1521/204
1601/204
MICRO-ELECTRONICS, ELECTRICAL PRINCIPLES II, ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS
Oct./Nov. 2016
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;
8085 instruction set;
*This paper consists of **TWO** sections; **A** and **B**.*
*Answer **ALL** the questions from section **A** and any **ONE** question from section **B**.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 6 printed pages.

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

Turn over

SECTION A

Answer ALL questions from this section.

1. (a) Define the following terms as used in alternating current (AC) generation:

(i) Form factor;
(ii) Periodic time. (4 marks)

(b) AC voltage at any instance is given by:

$V = 339.4 \sin (300 \pi t - 1.047)$. Determine:

(i) average and peak value of voltage;
(ii) Rms value and frequency of voltage;
(iii) phase angle;
(iv) V when $t = 1.67 \times 10^{-3}$s;
(v) t when v = 120 V. (11 marks)

(c) Draw a labelled diagram showing the construction features of a moving coil instrument. (5 marks)

2. (a) With respect to alternating current circuits, state **two**:

(i) advantages of high power factor;
(ii) methods of improving low power factor. (4 marks)

(b) A 5 Ω resistor, a 0.5 mH inductor and a 1.25 μF capacitor are connected in parallel across 240 V AC supply. Determine the:

(i) resonant frequency;
(ii) dynamic impedance;
(iii) Q-factor;
(iv) band-width. (10 marks)

(c) A coil has an inductance of 25 mH and a resistance of 15 Ω. It is connected across a 10 V dc supply. Determine the:

(i) time constant;
(ii) initial rate of rise of current;
(iii) final value of current. (6 marks)

3. (a) State any **two** 8085 CPU instructions to perform each of the following operations:

(i) arithmetic;
(ii) logical;

(iii) input/output;
(iv) branch. (8 marks)

(b) (i) Convert each of the following decimal numbers into hexadecimal:

(I) 59;
(II) 13;

(ii) Write an assembly language program to perform the following:

59 x 4 + 13. (6 marks)

(c) Table 1 shows an 8085 hexadecimal machine code program. using the 8085 instruction set, convert the program into 8085 mnemonic program. (6 marks)

Table I

Address (Hex)	Machine code (Hex)
2000	21
2001	00
2002	30
2003	01
2004	00
2005	40
2006	09
2007	76

4. (a) Define the term maintenance. (2 marks)

(b) (i) Name **three** instruments used in fault finding in DC and AC machines.
(ii) Outline the visual inspections carried out on an a.c motor during maintenance. (6 marks)

(c) Describe the following tests conducted on an electric machine:

(i) continuity test on a starter of the motor;
(ii) insulation resistance test performed on the motor. (6 marks)

(d) (i) Describe the tests and checks performed on a single phase A.C. motor that hums and fails to start.
(ii) State **three** possible faults that may cause a three phase a.c machine fail to start. (6 marks)

SECTION B

*Answer any **ONE** question from this section.*

5. (a) Show that apparent power of a three phase, star connected balanced load is given by $VA = \sqrt{3} V_L I_L$ volt amperes. (4 marks)

(b) Draw a **three** phase four wire distribution wiring system and indicate the line and phase voltages from a three phase transformer. (5 marks)

(c) Three single phase loads of 12 KW at 0.8 power factor (pf), 9.6 KVA load at 0.9 pf and 8.4 KW at unity pf are connected to Red, yellow and Blue phases respectively. The line voltage is 415 volts. Determine the:

(i) phase currents;
(ii) neutral current. (11 marks)

6. (a) Explain the functions of the following components in a discharge lamp:

(i) capacitor;
(ii) choke. (4 marks)

(b) (i) Explain the cause of stroboscopic effect in rotating machines under fluorescent lighting.
(ii) Describe **two** ways of minimising the effect in b (i). (10 marks)

(c) Draw a labelled circuit diagram of glow type starter switch in a fluorescent lamp. (6 marks)

7. (a) Name **five** common faults found in d.c machines. (5 marks)

(b) State any **two** periodic maintenance practices done on each of the following parts of a d.c. machine:

(i) brushes;
(ii) commutator;
(iii) windings. (6 marks)

(c) Table 2 shows possible symptoms in dc machines. Complete the table to indicate **two** possible causes and their respective remedies. (9 marks)

Table 2

	Fault	Possible cause	Remedy
(i)	Motor fails to start		
(ii)	On-load, excessive current is observed and armature coils heat up		
(iii)	On load, the motor sparks		

8. (a) Define each of the following with respect to memories:

(i) access time;
(ii) volatile;
(iii) random access. (6 marks)

(b) A 16 KX 8 - bits RAM memory is implemented using 4 K x 8 memory chips.

(i) Determine the number of:

(I) 4 K x 8 RAM chips required;
(II) address lines of 4K x 8 RAM chip.

(ii) Draw a schematic block diagram of the memory implementation. (8 marks)

(c) With the aid of a labelled diagram, explain the operation of magnetic bubble memory. (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	D7	RST 2
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 SPD16	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	DRC F	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
29	--	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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