

Khulna University of Engineering & Technology  
 B. Sc. Engineering 3<sup>rd</sup> year 1<sup>st</sup> Term (Regular) Examination, 2017  
 Department of Electrical and Electronic Engineering  
 EE 3109

Electronics III

Time: 3 hours

Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.  
 (ii) Figures in the right margin indicate full marks.

**Section A**

- Q1. (a) Define transition time, settling time, and resolving time in the analysis of multivibrators. (12)  
 (b) How can you reduce the transition time of a bistable multi? –Explain clearly. (10)  
 (c) Calculate the stable-state currents and voltages for the following binary. (13)

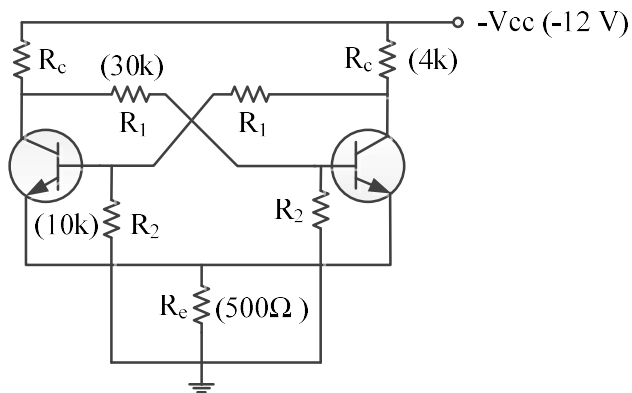


Fig. for Q.1(c)

- Q2. (a) Deduce the following expression for a collector coupled monostable multivibrator  $T = 0.69RC$ , where the symbols have their usual meaning. (11)  
 (b) Let's say you want to design a voltage-to-time converter. How can you do it with the help of an emitter coupled monostable multi? –Explain. (12)  
 (c) A collector-coupled monostable multi using npn silicon transistor has the following parameters: (12)  
 $V_{CC} = 12V$ ,  $V_{BB} = 3V$ ,  $R_C = 2k$ ,  $R_1 = R_2 = R = 20k$ ,  $h_{FE} = 30$ ,  $r'_{bb} = 200\Omega$ , and  $C = 1,000 pF$ . Neglect  $I_{CBO}$ .  
 (i) Calculate and plot to scale the waveshapes at each base and collector.  
 (ii) Find the width of the output pulse.
- Q3. (a) Describe the working principle of a free running multivibrator using npn transistors with necessary waveshapes. (14)  
 (b) What is a direct coupled binary? What are its merits and demerits? (11)  
 (c) Design the colpitts oscillator shown in fig. Q.3(c) below to produce a 40 kHz output frequency. Use a 120 mH inductor and op-amp with  $V_{CC} = \pm 12V$ . (10)

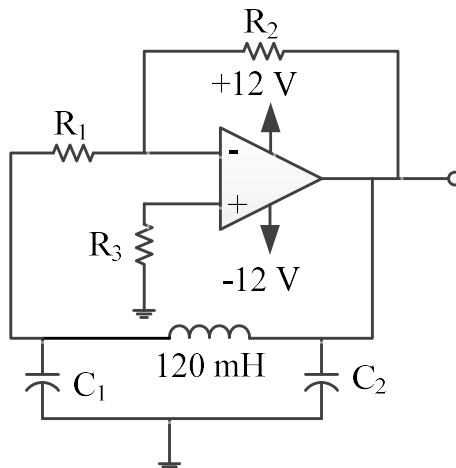


Fig. for Q.3(c)

- Q4. (a) “An oscillator circuit has no external input”-Justify the statement. (08)  
 (b) Describe the principle of RC phase shift oscillator. Deduce the expression for its frequency of operation. (12)  
 (c) What are meant by damped and undamped oscillation? (06)  
 (d) Show that two types of resonances take place in a crystal oscillator. Mention the frequency of resonances. (09)

### **Section B**

- Q5. (a) Describe optical process in semiconducts. What are different emissions that take place in optoelectronic devices? Explain them. (10)  
 (b) Why direct band gap semiconductor is used to fabricate optical devices. Answer with necessary illustrations. What is laser? Describe the working principle of laser with its basic structure. (13)  
 (c) Show the basic structure of OLED. Describe the light emission principle in OLED. What is photodiode? (12)
- Q6. (a) What are raster and pixel? Describe the procedure of H-scan and V-scan systems for transmitting a video frame. Answer with necessary illustrations. (12)  
 (b) Draw the block diagram of a receiver of a TV and explain. (13)  
 (c) What is plasma display? How can you differentiate between plasma display and LCD. Write down the merits and demerits of plasma display. (10)
- Q7. (a) Why modulation is necessary in TV transmission system? Show a comparison between the transmitted power of AM modulated signal for DSB and SSB modulations. Use necessary mathematical derivations. (10)  
 (b) How does CCD image scanner work? Write down the merits of CCD. Explain interline charge transfer techniques from a CCD. Use necessary illustrations. (12)  
 (c) What is an AFT? Describe the working principle of electronic remote control circuits in TV engineering. (13)
- Q8. (a) What is liquid crystal? Classify different display systems. What are the main elements of LCD? What are the approaches to be used for addressing a pixel? Describe multiplexed addressing with necessary diagrams. (12)  
 (b) In a particular display system the maximum size of the matrix  $30 \times 30$  and  $420 \times 420$  is used for twisted nematic and STN liquid crystal cells, respectively. Calculate the value of P for each of the liquid crystal cell, when cells are addressed by passive matrix addressing system. (08)  
 (c) Write short notes on HDTV and 3DTV. (15)

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Numerical Methods and Statistics

Time: 3 hours

Full Marks: 210

- N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.  
 (ii) Figures in the right margin indicate full marks.  
 (iii) Assume any data if missing.

**Section A**

- Q1. (a) What is meant by iterative process? Organize and explain an iterative process with advantage and disadvantage. (08)  
 (b) “Bisection method is not suitable for all class of nonlinear equations”- Justify the statement with example. (10)  
 (c) Find a real root of  $f(x) = x - \sin x - 1$  with a suitable method you like showing the convergence graph. (12)  
 (d) What is stopping criteria? Show some control loop with MATLAB or C program. (05)

- Q2. (a) What is meant by interpolation? Classify it. Explain forecasting and prediction from numerical point of view. (10)  
 (b) Develop an interpolating formula for equal interval. (10)  
 (c) By the method of interpolation, estimate the missing value in the following table of rice cultivation giving area in million hectares. (15)

Year	1911	1912	1913	1914	1915	1916	1917	1918	1919
Area	76.6	78.7	?	77.7	78.7	79.5	80.6	77.6	78.7

- Q3. (a) What are the intractability in analytic integration method? (07)  
 (b) Estimate the R.M.S value of  $f(x) = \sin x - \log_e^x + e^x$  starting from 0.2 to 1.4 using (i) Trapezoidal (ii) Simpson’s 1/3 and (iii) Simpson’s 3/8 rule. Also compare with the true value. Use no less than 10 equal divisions of the interval. (20)  
 (c) Show that the first differentiation  $f'(x_0)$  based on equal interval interpolation is  $\frac{(f_1 - f_0)}{h}$  (08)

- Q4. (a) Write down the algorithm for gauss Seidel method. Derive the convergence criterion of gauss-Seidel method. (15)  
 (b) Solve the equation  $\frac{dy}{dx} = \frac{-x + \sqrt{x^2 + y^2}}{y}$ ,  $y(-3) = 4$  for  $-3 \leq x \leq 7$  taking the step-length  $h = 0.5$  with Runge-Kutta classical method. (20)

**Section B**

- Q5. (a) What is the role of statistics in studying electrical and electronic engineering? What is sample, population, data, ungrouped data, and grouped data? (15)  
 (b) For the following distribution- (20)

Class interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	2	4	6	8	6	4	2

- (i) Find the value of mean, median, and mode.  
 (ii) Calculate the variance and mean deviation.

- (iii) Find the 29<sup>th</sup> percentile, 2<sup>nd</sup> decile and 3<sup>rd</sup> quartile.
- (iv) Draw the histogram, frequency polygon, and ogive for the above distribution.

Q6. (a) Establish the following relationship for coefficient of correlation, (14)

$$r = \frac{C_{ov}(x, y)}{\sigma_x \sigma_y}$$

where the symbols have their usual meaning. From above relationship, derive the expression of rank correlation coefficient.

- (b) Develop the relationship between correlation coefficient and regression coefficient. (06)
- (c) For the following data, comment on skewness and kurtosis. (10)

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	1	2	3	4	3	2	1

- (d) Mention the practical applications of correlation, regression, moments, skewness, and kurtosis. (05)

Q7. (a) Fit a second-degree parabola to the following data by least squares method. Also calculate the least error. (18)

x	1929	1930	1931	1932	1933	1934	1935	1936	1937
y	352	356	357	358	360	361	361	360	359

- (b) The table below shows the demand for a particular brand of fax machine in a department store in each of the last nine months. (17)

Month	1	2	3	4	5	6	7	8	9
Demand	10	12	13	17	15	19	20	21	20

- (i) Calculate the three months moving average for month three to nine. What would be your forecast for the demand in month ten?
- (ii) Apply exponential smoothing average with a smoothing constant 0.3 to derive a forecast for the demand in month ten.
- (iii) Which of the two forecasts for month ten do you prefer and why?

Q8. (a) Compare the error functions to be minimized for least square method. Also comment on the best function. (09)

- (b) What is meant by Gaussian distribution? If the probability is 0.70 that a student with very high grades will get into engineering school, what is the probability that three of five students with very high grades will get into engineering school. (12)

(c) Construct a scatter diagram from the following data. (07)

x	3	4	5	6	8	12	10	9	8	5
y	8	5	6	4	3	4	5	7	9	10

- (d) Explain the relation between independent and uncorrelated events with correlation theory. (07)