

1521/204

1601/204

MICROELECTRONICS, ELECTRICAL
PRINCIPLES II, ELECTRICAL MAINTENANCE
AND FAULT DIAGNOSIS

Oct./Nov. 2017

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC
TECHNOLOGY
(POWER OPTION)
MODULE II**

MICROELECTRONICS, ELECTRICAL PRINCIPLES II,
ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS

3 hours

INSTRUCTIONS TO CANDIDATES

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

*Answer **ONE** question from section **A**, **THREE** questions from section **B** and **ONE** question from section **C** in the answer booklet provided.*

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

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.**

SECTION A: MICROELECTRONICS

Answer ONE question from this section.

1. (a) (i) Describe the **three** main components of a microprocessor.
- (ii) With reference to Intel 8085 microprocessor, explain the importance of the following pins on the chip package.
- I. ALE
- II. READY
- (10 marks)
- (b) State **two** advantages of assembly language over high level language programming. (2 marks)
- (c) Starting at address 3000 H, write an assembly language program that will add two decimal numbers 36748 located at memory address starting 3500 H and 38117 located at memory address starting 3502 H. The result is stored in memory starting at 3504 H. (8 marks)
2. (a) State any **three** performance features considered when selecting a memory device for a given application. (3 marks)
- (b) Explain the function of the following internal microprocessor registers:
- (i) Accumulator;
- (ii) Memory address register;
- (iii) Program counter. (6 marks)
- (c) For each of the following instructions; state the addressing mode used and its bit size.
- (i) STAX B
- (ii) LHLD 4000 H
- (iii) ADD B (6 marks)
- (d) A microcomputer has 24 address lines and 8 data lines. Determine its:
- (i) word size;
- (ii) maximum number of addressable memory locations;
- (iii) number of hexadecimal digits needed to give an address code. (5 marks)

SECTION B: ELECTRICAL PRINCIPLES II

Answer any **THREE** questions from this section.

3. (a) Define the following terms as used in single phase a.c. circuits.

- (i) Cycle;
- (ii) Periodic time;
- (iii) Amplitude.

(6 marks)

(b) Two alternating currents are represented by $i_1 = 10 \sin \omega t$ and $i_2 = 20 \sin (\omega t + \frac{\pi}{3})$.

- (i) Sketch the phasor diagram and determine the resultant current.
- (ii) Write the equation for the resultant current.

$$f_0 = \frac{\omega L}{\sqrt{LC}}$$

(14 marks)

4. (a) State **four** conditions observed at resonance in a.c series circuits.

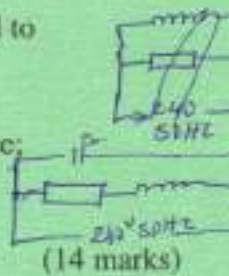
(4 marks)

(b) Explain the term 'Quality factor' as used in parallel a.c circuits.

(2 marks)

(c) An inductive circuit of resistance 10Ω and inductance 0.02 H is connected to 240V , 50Hz supply. Determine the:

- (i) Value of capacitor connected in parallel that will produce resonance;
- (ii) branch currents;
- (iii) supply current.



(14 marks)

$$I = \frac{I_m + I_a}{I - I_m}$$

5. (a) Outline **four** physical effects of electric current utilized in the operation of electrical measuring instruments.

(4 marks)

(b) (i) With aid of a diagram, describe the construction of an electrodynamical moving coil instrument.

(ii) State **three** applications of the instrument in b(i).

(9 marks)

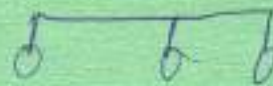
(c) (i) Illustrate how the range of a voltmeter can be extended.

(ii) The voltmeter in c(i) has a resistance of 15Ω and gives full scale deflection when carrying a current of 100 mA . Determine the resistance required for the instrument to read up to 0.7 kV .

(7 marks)

$$f_1 = \frac{\omega L}{\sqrt{LC}}$$

10/10
10/10
10/10



- 6-
- (a) State two advantages of the interconnection of power stations for a.c power distribution.
 - maintain power been supplied over a long distance (2 marks)
- (b) (i) Draw a circuit diagram for power measurement in unbalanced load using the three-wattmeter method.
- (ii) A three phase motor driving a posho mill has a power factor of 0.5. Two wattmeters connected to measure the input power read 25 kW. Determine the reading of each wattmeter.

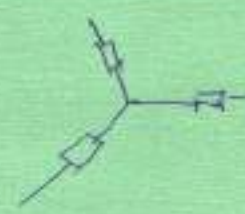
(12 marks)

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- (c) Three similar resistors are connected in star across a 415V, 3-phase lines. The line current is 10A. Determine the:

- (i) phase current; ✓
 (ii) phase voltage; ✓
 (iii) value of each resistor. ✓

$I_L = I_P$



$\frac{V_L}{\sqrt{3}}$

(6 marks)

SECTION C: ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS

Answer ONE question from this section.

7. (a) (i) Outline two ways in which stroboscopic effect can be dangerous.
- (ii) Illustrate how twin tube fitting of fluorescent lamps may be connected to minimize the effect in a(i) when connected to a single phase a.c supply. (7 marks)
- (b) (i) Describe the procedure of finding faults in underground electric cables.
- (ii) Show using a diagram the fault condition of a three core cable whose insulation resistance measurements are given as:

- Red core to earth - infinity
- Red core to yellow core - infinity
- Yellow core to earth - 100 KΩ
- Red core to blue core - infinity
- Blue core to earth - zero
- Yellow core to blue core - 100 KΩ

(10 marks)

(c) A d.c. machine was dismantled during annual maintenance and the following observed:

- (i) dirt, oil and grease on the surface;
- (ii) some parts had rusted;
- (iii) worn out ball bearings.

Outline for each, **one** remedy to be done.

(3 marks)

8. ✓ (a) State:

- (i) **five** objectives of preventive maintenance in a manufacturing company.
- (ii) **four** important functions of a preventive maintenance programme.

(9 marks)

(b) Outline **three** maintenance checks carried out for the following a.c motor faults.

- (i) Fuses blow or overload trip operates when any attempt is made to start the motor.
 - over load
 - short circuit
- (ii) Three phase motor hums but does not start.
 - single phasing
 - low voltage
- (iii) Single phase motor hums but does not start.

(9 marks)

(c) List **two** types of electrical faults occurring in electrical installation.

(2 marks)

- earth continuity
-

$$\sinh = \frac{e^x + e^{-x}}{e^x - e^{-x}}$$

$$\tanh = \frac{\cosh \sinh}{\cosh}$$

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	2B	DCX H	56	MOV D,M	81	ADD C	AC	XRA H	D7	RST 2
01	LXI B,DB	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,DB	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	DRA B	DB	IN DB
05	DCR B	30	SIM	5B	MOV E,E	86	ADD M	B1	DRA C	DC	CC Adr
06	MVI B,DB	31	LXI SP,DB	5C	MOV E,H	87	ADD A	B2	DRA D	DD	—
07	RLC	32	STA Adr	5D	MOV E,L	88	ADC B	B3	DRA E	DE	SBI DB
08	—	33	INX SP	5E	MOV E,M	89	ADC C	B4	DRA H	DF	RST 3
09	DAB B	34	INR M	5F	MOV E,A	8A	ADC D	B5	DRA L	E0	RPO
0A	LDAX B	35	DCR M	60	MOV H,B	8B	ADC E	B6	DRA M	E1	POP H
0B	DCX B	36	MVI M,DB	61	MOV H,C	8C	ADC H	B7	DRA 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	CPG Adr
0E	MVI C,DB	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 DB
10	—	3B	DCX SP	66	MOV H,M	91	SUB C	BC	CMP H	E7	RST 4
11	LXI D,DB	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,DB	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,DB	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	ERI DB
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 DB	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	HI
1D	DCR E	48	MOV C,B	73	MOV M,E	9E	SBB M	C9	RET Adr	F4	CP Adr
1E	MVI E,DB	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 DB
20	RIM	4B	MOV C,E	76	HLT	A1	ANA C	CC	OZ Adr	F7	RST 6
21	LXI H,DB	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 M,B	A3	ANA E	CE	ACL DB	F9	SPhL
23	INX H	4E	MOV C,M	79	MOV M,C	A4	ANA H	CF	RST 1	FA	JM Adr
24	INR H	4F	MOV C,A	7A	MOV M,D	A5	ANA L	D0	RNC	FB	EI
25	DCR H	50	MOV D,B	7B	MOV M,E	A6	ANA M	D1	POP D	FC	CM Adr
26	MVI H,DB	51	MOV D,C	7C	MOV M,H	A7	ANA A	D2	JNC Adr	FD	—
27	DAA	52	MOV D,D	7D	MOV M,L	A8	XRA B	D3	OUT DB	FE	CFI DB
28	—	53	MOV D,E	7E	MOV M,M	A9	XRA C	D4	CNC Adr	FF	RST 7
29	DAD H	54	MOV D,H	7F	MOV M,A	AA	XRA D	D5	PUSH D		
2A	LHLD Adr	55	MOV D,L	80	ADD B	AB	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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