Name:_____ Index No:_____/_____

1602/204
1522/204
MICROELECTRONICS, ELECTRICAL PRINCIPLES II, INSTRUMENTS AND ELECTRONIC FAULT DIAGNOSIS
Oct./Nov. 2015
Time: 3 hours

Candidate's Signature: _____

Date:_____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY (TELECOMMUNICATION OPTION)

MODULE II

MICROELECTRONICS, ELECTRICAL PRINCIPLES II, INSTRUMENTS AND ELECTRONIC 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 a Scientific calculator/mathematical table and 8080/8085 Instruction set for this examination.
*This paper consists of **EIGHT** questions in **THREE** sections; **A, B** and **C**.*
*Answer **ONE** question from section **A**, **TWO** questions from section **B** and **TWO** questions from section **C** in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
*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		20	
B		20	
		20	
C		20	
		20	
	Total Score	**100**	

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: MICRO-ELECTRONICS

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

1. (a) State the function of each of the following microprocessor registers:

(i) index;
(ii) stack pointer;
(iii) segment.

(3 marks)

(b) List any **two** characteristics of each of the following Intel microprocessors:

(i) 8085;
(ii) 8086;
(iii) pentium IV.

(6 marks)

(c) A 4 K x 8 RAM memory is implemented using 1 K x 8 memory chips.

(i) Determine the number of

(I) 1K x 8 chips required;

(II) Address lines for each 1 K x 8 memory chip.

(ii) draw the memory chip organisation. (8 marks)

(d) State **three** advantages of DRAM over SRAM memories. (3 marks)

2. (a) Define each of the following microprocessor addressing modes, illustrating each with an example:

(i) register;
(ii) direct;
(iii) indexed.

(6 marks)

(b) Table 1 shows an assembly language program segment and its corresponding machine code. Fill in the missing data. (10 marks)

Table 1

Address (Hex)	Machine code (Hex)	Instruction	Comment
1800	01 ___ ___	LX1 B, 40 ___	(BC) ← (4030H)
1803	21 50 20	LX1 H, ___ ___	(HL) ← (2050H)
_____	_____	DAD B	HL ← HL + BC
1807	3E 4E	MV1 A, ____	(A) ← (___)
1809	____ 4A	MV1 B, 4 AH	(B) ← (4 A H)
_____	____	ADD B	A ← A + B
180 C	76	HLT	

(c) Arrange the following microcomputer memories in terms of access times, starting with the fastest: magnetic cassette, DRAM, SRAM, hard disk. (4 marks)

SECTION B: ELECTRICAL PRINCIPLES II

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

3. (a) (i) State the **two** methods of damping used in analog instruments.

(ii) With the aid of a labelled diagram describe spring control of a spindle in moving coil instruments. (9 marks)

(b) Figure 1, shows a block schematic of a digital voltmeter. Describe its operation. (5 marks)

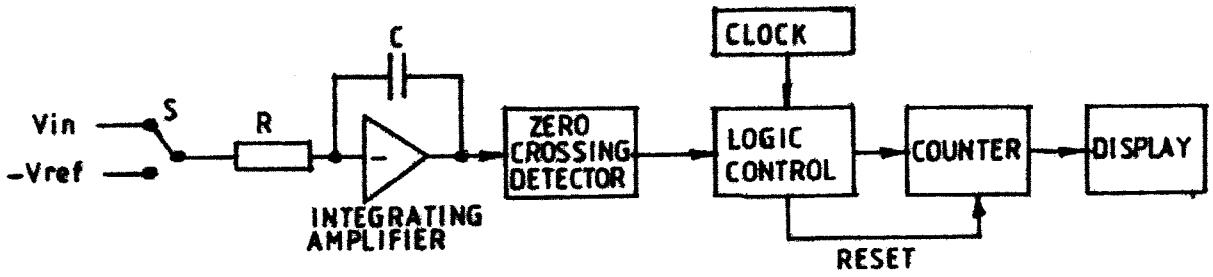


Fig. 1

(c) A moving-iron instrument requires 400 ampere-turn to give full-scale deflection. Determine the:

(i) number of turns in the shunt coil to enable the instrument be used as an ammeter reading upto 50 A;

(ii) number of turns in the multiplier coil to enable the instrument be used as a voltmeter reading up to 300 V;

(iii) resistance of the multiplier coil.

(6 marks)

4. (a) (i) Define each of the following with respect to alternating quantities:

(I) waveform;
(II) amplitude.

(ii) A sinusoidal voltage of frequency 60 Hz has a maximum value of 120 V.

(I) write down the expression for the instantaneous value of the voltage;
(II) determine the time taken by the voltage to rise from 0 V to 96 V.

(10 marks)

(b) (i) Draw a circuit diagram illustrating a 3-phase star connected generator feeding a 3-phase star connected load via a 3-phase, 4-wire system.

(ii) The ratio of the readings of the two wattmeters connected to measure power in a 3-phase balanced load is $W_2:W_1 = 3:1$. Determine the load power factor.

(10 marks)

5. (a) Figure 2 shows a circuit diagram of a parallel R - L network.

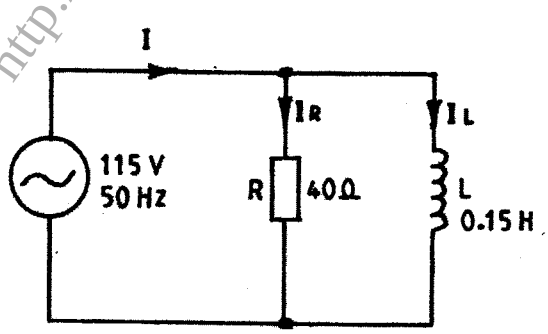


Fig. 2

(i) Determine the following:

(I) current through resistor R;
(II) current through inductor L;
(III) current taken from the supply;
(IV) phase angle between the supply current and the supply voltage.

(ii) Draw the phasor diagram for the circuit using the values determined in 5a(i). (12 marks)

(b) A 2 μF capacitor is connected to a 100 V dc supply through a 1 MΩ series resistor. Determine the:

(i) time constant of the circuit;

(ii) initial charging current;

(iii) voltage across the capacitor after 6 seconds;

(iv) time taken for the capacitor to be full charged. (8 marks)

SECTION C: INSTRUMENTS AND ELECTRONIC FAULT DIAGNOSIS

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

6. (a) (i) State the function of each of the following controls on an oscilloscope:

(I) focus;
(II) vertical position;
(III) volts/division.

(ii) Explain any **three** measures that should be taken to ensure the safety of test instruments. (9 marks)

(b) With the aid of a labelled diagram describe the calibration of working voltmeter against a standard voltmeter. (7 marks)

(c) A voltmeter having a sensitivity of 2,000 Ω/V is used to measure the voltage across a circuit having an output impedance of 10 kΩ. The open circuit voltage of the circuit is 6 V. Determine the reading on the meter when it is set to a 10 V scale. (4 marks)

7. (a) Define each of the following with respect to signal source:

(i) stability;
(ii) attenuation;
(iii) range error.

(6 marks)

(b) With the aid of a labelled block diagram, describe the test for phase distortion in a audio frequency amplifier using a audio frequency signal generator and an oscilloscope.

(7 marks)

(c) A rectangular wave displayed on an oscilloscope has 1 cycle occupying 8 cm on the horizontal scale and its amplitude is 3 cm in the vertical scale. The scale setting on the oscilloscope are 20 μs/cm and 10 V/cm respectively. For the wave, determine the:

(i) period;
(ii) frequency;
(iii) peak-to-peak value.

(7 marks)

8. (a) (i) State any **two** faults in electronic circuits that can be revealed by visual inspection.

(ii) Describe the operation of a solder sucker.

(5 marks)

(b) Figure 3 shows a logic circuit diagram of a car seat belt alarm.

(i) State the:

(I) fault that will cause the LED to be ON continuously irrespective of any input state;

(II) symptoms for an open circuit in the pcb track at the output of gate D.

(ii) Explain the effect of an open circuit in the power supply (+5V) line to IC_1.

(7 marks)

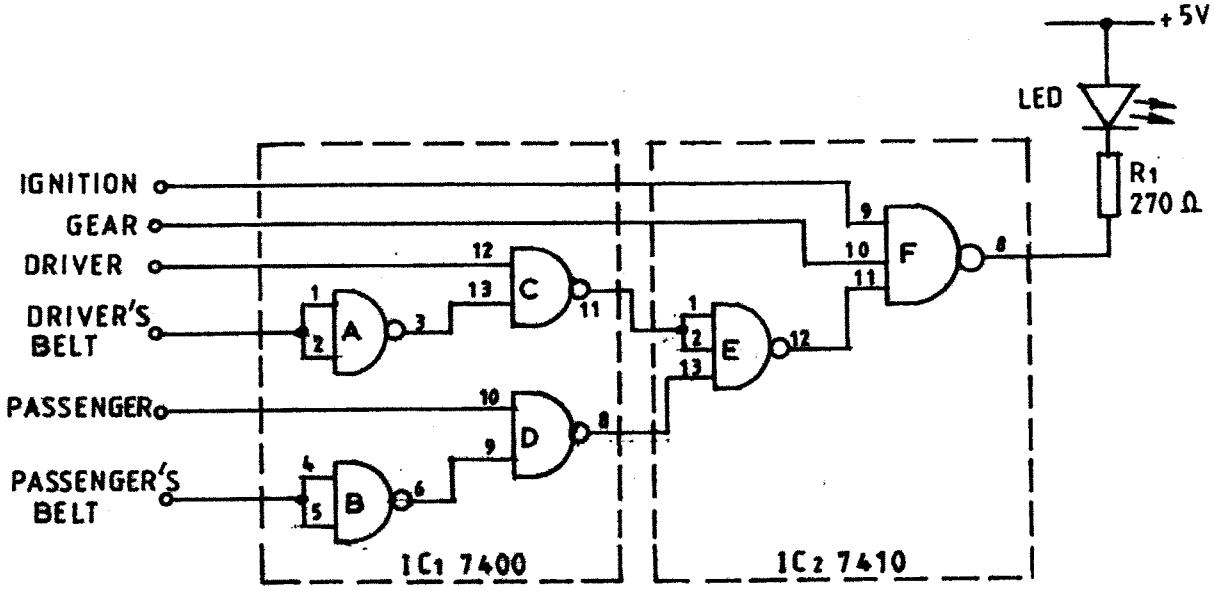


Fig. 3

(c) Figure 4 shows a circuit diagram of a common base amplifier and table 2 shows the dc bias voltages under normal and fault conditions. State the nature of the fault for each fault condition. (8 marks)

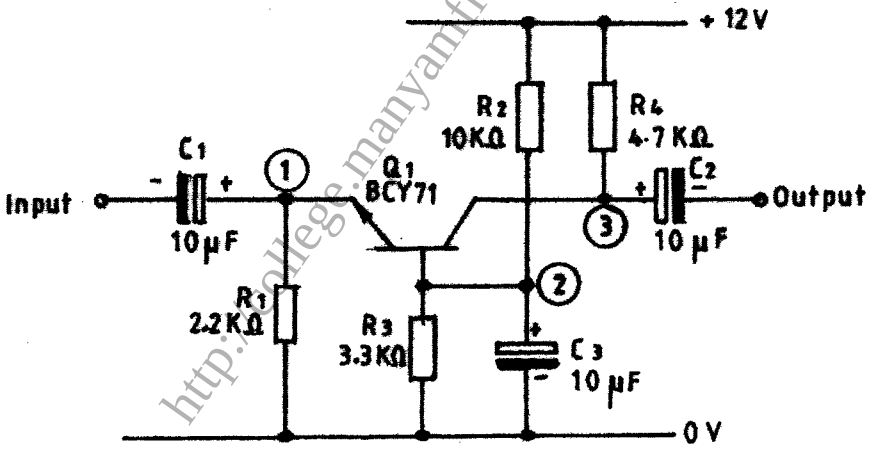
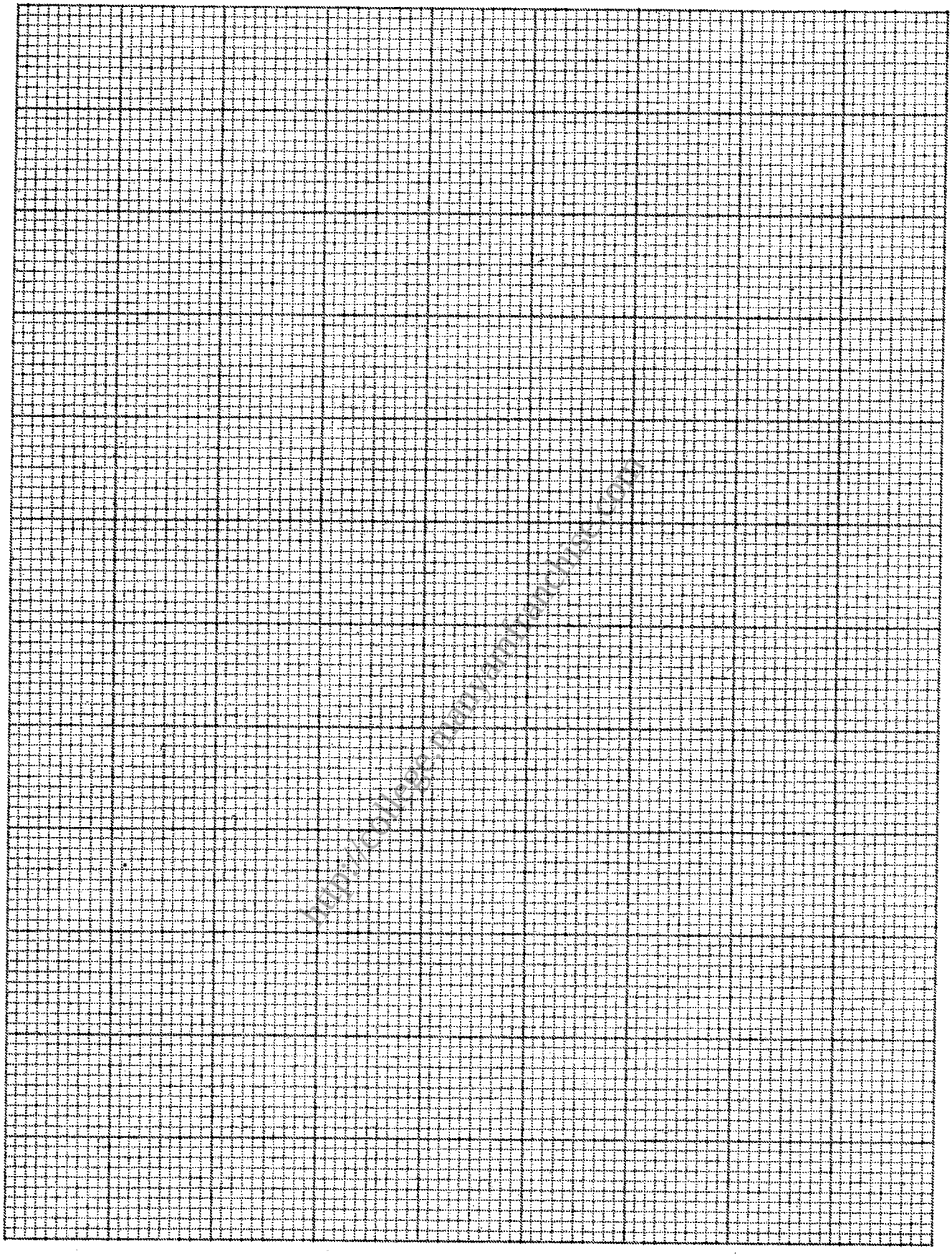


Fig. 4

Table 2

Test point	1	2	3
Normal voltage (V)	2.3	3.0	7.0
Fault A	0	0	12
Fault B	0	3	12
Fault C	3.8	3	3.8
Fault D	5.2	5.9	5.9



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.