AF	XRA A	0A	JC Adr
04	INR B	2F	CMA	5A	MOV E,D	88	ADD L	80	ORA B	0B	IN DB
05	DCR B	30	SIM	5B	MOV E,E	89	ADD M	81	ORA C	0C	CC Adr
06	MVI B,DB	31	LXI SPD16	5C	MOV E,H	8A	ADD A	82	ORA D	0D	—
07	RLC	32	STA Adr	5D	MOV E,L	8B	ADC B	83	ORA E	0E	SBI DB
08	—	33	INX SP	5E	MOV E,M	8C	ADC C	84	ORA H	0F	RST 3
09	DAD B	34	INR M	5F	MOV E,A	8D	ADC D	85	ORA L	10	RPO
0A	LDAX B	35	DCR M	60	MOV H,B	8E	ADC E	86	ORA M	E1	POP H
0B	DCX B	36	MVI M,DB	61	MOV H,C	8F	ADC H	87	ORA A	E2	JPO Adr
0C	INR C	37	STC	62	MOV H,D	90	ADC L	88	CMP B	E3	XTHL
0D	DCR C	38	—	63	MOV H,E	91	ADC M	89	CMP C	E4	CPO Adr
0E	MVI C,DB	39	DAD SP	64	MOV H,H	92	ADC A	8A	CMP D	E5	PUSH H
0F	RRC	3A	LDA Adr	65	MOV H,L	93	SUB B	8B	CMP E	E6	ANI DB
10	—	3B	DCR SP	66	MOV H,M	94	SUB C	8C	CMP H	E7	RST 4
11	LXI D,D16	3C	INR A	67	MOV H,A	95	SUB D	8D	CMP L	E8	RPE
12	STAX D	3D	DCR A	68	MOV L,B	96	SUB E	8E	CMP M	E9	PCHL
13	INX D	3E	MVI A,DB	69	MOV L,C	97	SUB H	8F	CMP A	EA	JPE Adr
14	INR D	3F	CMC	6A	MOV L,D	98	SUB L	80	RNZ	EB	XCHG
15	DCR D	40	MOV B,B	6B	MOV L,E	99	SUB M	C1	POP B	EC	CPE Adr
16	MVI D,DB	41	MOV B,C	6C	MOV L,H	9A	SUB A	C2	JNZ Adr	ED	—
17	HAL	42	MOV B,D	6D	MOV L,L	9B	SBB B	C3	JMP Adr	EE	EAL DB
18	—	43	MOV B,E	6E	MOV L,M	9C	SBB C	C4	CNZ Adr	EF	RST 5
19	DAD D	44	MOV B,H	6F	MOV L,A	9D	SBB D	C5	PUSH B	F0	RP
1A	LDAX D	45	MOV B,L	70	MOV M,B	9E	SBB E	C6	ATH DB	F1	POP PSW
1B	DCX D	46	MOV B,M	71	MOV M,C	9F	SBB H	C7	RST 0	F2	JP Adr
1C	INR E	47	MOV B,A	72	MOV M,D	A0	SBB L	C8	R2	F3	DI
1D	DCR E	48	MOV C,B	73	MOV M,E	A1	SBB M	C9	RET Adr	F4	CP Adr
1E	MVI E,DB	49	MOV C,C	74	MOV M,H	A2	SBB A	CA	JZ	F5	PUSH PSW
1F	RAR	4A	MOV C,D	75	MOV M,L	A3	ANA B	CB	—	F6	ORI DB
20	RIM	4B	MOV C,E	76	HLT	A4	ANA C	CC	CZ Adr	F7	RST 6
21	LXI H,D16	4C	MOV C,H	77	MOV M,A	A5	ANA D	CD	CALL Adr	F8	RM
22	SHLD Adr	4D	MOV C,L	78	MOV M,B	A6	ANA E	CE	ACI DB	F9	SPHL
23	INX H	4E	MOV C,M	79	MOV M,C	A7	ANA H	CF	RST 1	FA	JM Adr
24	INR H	4F	MOV C,A	7A	MOV M,D	A8	ANA L	D0	RMC	FB	EI
25	DCR H	50	MOV C,B	7B	MOV M,E	A9	ANA M	D1	POP D	FC	CM Adr
26	MVI H,DB	51	MOV C,D	7C	MOV M,H	AA	ANA A	D2	JNC Adr	FD	—
27	DAA	52	MOV C,D	7D	MOV M,L	AB	XRA B	D3	OUT DB	FE	CFI DB
28	—	53	MOV C,E	7E	MOV M,M	AC	XRA C	D4	CNC Adr	FF	RST 7
29	DAD H	54	MOV C,H	7F	MOV M,A	AD	XRA D	D5	PUSH D		
2A	LHLD Adr	55	MOV C,L	80	ADD B	AE	XRA E	D6	SUI DB		

DB = constant, or logical/arithmetic expression that evaluates to an 8-bit data quantity. D16 = constant, or logical/arithmetic expression that evaluates to a 16-bit data quantity. Adr = 16-bit address.

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