Name_____ Index No._____

Candidate's Signature_____

Date _____

1521/204
1601/204
MICRO-ELECTRONICS, ELECTRICAL PRINCIPLES II, ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS
Oct/Nov 2013
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

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have the following for this examination:
a non-programmable electronic calculator/mathematical table;
8085 instruction set.
*This paper consists of **TWO** Sections: **A** and **B**.*
*Answer **ALL** the questions in Section **A** and any **ONE** question from Section **B** in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	20	
	2	20	
	3	20	
	4	20	
B		20	
		Total Score	

This paper consists of 24 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** the question in this Section in the spaces provided.*

1. (a) Define the following terms as used in D.C. transients:

(i) transient time;

(ii) time constant. (4 marks)

(b) (i) The voltage (V_C) across a capacitor C is initially charged at V volts. It is then discharged through a resistance of R ohms . Show that the voltage V_C is given by the expression: $V_C = Ve^{-t/RC}$.

(ii) Figure 1 shows a typical growth curve of current in an R - L circuit where τ = time constant. Determine the:

I transient period;

II time constant. (12 marks)

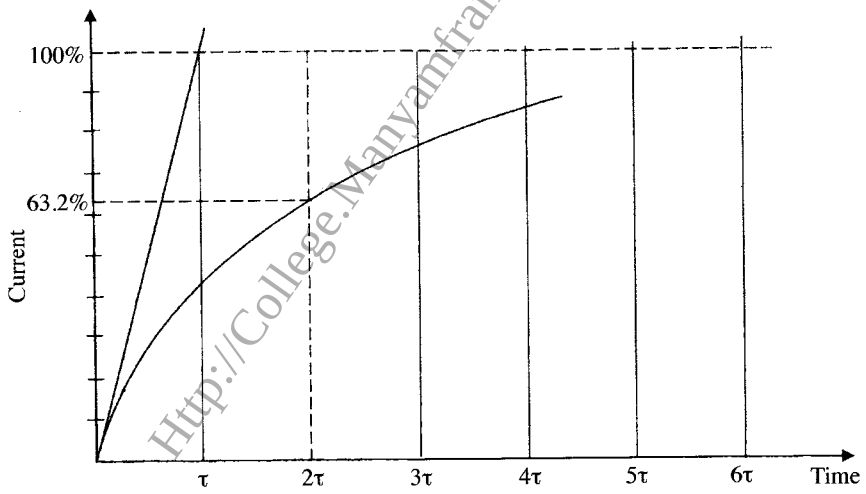


Fig. 1

(c) A d.c. voltage of 120 V is applied across of coil of resistance 8 Ω and inductance 12 H. Determine the value of current, 0.3 seconds after switching on the supply. (4 marks)

2. (a) (i) Define the following terms as used in a.c. systems:

I frequency;

(ii) form-factor.

(ii) State any **two** reasons for using sine waves in a.c. circuit analysis. (6 marks)

(b) Two currents are represented by the expressions:

$i_1 = 4\sin(\omega t - \pi/4)$
$i_2 = 2\sin(\omega t + \pi/6)$

(i) draw to scale, on the same axes, the phasor diagram of currents i_1 and i_2;

(ii) using the drawing in (b) (i), determine the sum of currents expressed in the form: $i = I\sin(\omega t - \alpha)$. (7 marks)

(c) A single phase a.c. circuit consists of a coil of inductance 0.05 H and effective resistance 5 Ω connected in parallel with a 0.1 μF capacitor.

(i) Draw the circuit diagram;

(ii) Determine the:

I frequency of circuit at resonance;

II dynamic resistance. (7 marks)

3. (a) State the functions of the following microprocessor registers:

(i) program counter;

(ii) instruction register;

(iii) stack pointer. (3 marks)

(b) Draw a labelled block diagram of a microprocessor based system and state the function of each block. (9 marks)

(c) (i) State the **two** parts on an instruction.

(ii) Describe the functions of the following groups of instructions stating **one** example in each case:

I data manipulation;

II transfer of control;

III input/output. (8 marks)

4. (a) (i) State:

I **three** objectives of the health and safety at work act 2007;

II any **two** steps that a safety engineer or inspector would take when the objectives in (I) above are not observed.

(ii) Outline **five** precautions taken to safeguard safety of personnel in a workshop environment. (10 marks)

(b) State any **two** causes of each of the following faults in a d.c. machine:

(i) generator fails to excite;

(ii) excessive sparking at the commutator;

(iii) starter of a d.c. motor fails to hold in ON-position although the motor starts correctly. (6 marks)

(c) List **four** installation and wiring requirements of electric motors. (4 marks)

SECTION B

*Answer any **ONE** question from this Section in the spaces provided.*

5. (a) (i) Outline the procedure of carrying out routine maintenance checks on a d.c. motor.

(ii) With the aid of circuit diagrams, describe how the following performance tests are carried out on three phase squirrel cage induction motors:

I open-circuit test;

II short-circuit test.

(iii) Describe any **two** abnormal conditions that are likely to occur during the operation of the motors in (a) (ii). (16 marks)

(b) (i) Explain the reasons for keeping a record of work carried out together with possible test results after a maintenance exercise.

(ii) List any **two** test instruments used during maintenance and servicing of equipment. (4 marks)

6. (a) (i) State the purpose of the following torques in measuring instrument:

I damping;

II deflecting.

(ii) Table 1 shows a comparison of moving coil and moving iron instrument parts. Fill in the missing sections.

Table 1

Type of Instrument	Moving Coil	Moving Iron
Scale	Linear	
Damping		Air
Control	Hairspring	

(iii) State any **three** advantages of digital over analogue instruments. (8 marks)

(b) A three phase alternator has its windings connected in star. The voltages induced in the windings are:

$e_R = E_m \sin \omega t$
$e_y = E_m \sin(\omega t - 120^\circ)$
$e_B = E_m \sin(\omega t - 240^\circ)$

where Em is the maximum value of voltage:

(i) draw on the same axis the waveforms to represent the three voltages;

(ii) show that $e_R + e_y + e_B = 0$. (8 marks)

(c) Show that the power dissipated in a three phase delta connected load is given by the expression $p = \sqrt{3} V_L I_L \cos\varphi$ watts. (4 marks)

7. (a) Describe the following memory types:

(i) primary;

(ii) back-up. (4 marks)

(b) (i) With the aid of a diagram, explain the operation of a dynamic random access memory cell (DRAM).

(ii) State **one** advantage of the cell in (b) (i) over static random access memory (SRAM). (8 marks)

(c) Table 2 shows a 8085 program listing. Using Intel 8085 instruction set, hand code the program, indicating the corresponding memory location. (8 marks)

Table 2

ORG	8000 H
LX I	H 8050 H
MVI	A 29 H
MOV	B, A
MVI	A 23 H
MOV	C, A
MVI	A 2 CH
ADD	C
MOV	M, A
SUB	B
INX	H
MOV	M, A
HLT	

8. (a) State any **three** common faults in discharge lamp circuits. (3 marks)

(b) List any **two** possible causes for each of the following faults in a three phase synchronous motor:

(i) smoke emitted from the machine;

(ii) shock experienced on touching the casing;

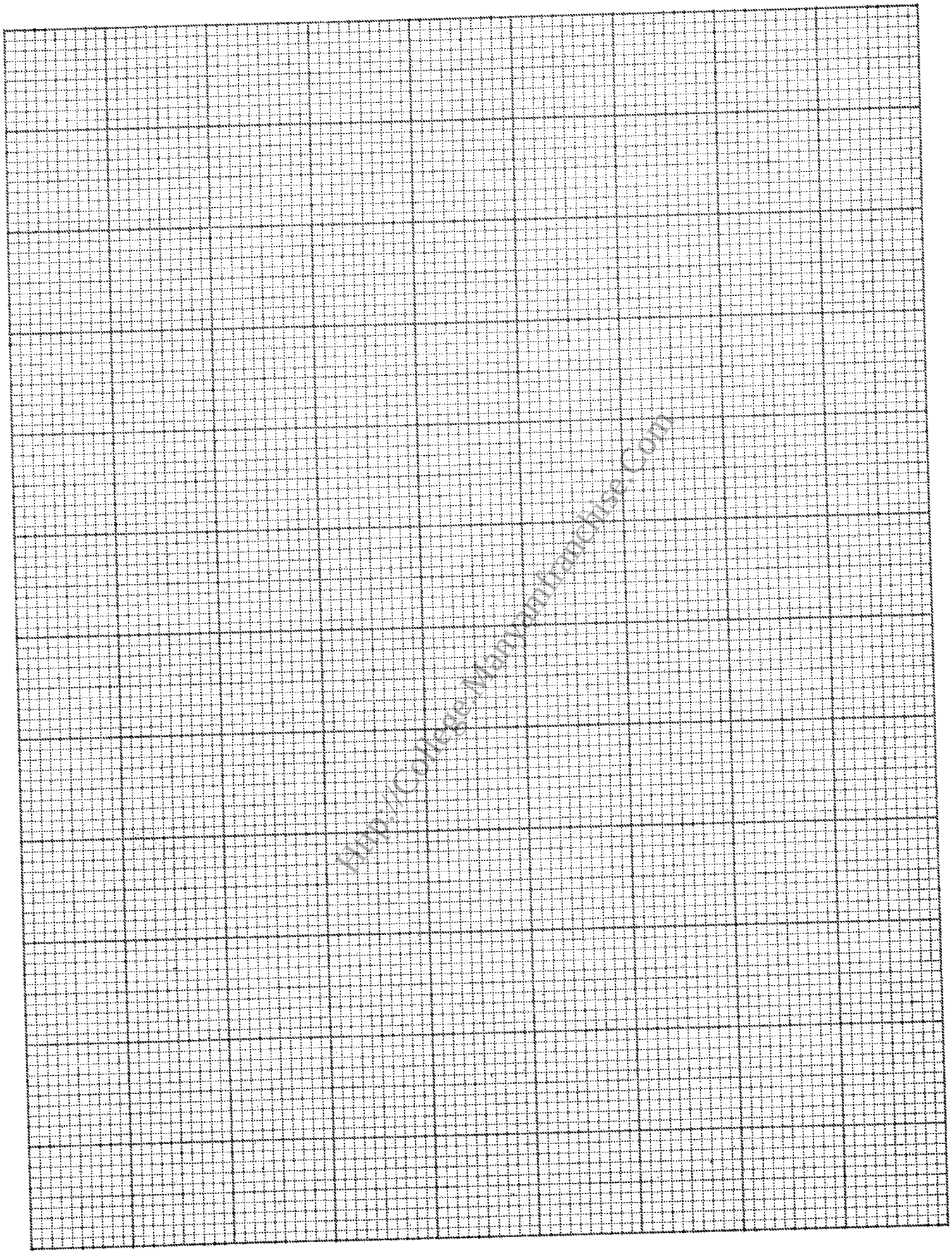
(iii) machine does not start when switched on;

(iv) machine starts and then stops. (8 marks)

(c) In a college workshop, at least two technicians are reported injured every year while carrying out visual inspection on some machines. The maintenance supervisor has come to the realization that this happens because the technicians assume that the machines are stationary.

(i) Explain the effect which causes the machines to appear stationary;

(ii) With the aid of a circuit diagram, illustrate how the effect in (c) (i) may be minimized. (9 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	2B	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	8G	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	ERI 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 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.