**1521/204**
**1601/204**
**MICRO-ELECTRONICS, ELECTRICAL PRINCIPLES II, ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS**
**June/July 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:*

*Non-programmable electronic calculator/mathematical table;*
*Answer booklet.*

*This paper consists of **TWO** sections; **A** and **B**.*
*Answer **ALL** the questions in section **A**, and **ONE** question from section **B**.*
*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.**



**Turn over**

## SECTION A

*Answer **ALL** the questions in this section.*

1. (a) Define the following terms as used in a.c. generation:

(i) frequency;

(ii) root mean square value (RMS).

(4 marks)

(b) Sketch the following waveforms:

(i) rectangular pulse;

(ii) sawtooth wave.

(2 marks)

(c) The instantaneous values of two voltages are given by $V_1 = 4 \sin 345.58t$ and $V_2 = 3 \sin (345.58t + \frac{\pi}{5})$. Complete table 1 and plot on same axes, graphs of $V_1$, $V_2$ and $V_1 + V_2$. Determine the:

(i) peak value of $V_1 + V_2$;

(ii) phase angle between $V_1$ and $(V_1 + V_2)$

(iii) frequency of $(V_1 + V_2)$

(iv) time taken to complete one cycle.

(14 marks)

**Table 1**

| Angle of displacement | 0° | 30° | 60° | 90° | 120° | 150° | 180° | 210° | 240° | 270° | 300° | 330° | 360° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_1$ | | | | | | | | | | | | | |
| $V_2$ | | | | | | | | | | | | | |
| $V_1 + V_2$ | | | | | | | | | | | | | |

2. (a) State **three** advantages of three phase a.c system over single phase a.c. system.

(3 marks)

(b) Derive an expression to determine the total power in three phase delta connected load.

(5 marks)

(c) (i) Draw the **two** wattmeter method of measuring 3-phase power.

(ii) A three phase load is rated 12 KW. If the power factor is 0.65 lag, determine the readings of the two wattmeters.

(12 marks)

3. (a) Define the following terms as applied in computer systems:

(i) microprocessor;

(ii) software.

(2 marks)

(b) Draw a block diagram of a digital computer system and state the function of each component part. (7 marks)

(c) (i) Describe an assembly language program.

(ii) Two hexadecimal numbers 32H and A2H are added after being loaded into registers B and C respectively. The sum is then displayed at the LED output of port (01H). Write the assembly language program to execute the operation.

(5 marks)

(d) Explain the following memory back-up devices:

(i) Hard disk;
(ii) Digital versatile disk;
(iii) Flash disk.

(6 marks)

4. (a) State **two**:

(i) classification of discharge lamps in relation to how the discharge is initiated;

(ii) functions of a capacitor in a discharge lamp.

(4 marks)

(b) Draw a labelled lead-lag circuit of a fluorescent lamp. (4 marks)

(c) Identify **two** causes of the following symptoms with respect to d.c machines:

(i) sparking on load;

(ii) difficulty in starting accompanied by excessive heating of starter.

(4 marks)

(d) (i) State **four** objectives of preventive maintenance.

(ii) Describe the following types of maintenance schedules:

(I) planned;

(II) routine.

(8 marks)

## SECTION B

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

5. (a) Outline **two** storage procedures of a.c machines (2 marks)

(b) Identify **two** causes for each of the following symptoms in three phase a.c machines:

(i) induction motor fails to start;
(ii) synchronous motor runs noisly;
(iii) all motor phases burnt out.

(6 marks)

(c) State **two** causes and their remedies for each of the following in fluorescent lap circuits:

(i) lamp flickers and does not start;
(ii) choke overheats.

(6 marks)

(d) With the aid of a labelled diagram, explain how to locate the position of an open circuit on an armature coil of a d.c machine using the voltage drop method.

(6 marks)

6. (a) Define the following terms as used in a.c R-L-C circuits.

(i) Resonance;

(ii) Quality factor.

(4 marks)

(b) A series a.c circuit resonates at a frequency of 60 Hz. It consists of a resistor of 15Ω, an inductor of 0.6H and a capacitor of unknown value. The supply voltage is 240V, determine the:

(i) supply current;
(ii) value of the capacitor;
(iii) Q-factor;
(iv) voltage across the capacitor;
(v) bandwidth.

(10 marks)

(c) (i) Draw a circuit diagram of a moving coil instrument that is used to measure alternating current.

(ii) A moving coil instrument gives a full scale deflection with a current of 50 mA and a resistance of 20Ω. Determine the value of a shunt that will enable it to measure a current of 100A. (3 marks)

(d) A moving coil instrument gives a full scale deflection of 20 mA when the potential difference across its terminals is 200 mV. Determine the shunt resistance for a full scale deflection corresponding to 100 A. (3 marks)

7. (a) Define the following terms with reference to programming:

(i) hand assembly;
(ii) assembler;
(iii) sub-routines.

(6 marks)

(b) Draw the architecture of an Intel 8085 microprocessor. (7 marks)

(c) (i) List **two** addressing modes as used in 8085 microprocessor;

(ii) Draw a labelled diagram of an 8 bit memory map of a typical microcomputer system and give the range of memory addresses. (7 marks)



8. (a) List **three** methods of locating faults in electrical systems. (3 marks)

(b) (i) Explain the need of each of the following tests carried out on a three phase induction motor:

(I) continuity;
(II) Insulation resistance.

(4 marks)

(ii) State the type of measuring instrument used for each test in b(i) and the expected reading. (4 marks)

(c) (i) State **five** factors to be considered when planning a preventive maintenance program.

(ii) Explain the following effects on the performance of fluorescent lamps:

(i) voltage variation;
(ii) temperature.

(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 | LX1 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.



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