MINOR 1 (2014)

(EEL375) EMBEDDED SYSTEMS

Time: 1 Hours **Max. Marks: 12 ½**

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N. B.: Do the calculations on continuation sheet provided. This is **open book/notes examination**, but **transfer** of notes to each other is strictly **prohibited**.

Take the value of *m n* = 36 for this question paper.

Q1:-The values assigned to various registers are:

DS = *m n m n* H,	**DI = 10C0 H,**	**SI = FF00 H,**	**DX = 2D *m n* H,**
SS = *m n* 00H,	**SP = 30 *m n* H,**	**BP = FF *m n* H,**	**BX = 009E H**
Theeta = 1500 H	**CS = 8765 H**		

Calculate and write the physical address of destination operand for the instructions below: **(1½)**

i) **MOV** **[DX], AL**

Physical Address = 39096 **H**

ii) **MOV** **[Theta + BP], AL**

Physical Address = 37436 **H**

III) **OUT** **2C H, AL**

Physical Address = **H**

Q2:- Write the contents of '**AL/AX**' after the last operation in the following: **(1)**

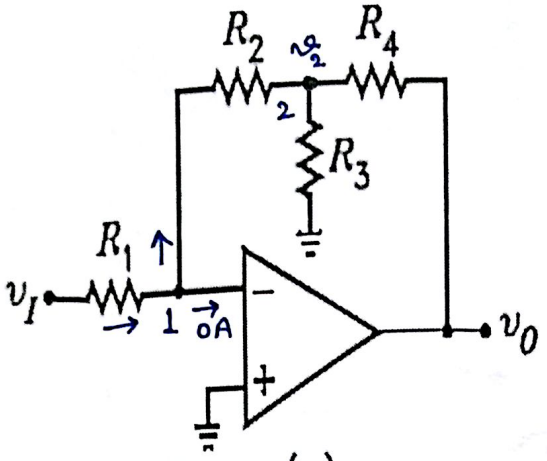
```
MOV     AL, m n H
MOV     AH, m n H
MOV     CL, 04 H
SHR     AL, CL
AND     AX, 0F0F H
AAD
```

Final **AX** after **AAD** = 3F H

Q3: - Mark correct statements with [√]. No negative marking up to **3** total markings. **(1)**

- **ADD CX, DS** [ ]
- **MOV [DI], [BX]** [ ]
- **MOV CS, AX** [ ]
- **POP CS** [✓]
- **MOV [BX+SI], SP** [✓]
- **MOV DI, [DI]** [ ]
- **MOV BX, ES** [✓]
- **MOV DS, SS** [ ]
- **MOV AL, SS** [ ]

Q4(a): - Derive an expression for the voltage gain of the circuit given below in terms of R_1, R_2, R_3 and R_4.. **(1½)**



(a)

Calculation & Answer: Let voltage at juction 2 is v_2.

Applying KCL at 1: $\frac{v_1}{R_1} = -\frac{v_2}{R_2}$ —(1)

Now applying KCL at 2: $\frac{v_2}{R_2} + \frac{v_2 - v_o}{R_4} + \frac{v_2}{R_3} = 0$

$$\Rightarrow v_2 = \frac{v_o (R_2 + R_3)}{(R_2 + R_3 + R_4)}$$

Putting value of v_2 in (1)

$$\frac{v_1}{R_1} = -\frac{v_o (R_2 + R_3)}{R_2 (R_2 + R_3 + R_4)}$$

$$\therefore \text{gain voltage} = \frac{v_o}{v_1} = -\frac{R_2 (R_2 + R_3 + R_4)}{R_1 (R_2 + R_3)}$$

(b):- Using maximum <u>two</u> operational amplifiers **design** a **Celsius thermometer** from a **Fahrenheit thermometer** (Already given). The following specifications are given: **(3)**

(1) **AD590** based Fahrenheit thermometer gives **0.32** volts output for freezing point of water and **2.12** volts for boiling point of water.

(2) **AD590** gives a change of **1 μA** current per degree Kelvin.

(3) Resistances available in laboratory are all standard values between 10 K. Ω and 1 M. Ω.

(4) The new thermometer should give 10.0 Volts for boiling water temperature and 0.0 volts for freezing temperature. Mention gain of each stage and highlight add/subtract voltages as well.

Answer:

Q5:- Draw a **neat** *(1)* **schematic-diagram** and make a self explanatory *(2)* **flow-chart** with appropriate remarks for 8086-based **kilo-watt-hour meter** (Domestic meter). Assume the following:

(a) Input voltage range **180** to **270** volts and maximum current **5** Amperes.

(b) Output device is **9** digits LCD-display and is incremented for every **0.1** Kilo-watt-hour power.

(c) The meter should have a battery backed **CMOS RAM 'FM$_1$'** for storing information (computed power)

(d) In main flow-chart compute power and store. Show use of NMI and corresponding **I. S. R.** for power failure routine (For doing tasks).

(e) Assume for writing an assembly program that voltage and current information are stored (in Hex) in CL and CH registers. Write *(3)* **an assembly program** to compute instantaneous power (Ignore assembler directives). Show when and how power is updated.

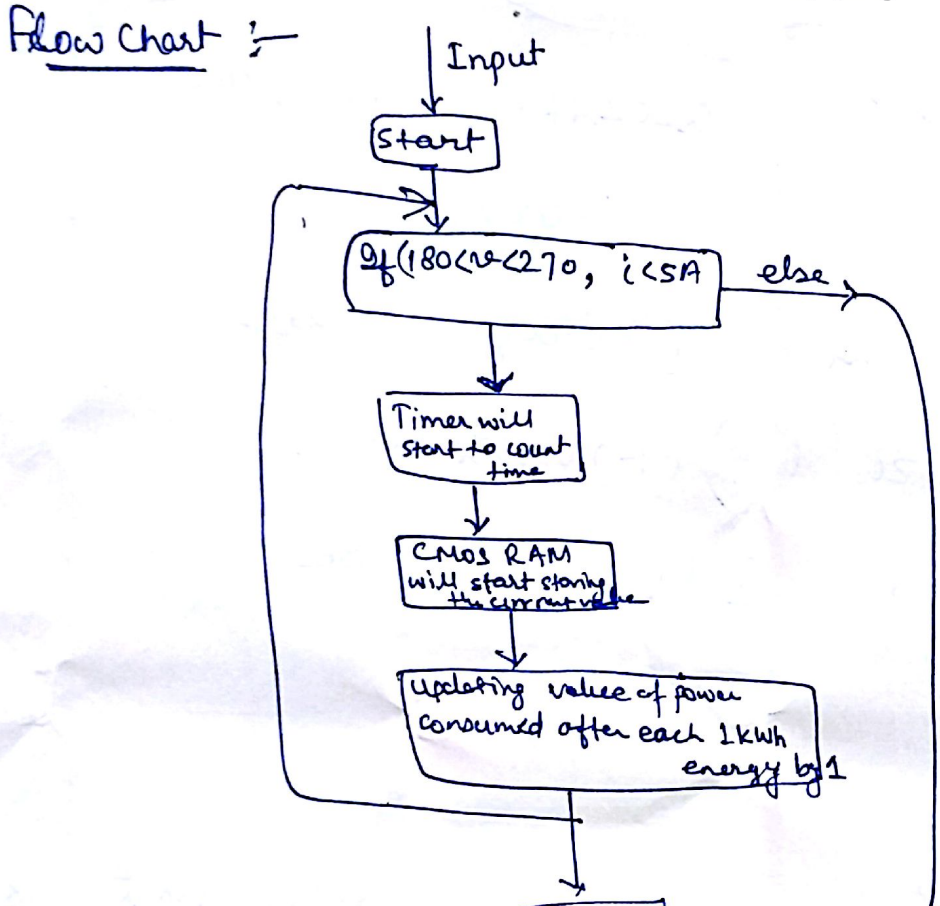
In the design **kit** the following things are **available**:

8086-CPU board with any desired numbers of ports, **A to D** converters, **D to A** converters, voltage transformer, current transformer, Hall sensor, **LCD** display, Timers of desired durations and other peripheral devices.

Assume any thing which you need. (Clearly and neatly implement algorithm for updating the display).

ANSWER: **Schematic-diagram, flow-chart and assembly program** **(1+2+1½)**

Flow Chart :-



1½

Schematic diagram :-