CBCS SCHEME

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18MAT31

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the Laplace transform of:
i) $(3t+4)^2 + 5^t$
ii) $e^{-t}\cos^2 3t$
iii) $\frac{\cos at - \cos bt}{t}$ **(10 Marks)**

b. Given $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$ where $f(t+a) = f(t)$, show that $L[f(t)] = \frac{E}{S}\tanh(as/4)$. **(05 Marks)**

c. Employ Laplace transform to solve the equation: $y'' + 5y' + 6y = 5e^{2t}$, taking $y(0) = 2$, $y'(0) = 1$. **(05 Marks)**

OR

2 a. Find the Inverse Laplace transform of:
i) $\frac{(s+2)^2}{s^6}$ ii) $\frac{s+1}{s^2+6s+9}$ iii) $\frac{3s+2}{s^2-s-2}$ **(10 Marks)**

b. Express $f(t) = \begin{cases} 1, & 0 < t \le 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms Heaviside's unit step function and hence find its Laplace transform. **(05 Marks)**

c. Find the Laplace transform of $\frac{s}{(s^2+a^2)^2}$ using convolution theorem. **(05 Marks)**

Module-2

3 a. Find the Fourier series expansion of $f(x) = x - x^2$ in $-\pi \le x \le \pi$. Hence deduce that $\frac{x^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$ **(07 Marks)**

b. Find the half-range cosine series of $f(x) = 2x-1$ in the interval $0 < x < 1$. **(06 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(07 Marks)

OR

4 a. Obtain the Fourier series of $f(x) = |x|$ in $(-l, l)$. Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. **(07 Marks)**

b. Find the sine half range series of $f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}$ **(06 Marks)**

c. The following table gives the variations of a periodic current A over a certain period T:

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a constant part of 0.75amp. in the current A, and obtain the amplitude of the first harmonic. **(07 Marks)**

Module-3

5 a. If $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$ find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(06 Marks)**

c. Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$ by using z-transform. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2} dx$, $m > 0$. **(07 Marks)**

b. Find the Z-transform of $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$.

c. Find the inverse Z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$. **(06 Marks)**

(07 Marks)

Module-4

7 a. Solve $\frac{dy}{dx} = x - y^2$, $y(0) = 1$ using Taylor's series method considering upto fourth degree terms and find the value of y(0.1). **(07 Marks)**

b. Using Runge-Kutta method of fourth order, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ taking $h = 0.2$. **(06 Marks)**

c. Apply Milne's method to compute y(1.4) correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data: $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$. **(07 Marks)**

OR

8 a. Using modified Euler's method find y(20.2) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 taking h = 0.2. **(07 Marks)**

b. Use Fourth order Runge-Kutta method to compute y(1.1) given that $\frac{dy}{dx} = xy^{1/3}$, y(1) = 1. **(06 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090, find y(0.4) using Adams – Bashforth predictor-corrector method. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, y(0) = 1, y'(0) = 0, evaluate y(0.1) using Runge-Kutta method of 4th order. **(07 Marks)**

b. Find the external of the functional $\int_{x_1}^{x_2}\left(y^{1^2} - y^2 + 2y\sec x\right)dx$. **(06 Marks)**

c. Derive Euler's equation in the standard form:
$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y^1}\right) = 0$. **(07 Marks)**

OR

10 a. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values:

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(07 Marks)

b. Find the external of the functional $\int_0^{\pi/2}(y^2 - y^{1^2} - 2y\sin x)\,dx$ under the end conditions y(0) = 0, y(π/2) = 0. **(06 Marks)**

c. Prove that the geodesics on a plane are straight lines. **(07 Marks)**

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18EC33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Electronic Devices

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the classification of material based on conductivity and energy band diagram. **(06 Marks)**

b. Explain with neat diagram direct and indirect semiconductors. **(08 Marks)**

c. Consider a semiconductor bar with $\omega = 0.1$ mm, $f = 10$ μm and $L = 5$ mm. For $\beta = 10$ kg ($1\ kg = 10^{-5}\ \omega b/cm^2$) and a current of 1 mA, we have $V_{AB} = -2$ mV and $V_{CD} = 100$ mV. Find the type, concentration and mobility of the majority carrier. **(06 Marks)**

OR

2 a. What is Hall effect? Explain with suitable diagram and equations how does Hall effect works? **(10 Marks)**

b. Compare between intrinsic and extrinsic material. **(06 Marks)**

c. Calculate the conductivity effective mass of electrons in silicon. (For silicon, $m_l = 0.98\ m_0$ and $m_t = 0.19\ m_0$) **(04 Marks)**

Module-2

3 a. Explain the qualitative description of current flow at p-n junction under equilibrium and biased condition. **(10 Marks)**

b. Explain zener break down and avalanche break down under reverse bias condition. **(10 Marks)**

OR

4 a. Explain photodetector in brief. **(08 Marks)**

b. Explain the piecewise linear approximation of junction diode under ideal condition. **(08 Marks)**

c. A silicon solar cell has a short circuit current of 100 mA and open circuit voltage of 0.8 V under full solar illumination. The fill factor is 0.7. What is the maximum power delivered to a load by this cell? **(04 Marks)**

Module-3

5 a. Draw Ebers-Moll model for a PNP transistor and explain its significance. **(10 Marks)**

b. With neat diagram, explain step by step fabrication of double poly silicon self aligned npn BJT. **(10 Marks)**

OR

6 a. Explain effect of base narrowing with neat diagram. **(06 Marks)**

b. Discuss switching operation in common emitter transistor. **(07 Marks)**

c. Explain with neat diagram the various components of current flow and current directions for normal active mode of operation of PNP transistor. **(07 Marks)**

Module-4

7 a. Explain with neat diagram construction and operation of n-JFET. **(08 Marks)**

b. Explain two terminal MOS structure using energy band diagram. **(08 Marks)**

c. Explain n-channel enhancement mode MOSFET with its circuit symbol. **(04 Marks)**

OR

8 a. Draw and explain small signal equivalent circuit of n-channel PNJFET. **(07 Marks)**

b. Explain with neat diagram ideal C-V characteristics of MOS capacitor with P-type substrate. **(07 Marks)**

c. Explain the effect of frequency on gate voltage of a MOS capacitor with P-type substrate. **(06 Marks)**

Module-5

9 a. Explain low pressure conical vapour deposition reactors. **(07 Marks)**

b. Explain photolithography process. **(07 Marks)**

c. What are the advantages of integration? **(06 Marks)**

OR

10 a. Explain method of ION implantation with schematic diagram. **(10 Marks)**

b. Explain integration of other circuit elements with suitable diagram. **(10 Marks)**

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18EC34

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Digital System Design

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Convert the Boolean expression to canonical SOP form, $f = (xy + \bar{z})(y + x\bar{z})$. **(04 Marks)**

b. A switching circuit has four inputs A, B, C and D, and one output Y. The inputs A and B represent the bits of the number N_1, whereas the inputs C and D represent the bits of the number N_2. The output is to be high only if the product $N_1 \times N_2$ is less than 2. Draw the truth table and obtain the Maxterm expression. **(06 Marks)**

c. Simplify f(A, B, C, D, E) = Σ (5, 7, 9, 12, 13, 14, 15, 20, 21, 22, 23, 25, 29, 31) using a 5-varible K-map, and obtain the simplified SOP expression. **(10 Marks)**

OR

2 a. Convert the Boolean expression to canonical POS form $f = (a + b')(a + c)$. **(04 Marks)**

b. Use K-map to obtain the simplified POS expression for
$f(A, B, C, D) = (A + B + \bar{C})(\bar{B} + \bar{D})(\bar{A} + C)(B + C)$. **(06 Marks)**

c. Simplify f(a, b, c, d) = Σ(9, 12, 13, 15) + dΣ (1, 4, 5, 7, 8, 11, 14), using QM technique out of several possible solutions, select solution which can be implemented using only one AND gate and one OR gate. **(10 Marks)**

Module-2

3 a. Draw the circuit of 2 × 4 decoder having enable input and active high outputs. Give its truth table. **(04 Marks)**

b. Construct a 16 × 1 multiplexer using only 4 × 1 multiplexers. **(06 Marks)**

c. Four chairs A, B, C and D are placed in a row. When the chair is empty, it is logic – 0, and when the chair is occupied, it is logic – 1. Design and implement a circuit using 8 × 1 multiplexer IC such that, whenever the adjacent chairs are occupied, the output should go high. **(10 Marks)**

OR

4 a. Implement a single – bit binary comparator circuit using basic gates, and give its truth table. **(04 Marks)**

b. Implement the multiple output function using a single 3 × 8 decoder IC and additional gates.
$f_1(a, b, c) = \Sigma(1, 4, 5, 7)$, $f_2(a, b, c) = \pi(2, 3, 6, 7)$. **(06 Marks)**

c. Derive the expressions and draw the complete logic circuit of a 4-bit look-ahead carry adder. **(10 Marks)**

Module-3

5 a. Draw the circuit of gated SR latch using NAND gates, and give its truth table. **(04 Marks)**

b. Construct a 4-bit parallel in serial out shift register using negative edge triggered D flip-flops. **(06 Marks)**

c. With neat diagram and truth table, explain the working of master slave JK flip-flop. The inputs shown in Fig Q5(c), are applied to the master slave JK flip-flop, which is initially in 0-state. Sketch the Q_M and Q_S outputs.

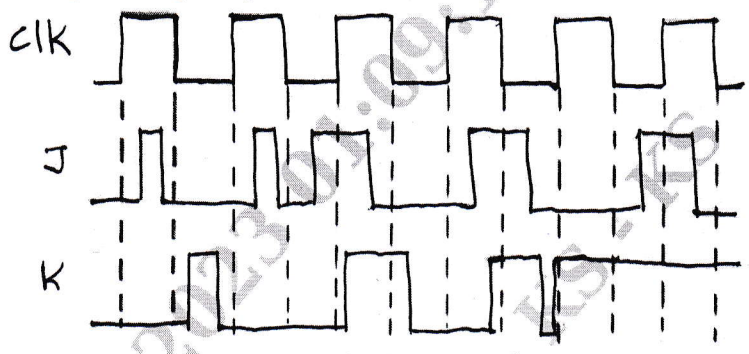

Fig Q5(c) **(10 Marks)**

OR

6 a. Give the comparison between combinational sequential circuits, with one example for each. **(04 Marks)**

b. Derive the characteristics equations of SR and JK flip-flops. **(06 Marks)**

c. Design a 4-bit binary ripple up-counter using positive edge triggered JK flip-flops. Neatly draw the timing diagrams, showing its complete count sequence. Mention the changes to be made in the above counter, using the same flip-flops so that it becomes a down-counter. **(10 Marks)**

Module-4

7 a. Draw the transition table and state diagram for the Moore circuit shown in Fig Q7(a).

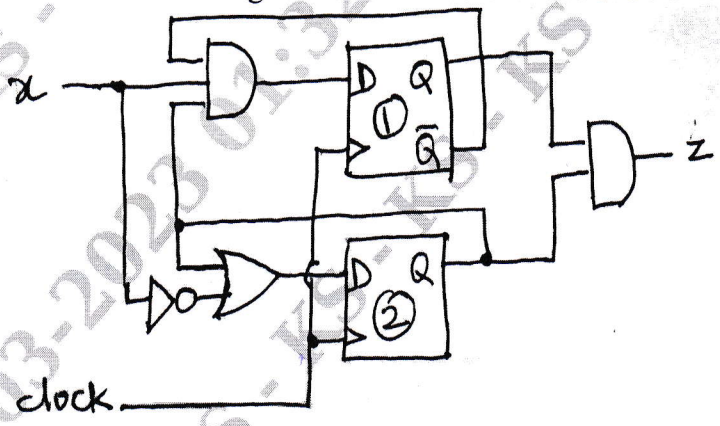

Fig Q7(a) **(08 Marks)**

b. Design a 3-bit synchronous counter having the repetitive count sequence of 0, 1, 2, 3, 5, 7 using JK flip flips. Check whether the counter is self correcting. **(12 Marks)**

OR

8 a. Design a mod – 5 synchronous binary counter, having the count sequence 0 to 4 and repeat, using D – flip-flops. **(08 Marks)**

b. Design a Mealy circuit for the state diagram shown in Fig Q8(b), Using JK flip-flops. Use the assignments: A = 00, B = 01 and C = 11.

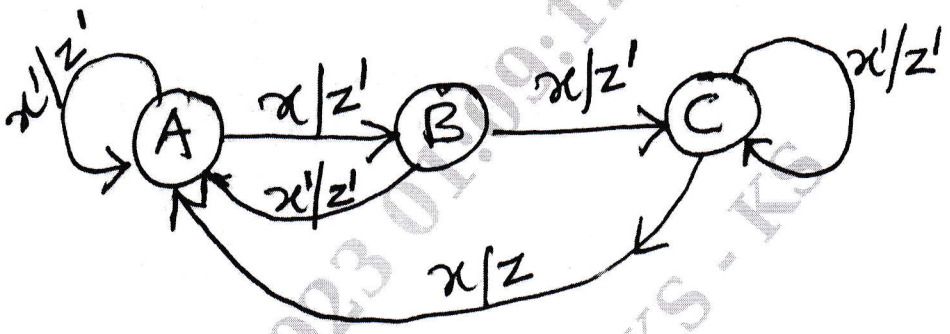

Fig Q8(b) **(12 Marks)**

Module-5

9 a. Construct a Mealy state diagram that will detect a serial input sequence of 10110 with overlap in a long data sequence. when the correct input pattern is detected, the output should go high. **(10 Marks)**

b. Design a Mealy state diagram for the sequential circuit that coverts a serial excess – 3 code to serial BCD code. The machine has to return to the beginning after four bits. The output should to high if the input is not a valid excess – 3 codes. **(10 Marks)**

OR

10 a. Draw the block diagram of a positive binary divider to divide an 8-bit dividend by a 4-bit divisor to obtain a 4-bit quotient and 4-bit remainder. Explain the operation briefly. **(10 Marks)**

b. Design a control circuit for a 4-bit serial adder using two shift register and a full adder. After receiving the start signal, the control circuit should give out four shift signals and then stop. When the addition is complete, the contents of one of the registers should be replaced by the sum. Draw the state diagram and transition table. Design and realize the circuit using D flip-flops. **(10 Marks)**

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18EC35

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With a neat diagram, explain basic operational concepts of computer. **(10 Marks)**

b. Illustrate Instruction and Instruction sequencing with an example. **(10 Marks)**

OR

2 a. How to measure the performance of a computer? Explain. **(08 Marks)**

b. Explain the 3-address, 2-adress and 1-address instruction with an example. **(06 Marks)**

c. Explain system software functions in computer. **(06 Marks)**

Module-2

3 a. What is an addressing mode? Explain any four types of addressing modes with example. **(10 Marks)**

b. Define subroutine and parameter passing. Explain how to pass the parameter by value and by reference. **(10 Marks)**

OR

4 a. What are assembler directives? Explain any five assembler directives. **(10 Marks)**

b. Explain shift and rotate operations with example. **(10 Marks)**

Module-3

5 a. With relevant diagram, discuss, implementation of interrupt priority using individual interrupt request. **(06 Marks)**

b. Explain the following: i) Vectored interrupts ii) Simultaneous requests. **(08 Marks)**

c. Write a note on registers in DMA interface. **(06 Marks)**

OR

6 a. Define interrupt, point out and explain various ways of enabling and disabling interrupts. **(08 Marks)**

b. Write a program to read a line from the keyboard and display it. **(06 Marks)**

c. Define bus arbitration. Explain centralized arbitration mechanism in DMA with a neat diagram. **(06 Marks)**

Module-4

7 a. With a neat diagram, explain internal organization of 16 × 8 memory chip. **(10 Marks)**

b. With a neat diagram, explain the working principle of magnetic disk. **(06 Marks)**

c. What are the major functions of disk controller? **(04 Marks)**

OR

8 a. With a neat diagram, explain internal organization of a 2M × 8 dynamic memory chip. **(08 Marks)**
b. With a neat diagram explain a single-transistor dynamic memory cell. **(06 Marks)**
c. Discuss the concept of cache memory. **(06 Marks)**

Module-5

9 a. With a neat diagram, explain single bus organization of the data path inside a processor. **(08 Marks)**
b. Discuss the control unit organization of hard wired control. **(06 Marks)**
c. With a neat diagram, explain mircoprogrammed control unit design. **(06 Marks)**

OR

10 a. Explain three bus organization of the data path. **(08 Marks)**
b. Discuss the control sequence for execution of instruction ADD (R3), R1. **(06 Marks)**
c. Draw and explain organization of the control unit to show conditional branching in the micro program. **(06 Marks)**

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18EC36

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Power Electronics and Instrumentation

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the static anode cathode characteristic of SCR. **(04 Marks)**

b. With the help of waveforms, explain dynamic turn on switching characteristics and turn-off mechanism of SCR. **(08 Marks)**

c. Write the applications of power electronics in various sectors. **(08 Marks)**

OR

2 a. Draw the circuit diagram of R.C. firing and explain its operation. **(06 Marks)**

b. With the help of circuit diagram and waveforms, explain Class-A commutation circuit. **(06 Marks)**

c. Design a UJT relaxation oscillator using UJT 2N2646, for triggering an SCR. The UJT has the following characteristics $\eta = 0.7$, $I_P = 50\ \mu A$, $V_V = 2V$, $I_V = 6$ mA, $V_{BB} = 20$ V, $R_{BB} = 7\ k\Omega$, $I_{EO} = 2$ mA. **(08 Marks)**

Module-2

3 a. With the help of circuit diagram and waveforms, explain the working of single phase full wave controlled rectifier. Consider M2 (midpoint) configuration and R-Load. **(08 Marks)**

b. Explain the effect of free wheeling diode in controlled rectifiers. **(04 Marks)**

c. A step down DC chopper has a resistive load of R = 15 Ω and input voltage $E_{dc} = 200$ V. When the chopper remains ON. Its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine: (i) Average output voltage (ii) RMS output voltage (iii) Chopper efficiency **(08 Marks)**

OR

4 a. Give the classifications of choppers according to the directions of output voltage and current. **(05 Marks)**

b. Explain the principle of operation of step up/down choppers with the help of circuit diagram. **(09 Marks)**

c. A single phase half wave controlled converter is operated from a 120 V, 50 Hz supply. Load resistance R = 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine: (i) Firing angle (ii) rms and average output currents (iii) Average and rms SCR currents **(06 Marks)**

Module-3

5 a. Define the following terms:
(i) Measurement (ii) Resolution (iii) Error (iv) Sensitivity **(04 Marks)**

b. Design a multi-range ammeter with range of 0-1A, 5A and 10A employing individual shunt in each D'Arsonval movement with an internal resistance of 500 Ω and a full scale deflection of 10 mA is available. **(08 Marks)**

c. With the help of necessary circuit diagram and waveforms, explain the operation of single phase half bridge inverter with R-Load. **(08 Marks)**

OR

6 a. Define the following:
(i) Instrumental error
(ii) Environmental errors
(iii) Observational errors **(06 Marks)**

b. A voltmeter having a sensitivity of 1 KΩ/V is connected across an unknown resistance in series with a miliammeter reading 80 V on 150 scale. When the miliammeter reads 10 mA, calculate the
(i) Apparent resistance of the unknown resistance
(ii) Actual resistance of the unknown resistance
(iii) Error due to the loading effect of the voltmeter. **(06 Marks)**

c. With the help of necessary circuit and waveforms, explain the operation of Buck converter. **(08 Marks)**

Module-4

7 a. With the help of neat block diagram, explain the working of dual slope integrating type digital voltmeter. **(08 Marks)**

b. An unbalanced Wheatstone bridge is given in Fig.Q7(b). Calculate the current through the galvanometer.

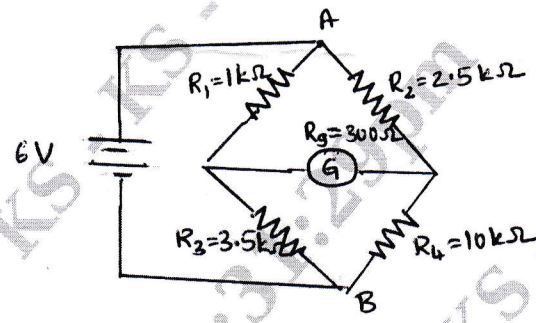

Fig.Q7(b) **(08 Marks)**

c. What is the principle of digital frequency measurement? Explain. **(04 Marks)**

OR

8 a. Explain successive approximation type digital voltmeter with the help of block diagram. **(08 Marks)**

b. Derive an expression for measuring unknown capacitance using capacitance comparison bridge. **(06 Marks)**

c. Obtain an expression for audio frequency using Wein's bridge **(06 Marks)**

Module-5

9 a. What are the parameters to be considered while selecting a transducer? **(04 Marks)**

b. Obtain an expression for the gauge factor of a strain gauge. **(08 Marks)**

c. Write the circuit of instrumentation amplifier and derive an expression for output voltage. **(08 Marks)**

OR

10 a. Explain the structure of PLC. **(07 Marks)**

b. Explain different type of thermistors. Also mention its advantages. **(06 Marks)**

c. With the help of diagram, explain the operation of linear variable differential transformer. **(07 Marks)**

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