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)

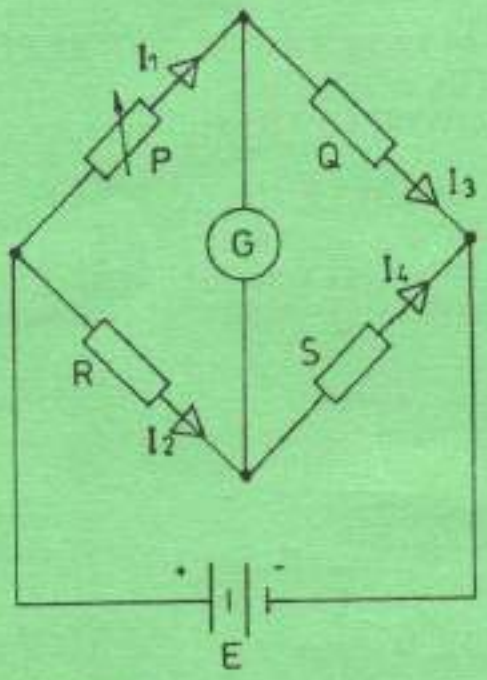

Fig.1

(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:

(i) phasor diagram;

(ii) 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:

(i) resonant frequency (assuming negligible resistance).

(ii) dynamic impedance. (6 marks)

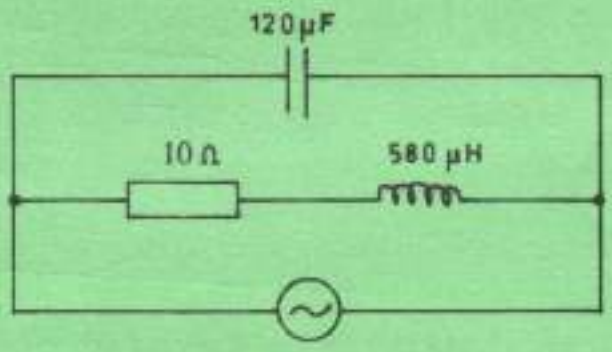

Fig. 2

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

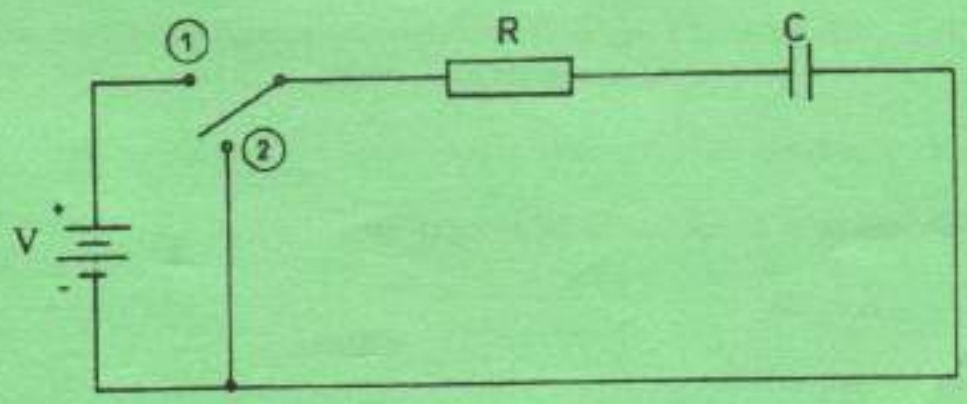

Fig. 3

(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 Ω and inductive reactance 15 Ω 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)

Instruction set of

8080/8085

OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC	OP CODE	MNEMONIC
00	NOP	28	DCX H	56	MOV D,M	81	ADD C	AC	XRA H	07	RST 7
01	LXI B,D16	2C	INR L	57	MOV D,A	82	ADD D	AD	XRA L	D8	RC
02	STAX B	2D	DCR L	58	MOV E,B	83	ADD E	AE	XRA M	D9	–
03	INX B	2E	MVI L,D8	59	MOV E,C	84	ADD H	AF	XRA A	DA	JC Adr
04	INR B	2F	CMA	5A	MOV E,D	85	ADD L	B0	ORA B	DB	IN D8
05	DCR B	30	SIM	5B	MOV E,E	86	ADD M	B1	ORA C	DC	CC Adr
06	MVI B,D8	31	LXI SP,D16	5C	MOV E,H	87	ADD A	B2	ORA D	DD	–
07	RLC	32	STA Adr	5D	MOV E,L	88	ADC B	B3	ORA E	DE	SBI D8
08	–	33	INX SP	5E	MOV E,M	89	ADC C	B4	ORA H	DF	RST 3
09	DAD B	34	INR M	5F	MOV E,A	8A	ADC D	B5	ORA L	E0	RPO
0A	LDAX B	35	DCR M	60	MOV H,B	8B	ADC E	B6	ORA M	E1	POP H
0B	DCX B	36	MVI M,D8	61	MOV H,C	8C	ADC H	B7	ORA A	E2	JPO Adr
0C	INR C	37	STC	62	MOV H,D	8D	ADC L	B8	CMP B	E3	XTHL
0D	DCR C	38	—	63	MOV H,E	8E	ADC M	B9	CMP C	E4	CPO Adr
0E	MVI C,D8	39	DAD SP	64	MOV H,H	8F	ADC A	BA	CMP D	E5	PUSH H
0F	RRC	3A	LDA Adr	65	MOV H,L	90	SUB B	BB	CMP E	E6	ANI D8
10	–	3B	DCX SP	66	MOV H,M	91	SUB C	BC	CMP H	E7	RST 4
11	LXI D,D16	3C	INR A	67	MOV H,A	92	SUB D	BD	CMP L	E8	RPE
12	STAX D	3D	DCR A	68	MOV L,B	93	SUB E	BE	CMP M	E9	PCHL
13	INX D	3E	MVI A,D8	69	MOV L,C	94	SUB H	BF	CMP A	EA	JPE Adr
14	INR D	3F	CMC	6A	MOV L,D	95	SUB L	C0	RNZ	EB	XCHG
15	DCR D	40	MOV B,B	6B	MOV L,E	96	SUB M	C1	POP B	EC	CPE Adr
16	MVI D,D8	41	MOV B,C	6C	MOV L,H	97	SUB A	C2	JNZ Adr	ED	–
17	RAL	42	MOV B,D	6D	MOV L,L	98	SBB B	C3	JMP Adr	EE	XRI D8
18	–	43	MOV B,E	6E	MOV L,M	99	SBB C	C4	CNZ Adr	EF	RST 5
19	DAD D	44	MOV B,H	6F	MOV L,A	9A	SBB D	C5	PUSH B	F0	RP
1A	LDAX D	45	MOV B,L	70	MOV M,B	9B	SBB E	C6	ADI D8	F1	POP PSW
1B	DCX D	46	MOV B,M	71	MOV M,C	9C	SBB H	C7	RST 0	F2	JP Adr
1C	INR E	47	MOV B,A	72	MOV M,D	9D	SBB L	C8	RZ	F3	DI
1D	DCR E	48	MOV C,B	73	MOV M,E	9E	SBB M	C9	RET Adr	F4	CP Adr
1E	MVI E,D8	49	MOV C,C	74	MOV M,H	9F	SBB A	CA	JZ	F5	PUSH PSW
1F	RAR	4A	MOV C,D	75	MOV M,L	A0	ANA B	CB	—	F6	ORI D8
20	RIM	4B	MOV C,E	76	HLT	A1	ANA C	CC	CZ Adr	F7	RST 6
21	LXI H,D16	4C	MOV C,H	77	MOV M,A	A2	ANA D	CD	CALL Adr	F8	RM
22	SHLD Adr	4D	MOV C,L	78	MOV A,B	A3	ANA E	CE	ACI D8	F9	SPHL
23	INX H	4E	MOV C,M	79	MOV A,C	A4	ANA H	CF	RST 1	FA	JM Adr
24	INR H	4F	MOV C,A	7A	MOV A,D	A5	ANA L	D0	RNC	FB	EI
25	DCR H	50	MOV D,B	7B	MOV A,E	A6	ANA M	D1	POP D	FC	CM Adr
26	MVI H,D8	51	MOV D,C	7C	MOV A,H	A7	ANA A	D2	JNC Adr	FD	–
27	DAA	52	MOV D,D	7D	MOV A,L	A8	XRA B	D3	OUT D8	FE	CPI D8
28	–	53	MOV D,E	7E	MOV A,M	A9	XRA C	D4	CNC Adr	FF	RST 7
29	DAD H	54	MOV D,H	7F	MOV A,A	AA	XRA D	D5	PUSH D		
2A	LHLD Adr	55	MOV D,L	80	ADD B	AB	XRA E	D6	SUI D8		

D8 = 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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