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												-3·1	0
V_2		82·6	898	103·6	89·8	82·6	0	51·7	-88·2	-103·6	-89·7	-3·11	0·6
$V_1 + V_2$													

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)

8080/8085

Instruction set of

OP CODE	MNEMONIC	OP CODE	MNEMONIC	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	E1				
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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