Khulna University of Engineering & Technology

B. Sc. Engineering 3rd year 2nd Term (Regular) Examination, 2017

Department of Electrical and Electronic Engineering

EE 3201

Control System Engineering

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) Normal and Semi-log graph paper will be supplied on request.

(iv) Assume any data if missing.

Section A

Q1. (a) Define the terms: loop gain, forward path, and branch. Briefly describe the steps involved with the design of feedback control system. (08)

(b) A common actuator or plant in control systems is the DC motor. It directly provides rotary motion and, coupled with wheels or drums and cables, can provide translational motion. The electric equivalent circuit of the armature and the free-body diagram of the rotor are shown in Fig. 1(b1). (20)

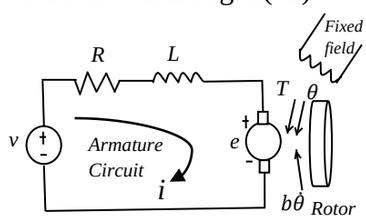


Fig. 1(b1)

The physical parameters for the motor are: *J*, *b*, *Ke*, *Kt*, *R*, *L* that have their usual meaning. The input of the system is the voltage source (*v*) applied to the motor's armature, while the output is the rotational speed of the shaft θ. The rotor and shaft are assumed to be rigid. We further assume a viscous friction model, that is, the friction torque is proportional to shaft angular velocity.

The motor is considered as the plant of a unity feedback control system. In this system, an inverter amplifier of 1. (b2) is used as the controller to drive the plant.

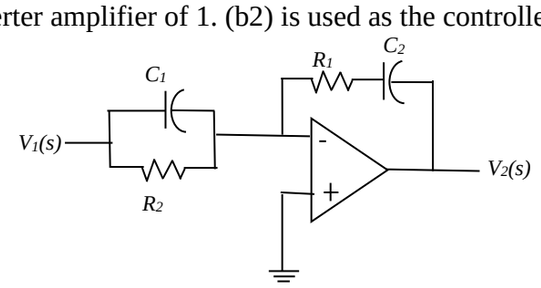


Fig. 1(b2)

Determine the transfer function of the motor, controller, and the system. Also, find the steady state response to a standard step input.

(c) A common example of a two-input control system is a home shower with separate valves for hot and cold water. The objective is to obtain (1) a desired temperature of the shower water and (2) a desired flow of water. Sketch a block diagram of the closed-loop control system. (07)

Q2. (a) Find the damping ration, undamped natural frequency, damped natural frequency, and the time at which peak overshoot occurs for the following system as shown in Fig. 2(b). (12)

(b) For the unity feedback control system with a forward path transfer function $G(s) = \frac{16}{s(s+a)}$, design the value of "*a*" to yield closed-loop step response that has 5% overshoot. (10)

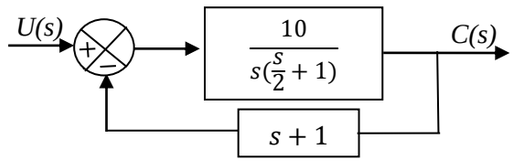


Fig. Q. 2(b)

(c) Describe the significance of state modelling of a control system. Derive the transfer function of lead compensator made of passive elements. (13)

Q3. (a) For the block diagram of Fig. 3(a), determine open loop transfer function, feed forward transfer function, control ratio, feedback ration, error ration, closed loop transfer function, and characteristics equation. (12)

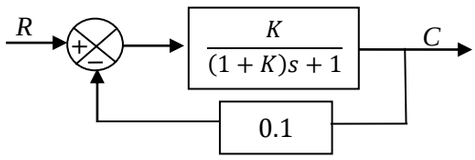


Fig. Q. 3(a)

(b) Draw the signal flow graph corresponding to the system shown in Fig. 3(b). Find the overall transfer function using Mason's gain formula. (12)

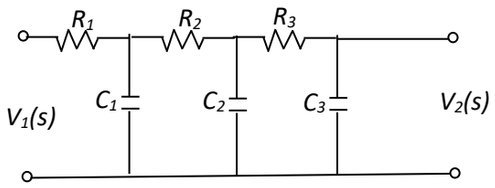


Fig. Q. 3(b)

(c) Draw the signal flow graph for the following state and output equations. (11)

$$\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\\ \dot{x_3}\end{bmatrix}=\begin{bmatrix}-2 & 1 & 0\\ 0 & -3 & 1\\ -3 & -4 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}r,\quad y=\begin{bmatrix}0 & 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

Q4. (a) What do you mean by poles and zeros? Explain absolute and relative stability of systems based on poles and zeros. (07)

(b) Find the range of *K* for which the system is stable. (12)

$$\frac{X_2(s)}{X_1(s)}=\frac{P(s)}{Q(s)}=\frac{K(s+2)}{s(s+5)(s^2+2s+5)+K(s+2)}$$

(c) Derive the necessary conditions for the coefficients of a third order system to be marginally stable. (06)

(d) Consider the system is represented in state variable form (10)

$$\dot{x}=\boldsymbol{A}x+\boldsymbol{B}u$$
$$y=\boldsymbol{C}x+\boldsymbol{D}u$$

Where,

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -k & -k & -k\end{bmatrix},\qquad B=\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}$$

$$C=[1\quad 0\quad 0],\qquad D=[0].$$

Determine the transfer function and find the value of '*k*' for which the system is stable.

Section B

Q5. (a) Define series and parallel compensation. Sketch the root loci for the following system. Also indicate the value of "*K*" at the breakaway points. (15)

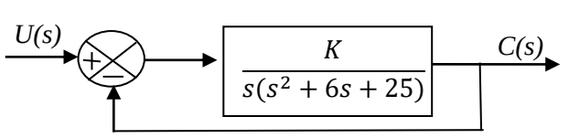


Fig. Q. 05(a)

(b) What is the physical significance of having poles and zeros in the s-plane? Explain the effect of adding poles and zeros on the root locus diagram of a system. (08)

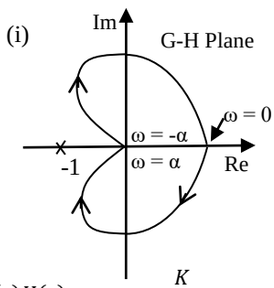
(c) Define gain and phase margin. Explain the physical significance of them in designing control system. (12)

Consider the network given by $G(s) = \frac{s+\frac{1}{T_1}}{s+\frac{1}{T_2}}$. Determine whether this network is a lead or lag network.

Q6. (a) Derive the expression for resonant frequency (ω_r) and resonant Peak (M_r) of quadratic factors for bode diagram. (15)

(b) State Nyquist stability criterion. Apply this criterion to determine the stability of the system shown in the following figures. (08)

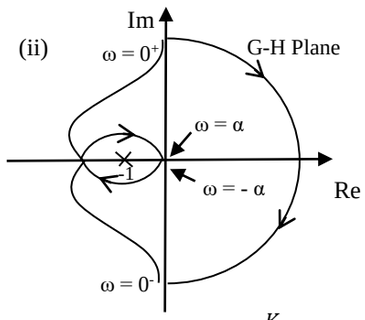
(i)



$$G(s)H(s) = \frac{K}{(T_1 s + 1)(T_2 s + 1)}$$

where, K, T_1, $T_2 > 0$

(ii)



$$G(s)H(s) = \frac{K}{s(T_1 s + 1)(T_2 s + 1)}$$

where, K is large

(c) Define polar plot. What are the advantages and disadvantages of polar plot in determining the stability of a control system? Prove that the polar plot of first order factor, $G(j\omega) = \frac{1}{1+j\omega T}$ is a semicircle. (12)

Q7. (a) What is ON-OFF controller? Why differential gap is introduced in ON-OFF controller? (08)

(b) Why controller tuning is necessary for PID controller? Determine the transfer function ($G_C(s)$) of PID controller for the following control system. (15)

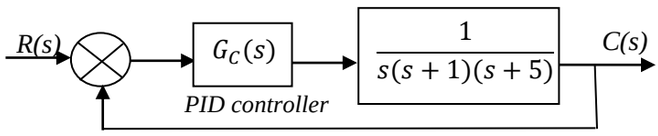


Fig. Q. 07 (b)

(c) Obtain the state space representation in the controllable canonical form, observable canonical form and diagonal canonical form of the following system. (12)

$$\frac{Y(s)}{U(s)} = \frac{s+3}{s^2+3s+2}$$

Q8. (a) Define state, state variable, and state space. Give the state space representation of the following system. (10)

$$\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = 6u.$$

(b) Obtain the time response of the following system (15)

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where, $u(t)$ is the unit step function occurring at $t = 0$ and $x(0) = 0$.

(c) Define controllability and observability. State whether the following system is controllable and observable. (10)

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & 1.5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 4 \end{bmatrix} u, \quad y = [0.8 \quad 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Khulna University of Engineering & Technology

B. Sc. Engineering 3rd year 2nd Term (Regular) Examination, 2017

Department of Electrical and Electronic Engineering

EE 3203

Power System Analysis-I

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 inductance. Find the inductance of a round conductor attributed only by the flux inside the conductor. (10)

(b) Define transposition. Derive an expression for the inductance per phase of a 3-φ line when conductors are unsymmetrically placed and completely transposed. (12)

(c) Find the solution for voltage and current of a long transmission line and then explain incident voltage, reflected voltage and an infinite line. (13)

Q2. (a) Deduce the expression for inductance of a single phase line consisting of two composite conductors. Then explain mutual GMD and self GMD. (15)

(b) The distance between conductors of a single phase line is 10 feet. Each conductor is composed of seven equal strands. The diameter of each strand is 0.1 inch. Show that D_S for the conductor is 2.177 times the radius of each strand. Find the inductance of the line in millihenrays per mile. (15)

(c) Describe different types of U/G cables with ratings. (05)

Q3. (a) What is charging current of a transmission line? Find the capacitance of a three phase line with equilateral spacing and find also the equations of charging current. (12)

(b) Deduce the expression for the capacitance of a three phase line with considering the effect of earth into account. How can the effect be minimized? (14)

(c) A three phase 60 Hz line has flat horizontal spacing. The conductors have an outside diameter of 3.28 cm with 12 m between conductors. Determine the capacitive reactance of the line in ohms if the length of the line is 125 km. (09)

Q4. (a) What is receiving end power circle diagram? How can it be drawn? What information does a circle diagram provide? (07)

(b) What do you mean by skin effect and proximity effect? How does it influence the resistance, inductance and capacitance of a conductor? Explain clearly. (07)

(c) The constant of a 3-φ lines are A = 0.9 < 2˚ and B= 140 < 70˚ ohm per phase. The line delivers 60 MVA at 132 kV and 0.8 p.f. lagging. Draw the circle diagram and find- (15)

i. Sending end voltage and power angle,
ii. Sending end power and power factor,
iii. Line losses.

(d) What are bundle conductors? Write down the advantages of bundle conductors and show their arrangements. (06)

Section B

Q5. (a) What do you mean by insulators? Classify different types of insulators and mention their applications as voltage basis. Explain different types of test conducted on insulators. (12)

(b) Define spark over voltage and string efficiency. Explain the method of equalizing the potential across the disc by using guard ring. (13)

(c) A string of suspension insulators consist of three units. The capacitance between each link P_{in} and earth is 1/6 times of the self-capacitance of the unit. If the maximum peak voltage per unit is not to exceed 35 kV, determine the greatest working voltage and string efficiency. (10)

Q6. (a) What is underground cable? What are the requirements of underground cables? Explain the constructional details of underground cable. (11)

(b) What do you mean by grading of cables? Explain how a cable can be graded using inter-sheath. Mention the limitations of inter-sheath grading. (12)

(c) Prove that the potential gradient with inter-sheath will be smaller than that without inter-sheath for the same overall radius and operating voltage of a cable. (12)

Q7. (a) What do you mean by conductor vibration? Explain resonant type vibration clearly. Illustrate the measure to reduce the vibration. (10)

(b) Mention the advantages of corona. How can corona effect be reduced? (07)

(c) The capacitance of a 3-core lead sheathed cable measured between any two of the conductors with sheath earthed is 0.19 μF/km. Determine the equivalent star connected capacity and the KVA required to keep 16 km of the cable charged when connected to 20 kV, 50 Hz supply. (09)

(d) A 3-φ line consisting of three conductors placed at the corners of an equilateral triangle has a total corona loss of 0.3835 kW at 132 kV and 6.511 kW at 150 kV. Compute the critical disruptive voltage using Peek's formula for corona loss under fair weather. (09)

Q8. (a) What do you mean by Sag, span length and safety factor? Mention the formula to determine the spacing between conductors. (10)

(b) Explain the effect of wind and ice loading on conductors for overhead transmission line and also calculate the horizontal sag. How can you reduce sag? (14)

(c) A transmission line over a hillside where the gradient is 1:20 supported by two 22 m high towers with a distance of 300 m between them. The lowest conductor is fixed 2 m below the top of each tower. Find the clearance of the conductor from the ground. Given that the conductor weight is 1kg/m and allowable tension is 1500 kg. (11)

Khulna University of Engineering & Technology

B. Sc. Engineering 3rd year 2nd Term (Regular) Examination, 2017

Department of Electrical and Electronic Engineering

EE 3205

Communication Engineering-I

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) What are the advantages and disadvantages of digital communication over analog communication? (10)

(b) What is meant by communication channel? List different types of communication channels. (06)

(c) Define modulating signal and modulated signal. Prove that the carrier power increases from P_C to $P_C(1+\frac{m^2}{2})$ in amplitude modulation, where the symbols have their usual meanings. (12)

(d) Total power content of an AM signal is 3000 W. For 80% modulation, calculate (i) carrier power and (ii) power in each sideband. (07)

Q2. (a) Define the terms SSB-SC and DSB-SC for amplitude modulation. Describe a SSB generation technique with necessary block diagram. (12)

(b) What do you mean by PLL? Show that a PLL can be used as a frequency modulator and frequency demodulator. (08)

(c) What is balanced modulator? Describe the diode bridge modulator for generating AM signal. (08)

(d) Draw the block diagram of a superheterodyne AM receiver and show the wave shapes at different points. (07)

Q3. (a) Explain the following noises: (i) Shot noise, (ii) Flicker noise, (iii) Partition noise, and (iv) Solar noise. (10)

(b) Define and explain the following terms: (09)
(i) frequency deviation, (ii) frequency deviation constant, and (iii) modulation index for sinusoidal FM.

(c) Show that $F = 19.3\, R_a I_p$, where the symbols have their usual meanings. (10)

(d) A receiver having equivalent noise resistance of 2500 Ω and input resistance of 500 Ω is connected to an antenna of resistance 50 Ω. Compute the noise figure (in dBs) and equivalent noise temperature for the receiver. (06)

Q4. (a) What do you mean by information theory? Show that entropy will be maximum only for equally likely events. (10)

(b) Define system capacity and information rate. Derive the expression for maximum possible channel capacity for a Gaussian channel. (09)

(c) What are the advantages of ISB system? Describe the operation of ISB system. (09)

(d) A source emits one of four symbols S_0, S_1, S_2, and S_3 with probabilities $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{4}$, and $\frac{1}{4}$, respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source. (07)

Section B

Q5. (a) State and explain Nyquist sampling theorem with necessary diagrams. (10)

(b) Four channels are time multiplexed having signal frequencies 500 Hz, 1 kHz, and 2 kHz. The signals are sampled with sampling frequency 1 MHz. Calculate the number of samples obtained for each channel in a cycle. Also, calculate the time required for the TDM frame. (08)

(c) What is aliasing effect and how it can be overcome? Why anti-aliasing filter is low pass? Explain with appropriate technical reasons. (10)

(d) What is quantization noise? Show that the quantization noise is proportional to the spacing between two quantization levels. (07)

Q6. (a) The quantity of PCM transmission is related with bandwidth requirement, how this issue can be addressed by DPCM approach? What are the demerits of DPCM system? (09)

(b) Show different types of waveforms for the binary sequence 10110001101. Write their merits and demerits. (09)

(c) What are LDM and ADM? Explain the problems of LDM and then describe the technique that can be used to overcome them. (12)

(d) What properties should have a line code? Draw the HDB_3 coding for the binary sequence 1101100001011101000000000101. (05)

Q7. (a) What is MSK modulation? Show that the peak frequency deviation in MSK modulation should be $f_b/2$ in order to have more compact spectrum, where f_b is the bit frequency. (11)

(b) Explain the needs of frequency synchronization and phase synchronization in coherent detection system. (12)

(c) Describe the needs of modulation. Write down the names of different digital modulation techniques. Calculate the nominal bandwidth required for ASK, PSK and FSK modulations when bits '1' and '0' having bit rates 1.5 Kb/s are modulated by carrier frequencies 2.5 MHz and 2.3 MHz, respectively. (12)

Q8. (a) Describe the operation of QPSK transmitter and receiver. (12)

(b) Calculate and compare the separation between two symbols for M-ary PSK and M-ary QAM modulations when the symbols are constructed with the combination of five bits. Assume that the bit frequency and power are 1 Mb/s and 1 mW, respectively. (08)

(c) Define CDM and SDM. How basic group is constructed in FDM system. (08)

(d) Suppose first level and 2^{nd} level MUX are constructed by the input channels of 20 and 5, respectively. If the channels are sampled at 8 kHz and the PCM frame are constructed with a framing bits in 1^{st} level MUX and 17 overhead bits as control bits and stuff bits in 2^{nd} level MUX. Calculate bit rate at the output of 1^{st} level MUX and 2^{nd} level MUX when each sample is quantized by 256 level quantizer. (07)

Khulna University of Engineering & Technology

B. Sc. Engineering 3rd year 2nd Term (Regular) Examination, 2017

Department of Electrical and Electronic Engineering

EE 3213

Microprocessors, Microcontrollers and Peripherals

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) Explain the input-output interfacing strategies in microprocessor environment. (09)

(b) Configure the main section of programmable keyboard and display interface. Write a program to display the last digit of your roll number showing the control word. (12)

(c) Differentiate 2- key lockout and N- key rollover in 8279 chip. (06)

(d) Justify the statement- "The events that determine when an input device has data available or when an output device needs data are independent of the CPU". (08)

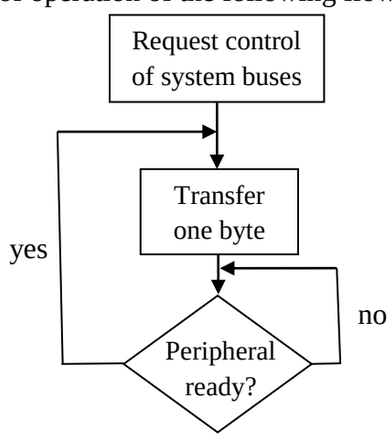
Q2. (a) Explain the Read-back command in 8254 programmable interval timer. (06)

(b) Arrange the programmable-interval timer in such a way that it produces a pulse every 100 ms. Assume the clock frequency is 2 MHz. Use any counter in 8254. (12)

(c) State and configure the internal components of programmable interrupt controller with all signals and pins. Distinguish between maskable and non-maskable interrupt. (17)

Q3. (a) "Data transfer via DMA controller is the fastest one among all others"- Justify the statement. (08)

(b) Analyze the mode of operation of the following flow chart. (07)



(c) What are the contents of counter register and mode set register in 8257 DMA controller? (13)

(d) Write some disadvantages of flash type ADC. What type of ADC is the most suitable in microprocessor system development kit? (07)

Q4. (a) Classify microcontroller. What are the main features of 8051 family? Mention the special function register of 8051 microcontroller. (10)

(b) Evaluate the mode set condition if it contains 40H in programmable-communication interface 8251. (08)

(c) Distinguish between RS 232C and RS 423A. (08)

(d) What are the differences between microprocessor and microcontroller? (09)

Section B

Q5. (a) What is byte ordering? Classify it. Assume your roll as 32 bit data and explain different types of byte ordering. (10)

(b) What do you mean by coprocessor? Compare RISC and CISC processor. (10)

(c) Write a program using 8086 assembly language to add two 64 bit data in which the low byte of the first data pointed to by SI and the low byte of the second data pointed to by DI. Store the results in a memory location indicated by offset 5000H. (15)

Q6. (a) Draw the block diagram of a microprocessor based computer and describe the function of each block. (10)

(b) Describe the internal architecture of 8086 microprocessor. What is pipelining? (10)

(c) Draw the timing diagram of 8086 microprocessor's write cycle in memory. (10)

(d) Mention one way of segmenting 1 MB of memory. (05)

Q7. (a) How even and odd bank memory addressing works? (06)

(b) Analyse the program in 8086 assembly language in Fig. 7(b) and make a flow chart. (16)

(c) Discuss the limitations of 8086 microprocessor. What are the additional features in 80286 microprocessors? (13)

Q8. (a) What is addressing mode? Describe different types of addressing mode with at least 3 examples. Write the names of all interrupts used in 8086. (10)

(b) Explain the instruction AAD and DAA with examples. (06)

(c) What is assembler directives? Explain the meaning and application of EQU, ASSUME, SEGMENT, END, DB, DW and DD directives. Describe the data types that supported by 8087. How does the 8086-8087 microcomputer system executes the 8087 instructions? (12)

(d) If the content of flag register is 0F05H in 8086 environment, state the exact operation. (07)

Fig. 7(b): Program for Q. 7(b):

```
DATA SEGMENT
STRING1 DB 99H,12H,56H,45H,36H
DATA ENDS
CODE SEGMENT
ASSUME CS:CODE, DS:DATA

START: MOV AX, DATA
       MOV DS,AX
       MOV CH,04H
UP2: MOV CL,04H
     LEA SI,STRING1

UP1: MOV AL,[SI]
     MOV BL,[SI+1]
     CMP AL,BL
     JC DOWN
     MOV DL,[SI+1]
     XCHG [SI],DL
     MOV [SI+1],DL

DOWN:  INC SI
       DEC CL
       JNZ UP1
       DEC CH
       JNZ UP2
       INT 3
CODE ENDS
END START
```

Khulna University of Engineering & Technology
B. Sc. Engineering 3rd year 2nd Term (Regular) Examination, 2017
Department of Electrical and Electronic Engineering
EE 3219
Electrical Engineering Materials

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 lattice and basis. "Hexagonal lattice never form the bravais lattice" - Justify the statement. (09)

(b) State the condition to form a stable bond when two atoms are brought to close. Given that $A = 8 \times 10^{-77}$ and $B = 1.12 \times 10^{-133}$, calculate the bond length and bond energy for solid Argon using Lennerd jone potential. (10)

(c) Explain the role of vacancies, dislocations, and grain boundaries in material engineering. What are the significance of crystallographic directions and planes in material properties? (09)

(d) What is meant by allotropy? Briefly explain the allotropes of carbon. (07)

Q2. (a) Briefly describe the Matthiessen's rule and Fourier's law of heat conduction. (08)

(b) What are the drawbacks of Drude model? Derive the Ohm's law from the Drude model of classical mechanics. (10)

(c) How will you explain the resistivity of nonpure metals? (09)

(d) Given that the mean speed of conduction electrons in copper is 1.5×10^6 ms^{-1} and frequency of vibration of the copper atoms at room temperature is about 4×10^{12} ms^{-1}, estimate the drift mobility and the conductivity of copper. The density of copper is 8.96 gcm^{-3} and the atomic mass M_{at} is 63.56 g mol^{-1}. (08)

Q3. (a) What does it physically mean by the Schrodinger equation? Solve the Schrodinger equation for a finite potential well system. Show the possible energy wave functions and the probability distribution for the electron. (20)

(b) State and explain Heisenberg's uncertainty principle. (05)

(c) Why nanotechnology is needed? Mention some nano materials. What are the advantages of organic electronics over inorganic electronics? Also write down some applications of organic materials in devices. (10)

Q4. (a) Define density of states? Derive the relationship of electron energy density of states for a three dimensional solid. Hence, draw the density of states for 3D, 2D and 1D solids. (11)

(b) Why we need to consider effective mass instead of actual mass of carrier? How the effective mass can be calculated? (08)

(c) Explain how the energy band of a solid (e.g. Si) is formed? (09)

(d) How will you classify the materials according to optical characteristics? Briefly explain birefringence and optical anisotropy. (07)

Section B

Q5. (a) What is meant by dielectric material? Write down the example and application of dielectric materials. (06)

(b) What is meant by polarization? Briefly explain different polarization mechanisms. Why electronic polarization within an atom is quite small compared with the polarization due to the valance electrons in the covalent bonds within the solid? (17)

(c) Consider a pure Si crystal that has $\in_r = 11.9$. The number of Si atoms per unit volume, N, is given as 5×10^{22} cm^{-3}. (12)

(i) What is the electronic polarizability due to valance electrons per Si atom?

(ii) Suppose that a Si crystal sample is electroded on opposite faces and has a voltage applied across it. By how much is the local field greater than the applied field?

(iii) What is the resonant frequency f_o corresponding to ω_o?

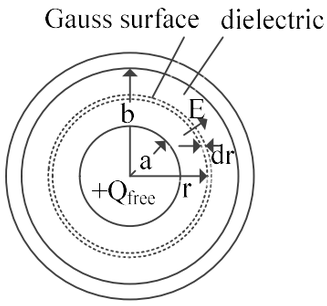
Q6. (a) What is dielectric constant? Show that the dielectric loss per unit volume is given by $W_{vol} = \omega E^2 \varepsilon_o \varepsilon_r' \tan\delta$, where the symbols have their usual meaning. (16)

(b) Briefly discuss the mechanism by which microwave ovens heat food. Calculate the heat generated per second of XLPE and Al_2O_3 at 1 MHz and at a field of 100 KVcm^{-1}. What is your conclusion? The properties of the above materials are given below at 1 MHz. (09)

Material	ε_r'	$\tan\delta$
XLPE	2.3	4×10^{-4}
Al_2O_3	8.5	1×10^{-3}

(c) Derive the Debye equations. Also draw the Cole - Cole plot and equivalent circuit of a Debye dielectric. (10)

Q7. (a) State Gauss's law and boundary condition. Using Gauss's law, find the capacitance of the following coaxial cable of length L with a and b defining the radii of the inner, and outer conductors. (10)



(b) Describe the construction of ceramic and electrolytic capacitor. (10)

(c) Briefly explain piezoelectricity, ferroelectricity and pyroelectricity. (07)

(d) What is meant by Ferromagnetism and Ferrimagnetism? Why all useful magnetic materials in electrical engineering are invariably ferromagnetic or ferrimagnetic? (08)

Q8. (a) Define soft and hand magnetic materials with examples and applications. (06)

(b) What is meant by magnetic domain? Draw the M verses H behaviour of a previously unmagnetized polycrystalline iron specimen. (10)

(c) What is meant superconductor? Briefly discuss the salient features of superconductivity. (09)

(d) A superconductor solenoid of 10 cm in diameter, 1 m in length and has 500 turns of Nb_3S_n wire, whose critical field B_c at 4.2 K is about 20 T and critical current density J_c is 3×10^6 Acm^{-2}. What is the current necessary to set up a field of 5 T at the center of a solenoid? What is approximate energy stored in the solenoid? Assume that the critical current density decreases linearly with the applied field and the field across the diameter of the solenoid is approximately uniform. (10)