Seat Number

*1720*

# Engineering Mathematics - III
## (144111 / 184111 / 234111)

**P. Pages : 4**

**Time : Three Hours**                                    **Max. Marks : 80**

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Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Figures to right indicate full marks.
5. Use of non programmable calculator is allowed.
6. All questions are compulsory.

**1.**  Attempt **any two.**

a) i) Solve : $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = 2e^x \cos\dfrac{x}{2}$.    **4**

   ii) Solve : $\dfrac{d^2y}{dx^2} + 2\dfrac{dy}{dx} + y = x\sin x$    **4**

b) i) Solve : $x^2\dfrac{d^2y}{dx^2} + 2x\dfrac{dy}{dx} - 12y = x^3\log x$    **4**

   ii) Solve : $\dfrac{d^2y}{dx^2} + 9y = \sec 3x$ by V.P. method.    **4**

c) An electric current consists of an inductance 0.1 henry, a resistance R of 20 ohms and a condenser of capacitance C of 25 microfarads. If the differential equation of electric circuit is    **8**

$$L\dfrac{d^2q}{dt^2} + R\dfrac{dq}{dt} + \dfrac{q}{C} = 0$$

then find the charge q and current i at any time t, given that, at

t = 0, q = 0.05 coulombs, $i = \dfrac{dq}{dt} = 0$ when t = 0.

2. Attempt **any two.**

a) i) If f(z) = u + iv is any analytic function of the complex variable    **4**
   z and $u-v = e^x(\cos y - \sin y)$, find f(z) interms of z.

   ii) Test the analyticity of the function w = sin z.    **4**

b) i) Find the bilinear transformation which maps the points    **4**
   z = 1, i, 2i on the points w = -2i, 0, 1 respectively.

   ii) Show that the transformation $w = z + \dfrac{1}{z} - 2i$ maps the circle    **4**
   $|z| = 2$ into an ellipse. Find the centre of the ellipse and its
   semi major and minor axis.

c) i) Evaluate $\displaystyle\oint_C \frac{z^2+1}{z-2} \, dz$ where C is the circle $|z| = 1$.    **4**

   ii) Evaluate the following integral using residue theorem    **4**
   $\displaystyle\int_C \frac{4-3z}{z(z-1)(z-2)} \, dz$ where C is the circle $|z| = \dfrac{3}{2}$.

3. Attempt **any two.**

a) i) Find $L\left[e^{-4t} \int_0^t t \sin 3t \, dt\right]$.    **4**

   ii) Find $L^{-1}\left[\dfrac{1}{S^2(S+1)^2}\right]$ by convolution theorem.    **4**

b) i) Find $L\left[\text{terf}\left(2\sqrt{t}\right)\right]$    **4**

   ii) Find $L^{-1}\left[\log\left(\dfrac{s^2+a^2}{s^2+b^2}\right)\right]$    **4**

c) Solve using Laplace transform,    **8**

   $y'' + 4y' + 13y = \dfrac{1}{3} e^{-2t} \sin 3t, \ y(0) = 1, y'(0) = -2.$

4. Attempt **any two.**

a) i) Find the Fourier cosine transform of the function      4

$$f(x) = \begin{cases} \cos x, & 0 < x < a \\ 0, & x > a \end{cases}$$

ii) Find z-transform of $f(k) = \begin{cases} -\left(-\dfrac{1}{3}\right)^k, & k < 0 \\ \left(-\dfrac{1}{4}\right)^k, & k \geq 0 \end{cases}$      4

b) i) Find z-transform of $f(k) = k5^k, \; k \geq 0$.      4

ii) Find $Z^{-1}\left[ \dfrac{z}{\left(z - \dfrac{1}{4}\right)\left(z - \dfrac{1}{5}\right)} \right], \; |z| > \dfrac{1}{4}$      4

c) Using Fourier integral representation, show that      8

$$\int_0^\infty \frac{1 - \cos \pi\lambda}{\lambda} \sin\lambda x \, d\lambda = \begin{cases} \dfrac{\pi}{2}, & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

5. Attempt **any two.**

a) i) A particle describes the curve $r = 2a\cos\theta$ with constant angular speed w. Find the radial and transverse components of velocity and acceleration.      4

ii) If the directional derivative of $\phi = axy + byz + czx$ at (1, 1, 1) has maximum magnitude 4 in a direction parallel to x axis, find the values of a,b,c.      4

b) i) Find the directional derivative of $\phi = e^{2x}.\cos yz$ at (0, 0, 0) in the direction of tangent to the curve.      4

$$x = a\sin t, \; y = a\cos t, \; z = at \text{ at } t = \frac{\pi}{4}$$

ii) Find curl curl $\overline{F}$ at the point (0,1,2) where    4
$\overline{F} = x^2 y i + xyz j + z^2 y k$

c) i) Prove that $\overline{F} = \dfrac{1}{(x^2 + y^2)}(xi + yj)$ is Solenoidal.    4

ii) Show that the vector field given by    4
$\overline{F} = (y^2 \cos x + z^2)i + (2y\sin x)j + 2xz\,k$
is conservative and find scalar field such that $\overline{F} = \nabla\phi$

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Seat Number

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*1725*

# Solid State Devices & Circuits - II
## (144112/184112/234112)

P. Pages : 3

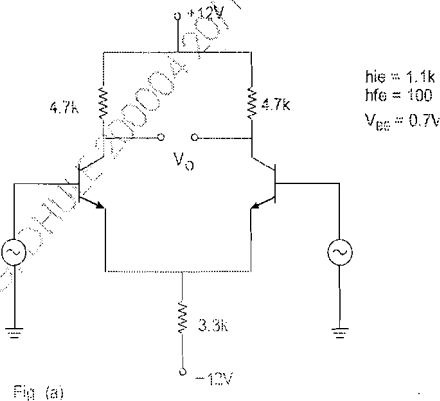Time : Three Hours                                    Max. Marks : 80

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Assume suitable data if necessary.
5. Use of non- programmable calculator is allowed.
6. Attempt **any two** questions from each unit.

## UNIT – I

1. Attempt **any two**.

a) Draw the circuit diagram of a Bistable multivibrator and explain     **8**
   its operation with the help of waveforms.

b) What is significance of CMRR? Explain any one method to     **8**
   improve CMRR of a differential amplifier.

c) For the differential amplifier shown in fig. (a) determine-     **8**
   1) Operating points.          2)  Voltage gains $AV_d$ and $AV_c$.
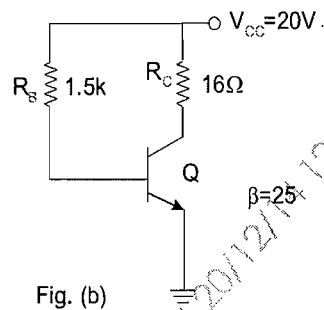   3) CMRR.



Fig (a)

hie = 1.1k
hfe = 100
$V_{BE}$ = 0.7V

## UNIT – II

2. Attempt **any two**.

a) Draw the circuit diagram of double tuned amplifier and explain its operation in detail.　　　8

b) Derive the expression for short circuit current gain of CE amplifier using hybrid-$\pi$ model.　　　8

c) Draw the circuit diagram of single tuned amplifier and explain its operation in detail.　　　8

## UNIT – III

3. Attempt **any two**.

a) Derive the expression for maximum conversion efficiency of a class-B push pull amplifier.　　　8

b) A series fed class A power amplifier uses a supply voltage of 20 V as shown in fig (b). The ac i/p voltage results in a base current of 9 mA peak. Calculate –　　　8
1) Co-ordinates of Q point
2) DC i/p power.
3) AC o/p power.
4) Conversion efficiency.
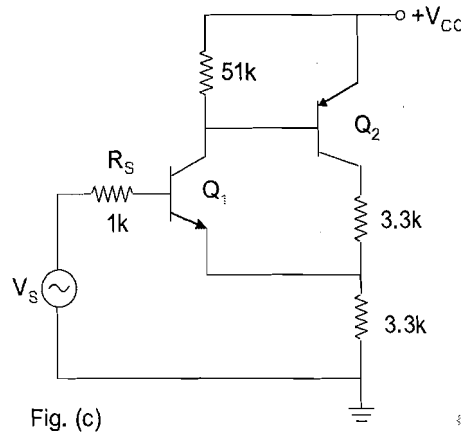5) Power Dissipation.
6) Max. power dissipation.



Fig. (b)

c) Explain :　　　8
i) Cross – over distortion.
ii) Use of transformer in class A power amplifier.

## UNIT – IV

4.    Attempt **any two**.

a) What is negative feedback? Explain how the performance of an    8
   amplifier improves with negative feedback. Also derive the
   expression for gain with neat diagram.

d) Derive the expression for input impedance and output    8
   impedance of a voltage series negative feedback amplifier.

c) Identify the feedback topology shown in fig (c). The transistors    8
   used are identical & have parameters $h_{ie}$ = 2 K, $h_{fe}$ = 50,
   $h_{re}$ = $h_{oe}$ = 0.
   Determine $A_{vf}$, $R_{if}$ and $R_{of}$.



Fig. (c)

## UNIT – V

5.    Attempt **any two**.

a) What are the types of voltage regulators? Derive the    8
   expression for output voltage of a transistorised series
   regulator.

b) Explain foldback protection circuit in detail.    8

c) With neat diagram explain the working of Hartley oscillator.    8
   Also derive the equation for frequency of oscillation.

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Seat Number

*1729*

# Microprocessors
## (144113/184113/234113)

**P. Pages : 2**

**Time : Three Hours**                                        **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Each question carry equal marks & figure to right indicate full marks non programmable scientific calculator is allowed.

## UNIT – I

1.  a)  Draw the architecture of 8085 microprocessor and explain.          8

    b)  Explain Demultiplexing of low order bus and generation of control          8
        signals.

    c)  Explain the working of :          8
        i)   Flag register
        ii)  Program counter
        iii) Stack pointer
        iv)  Accumulator

## UNIT – II

2.  a)  Explain the instructions.          8
        ANA, ANI, ORA, ORI, XRA, XRI, CMA and SUI.

    b)  Explain all possible JUMP instructions in 8085.          8

    c)  Explain the concept of subroutine with conditional and          8
        unconditional CALL and RETURNS.

## UNIT – III

3. a) Explain the addressing modes with example of each.  8

   b) Sixteen bytes of data are stored in memory locations at 5050H to 505FH. Transfer the entire block of data to new memory locations starting at 7070H.  8

   c) Write a program to count from 0 to 9 with one second delay between each count. At the count of 9, the counter should reset itself to zero and repeat the sequence continuously. Use register pair HL to set up delay and display each count at output parts. Assume clock = 1 MHz.  8

## UNIT – IV

4. a) Explain the interrupt structure of 8085 microprocessor.  8

   b) Explain concept of stack, with instructions associated with utilization of stack.  8

   c) Differentiate between memory mapped I/O and I/O mapped I/O.  8

## UNIT – V

5. a) Draw and explain block diagram of 8255 PPI.  8

   b) Explain all possible modes of 8255 with it's control word.  8

   c) Explain programmable internal timer / counter with it's block diagram and control word.  8

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Seat Number

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*1731*

# Linear Integrated Circuits
## (144114 / 184114 / 234114)

**P. Pages : 2**

**Time : Three Hours**                                              **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** sub questions from each unit.
5. Assume suitable data if necessary.
6. Figures to the right indicates full marks.
7. Use of non-programmable calculator is allowed.

## UNIT – I

1. a) Draw & explain Wilson current source ckt. in detail.                    8

   b) Draw & explain block diagram of OP-Amp.                                  8

   c) Draw & explain equivalent ckt. of OP-Amp. Also draw & explain ideal      8
      voltage transfer curve.

## UNIT – II

2. a) Draw & explain instrumentation amplifier using transducer bridge.        8

   b) Write the specification of a good instrumentation amp$^r$.               8

   c) Draw & explain log amplifier.                                            8
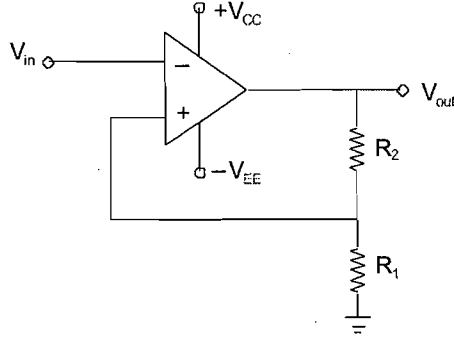
## UNIT – III

3. a) Draw & explain all pass filter with associated waveforms.                8

   b) Draw & explain shunt regulator using OP-AMP with it's limitations.       8

c) With neat block diagram explain series voltage regulator. **8**

## UNIT – IV

**4.** a) For the ckt. shown in following fig. evaluate the values of $R_1$ & $R_2$ if saturation voltages are +12V & -12V. Assume hysteresis width = 6V. **8**



b) Derive an expression for lock-in range with respective to PLL. **8**

c) Draw the pin diagram of IC 555 & explain. **8**

## UNIT – V

**5.** a) Write the specifications of DAC & ADC. **8**

b) For a particular dual slope ADC, $t_1$ is 83.33 msec. & the Vref. is 100mv. Calculate $t_2$ if : **8**

   i) $V_i$ is 100 mv & ii) 200 mv

c) Draw & explain pin diagram of IC ADC 0808/0809 family. **8**

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*1733*

# Network Analysis & Synthesis
## (144115/184115/234115)

**P. Pages : 3**

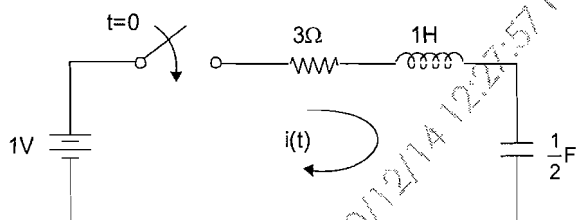**Time : Three Hours**                                        **Max. Marks : 80**
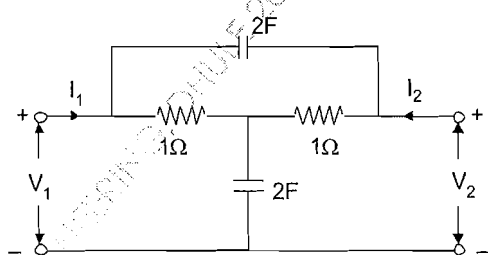
Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Figures to the right indicate full marks.
6. Assume suitable data if necessary.
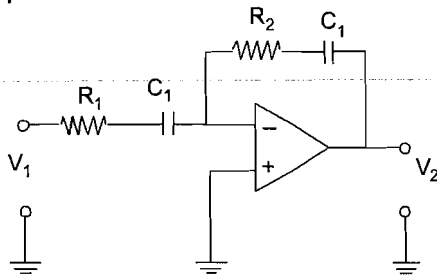7. Use of non programmable calculator is allowed.

## UNIT – I

1.  a) For the circuit shown below solve for i(t) using Laplace transform with switch 'k' closed at t = 0. Assume zero initial conditions.          8



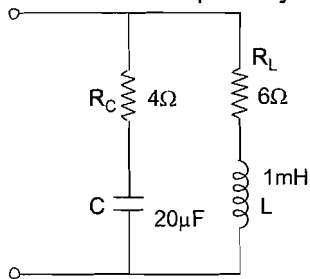b) Find the network function $z_{11}(s)$ and $z_{21}(s)$ for the network shown.          8

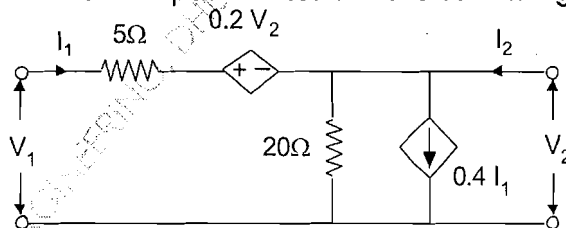c) For the circuit shown find the voltage ratio $\dfrac{V_o}{V_i}$ and plot pole-zero on s-plane.



## UNIT – II

2. a) Explain the significance of Q-factor. Derive the equation of Q of an inductor. **8**

b) A series resonant circuit is in resonance at $8 \times 10^6$ Hz and has coil of $35\mu H$ and $10\Omega$ resistor. Find : **8**

   i)   current at resonance.
   ii)  value of required capacitor
   iii) Impedance of freq. 8.1 MHz
   iv)  Current at 8.1 MHz, applied voltage is 100 $V_{rms}$.

c) In the circuit shown below calculate the resonant frequency war. If $R_C$ is increased what is its maximum value for which there is resonant frequency ? **8**
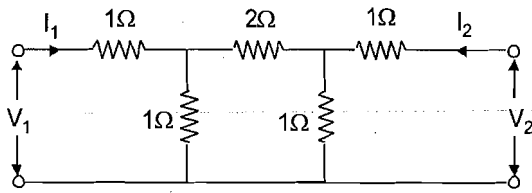


## UNIT – III

3. a) Derive the symmetry and reciprocity condition of z-parameters. **8**

b) Find the Y parameter for the following two port network. **8**

c) For the network shown find $z_{in} = \dfrac{V_1}{I_1}\Big|_{V_2=0}$ using cascade connection.  **8**
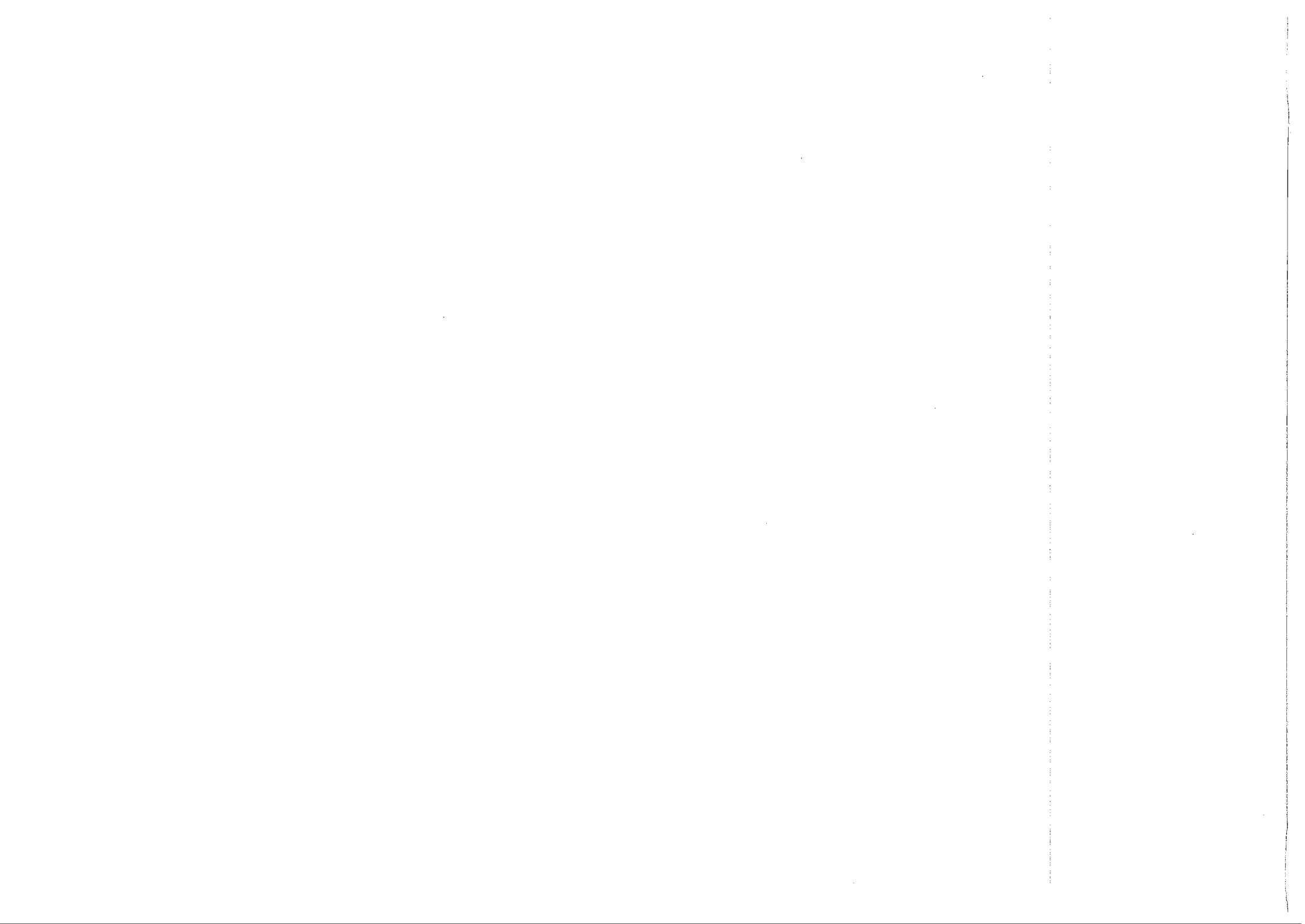


## UNIT – IV

4. a) What is attenuator ? Classify its types. An attenuator is composed of symmetrical T – section having series arm of 175Ω each and shunt arm of 350Ω. Find the characteristic equation and attenuation (in dB).  **8**

b) A prototype HPF has cutoff frequency of 10 kHz and design impedance of 600Ω. Find element values of L & C. Also find attenuation in dB and phase shift in degrees at a frequency of 8 kHz.  **8**

c) Design m-derived LPF to match a line having characteristic impedance of 500 Ω and to pass signals upto 1 kHz with infinite attenuation at 1.2 kHz.  **8**

## UNIT – V

5. a) Find out Cauer – I & Cauer – II of the network for  **8**

$$z(s) = \frac{s^4 + 10s^2 + 9}{s^3 + 4s}$$

b) Test whether $F(s) = \dfrac{s^3 + 10s^2 + 27s + 18}{s^2 + 7s + 11.25}$ is P.R.F.  **8**

c) $z(s) = \dfrac{(s+1)(s+4)}{s(s+2)}$  **8**

Solve by Foster – I & II form for RC driving point admittance.

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Seat Number

# Digital Techniques and Applications
## (143103/183103/233103)

**P. Pages : 2**

**Time : Three Hours**                    **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any two** question from each unit.
5. Figures to right indicate full marks.

## UNIT - I

1. a) Perform following operations.                          8

    i) $(615)_8$ to hexadecimal.

    ii) $(24.6)_{10}$ to binary number.

    iii) Add 8 and 6 in Excess 3.

    iv) Substract 8 from 5 in Excess 3.

  b) Using Boolean laws prove that.                     8

    i) $AC + C(A + \overline{A}B) = C(A + B)$

    ii) $XY + XYZ + XY\overline{Z} + \overline{X}YZ = Y(X + Z)$

    iii) $\overline{A}\overline{B}CD + \overline{A}BCD + ABD = BD$

    iv) $XY + \overline{X}Z + YZ = \overline{X}Z + XY$

  c) Minimize the given function using KMAP.              8

    i) $F(A,B,C,D) = \sum m(1, 3, 7, 11, 15) + \sum d(0, 2, 4)$.

    ii) $f(A, B, C, D) = \prod M(4, 6, 10, 12, 13, 15)$.

## UNIT – II

2. a) i) Design and implement full adder using gates.      4

       ii) Implement Boolean function using 4:1 Multiplexer.      4
$$F(A, B, C, D) = \sum M(1, 3, 5, 6).$$

    b) Design logic circuit to convert Binary to Gray code.      8

    d) Design BCD adder using 4 bit adder IC 7483 and explain with suitable example.      8

## UNIT - III

3. a) What is race around condition? Explain operation of positive edge clocked SR FF using NAND gate with waveform.      8

    b) Convert JK FF to DFF using excitation table. Draw 4 bit twisted ring counter using DFF.      8

    c) Draw and explain SIPO and PIPO shift register.      8

## UNIT - IV

4. a) Design Mod 10 asynchronous counter using JK FF. Also draw timing diagram.      8

    b) Design Mod S synchronous binary counter using T FF.      8

    c) Explain Moore and Mealy model with the help of diagram.      8

## UNIT - V

5. a) Define following parameters.      8
       i) Power dissipation.
       ii) Noise Margin.
       iii) Figure of Merit.
       iv) Propogation Delay.

    b) Explain interfacing of TTL to CMOS and CMOS to TTL.      8

    c) Draw and explain CMOS Inverter and CMOS NAND gate.      8

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*1735*

# Component Devices and Instrumentation Technology
## (143104/183104/233104)

**P. Pages : 2**

**Time : Three Hours**                                      **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** questions from each unit.
5. Draw neat diagram whenever necessary.
6. Assume suitable data if necessary.
7. Figures to right indicate full marks.

## UNIT - I

1. a) Define error and explain types of error.                         8

   b) Explain sensitivity of d.c. voltmeter and calculate the value of the multipier resistance on the 50 V range of a d.c. voltmeter that uses a 200 µA meter movement with an internal resistance of 100Ω.                         8

   c) Explain series type of ohmmeter with its calibration.             8

## UNIT - II

2. a) Draw and explain block diagram of function generator.            8

   b) Explain working principle and block diagram of dual slope integrating type of DVM.                         8

   c) List various features of instrumentation amplifier and explain how it differ from the ordinary Op-amp.                         8

## UNIT - III

3.  a)  Show that $I_g = \dfrac{E_{th}}{R_{th} + R_g}$ for unbalance Wheatstone bridge.  **8**

    b)  An a. c. bridge has the following constants  **8**

| Arm AB | - | Capacitor of 0.5 μF in parallel with 1 kΩ resistance. |
|--------|---|------------------------------------------------------|
| Arm AD | - | resistance of 2 kΩ. |
| Arm BC | - | capacitor of 0.5 μF. |
| Arm CD | - | Unknown capacitor $C_x$ and $R_x$ in series frequency – 1 kHz |

   Determine the unknown capacitance and Resistance and dissipation factor.

    c)  Draw and explain Maxwell's bridge.  **8**

## UNIT - IV

4.  a)  Explain resistance thermometer with diagram. Give its advantages and disadvantages.  **8**

    b)  Write short note on turbine flowmeter.  **8**

    c)  Explain Aluminium oxide hydrometer with neat diagram.  **8**

## UNIT - V

5.  a)  Explain guidelines for preparing Artwork.  **8**

    b)  Explain properties of laminates.  **8**

    c)  Explain fabrication process of single side PCB.  **8**

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*1 7 3 6 *

# Communication Systems - I
## (143105/183105/233105)

**P. Pages : 2**

**Time : Three Hours**                                                   **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub- questions form each unit.
5. Use of non programmable calculators is permitted.
6. Figures to the right indicate full marks.

## UNIT – I

1.  a)  Derive expression for noise in reactive circuit                    8

    b)  Prove that in case of thermal noise $V_n = \sqrt{4KT\delta fR}$       8

    c)  Write short notes on                                               8
        i)   Signal to noise ratio
        ii)  Noise Temperature.

## UNIT – II

2.  a)  Derive equation for total power for AM wave also prove that        8
        Pt= 1.5 PC if maximum power transmitted.

    b)  Derive the equation for modulation Index terms of Vmax &           8
        Vmin & calculate the depth of modulation index as well as
        calculate Vm & Vc if Vmax = 10 volt and Vmin = 4 volt.

    c)  Describe single side Band generation by filter method.            8

## UNIT – III

3.  a)  Draw & Describe block diagram of Armstrong $Freq^n$ modulation     8
        system.

    b)  For standard pre-emphasis circuit R is 100 $\Omega$ find out C.     8
        Describe per-emphasis & De-emphasis circuit in detail.

    c)  Explain direct methods of FM generation.                          8

## UNIT – IV

4.   a)   Draw and describe frequency modulation receiver                                    8

     b)   Define the following terms related to radio receiver                              8
          i)   Sensitivity ii) Selectivity ii) fidelity iv) Image rejection ratio.

     c)   Describe phase discriminator with neat circuit.                                   8

## UNIT – V

5.   a)   Compare Frequency Division multiplexing and time division                        8
          multiplexing.

     b)   Describe pulse Amplitude modulation generation and                               8
          reconstruction with waveform.

     c)   Derived following properties of Fourier transform                                8

          i)    $x(t) = ax(t) + by(t) \xleftrightarrow{FT} x(\omega) = a\,x(\omega) + by(\omega)$

          ii)   $x(t) = x(t - t_0) \xleftrightarrow{FT} x(\omega) = e^{-jwt_0}\,x(\omega)$

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Seat Number

*1738*

# Solid State Devices Circuits - I
## (143101/183101/233101)

**P. Pages : 3**

**Time : Three Hours**                                    **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Assume suitable data wherever necessary.
5. Attempt **any two** questions from each unit.
6. Use of non-programmable calculator is allowed.

## UNIT – I                                                      16

1.  a)  State mass-action law. A sample of Si has a resistivity of $25 \times 10^4 \, \Omega$-cm. in intrinsic condition. The sample is now doped to the extent of $4 \times 10^{10}$ donor atoms/ $cm^3$ and $10^{10}$ acceptor atoms/$cm^3$. Find the total conduction current density if electric field of 4v/cm is applied across the sample.

    Take- $\mu n = 1250 cm^2/v - sec, \mu p = 475 cm^2/v - sec, q = 1.6 \times 10^{-19} c$.

    b)  With neat circuit diagram. explain the voltage doubler circuit

    c)  Write notes on:
        i)   Transition and Diffusion capacitance.
        ii)  Diode resistances.

## UNIT – II                                                     16

2.  a)  Derive an expression for stability factor and Q-points of a voltage divider bias circuit.

    b)  Explain bias compensation techniques of BJT using diodes and thermistors.

c) A voltage source of internal source resistance Rs = 900 Ω drives a cc amplifier using load resistance $R_L$ = 2000Ω. The CE h-parameters are $h_{ie}$=1200 Ω, $h_{re}$ = 2x10$^{-4}$, $h_{fe}$=60 and $h_{oe}$=25 μA/V compute $A_I$, $R_i$, $A_v$ & $R_o$ using exact analysis.

## UNIT – III                                                     16

3.  a) With neat diagram explain the V-I characteristic of n-channel FET.

    b) For the biasing ckt shown in fig. 1 calculate the Q- point values $I_{Dsq}$, $V_{Dsq}$ and $V_{Gsq}$. If $I_{DSS}$= 12mA and $V_p$ = -4v using analytical approach.



Fig.1

    c) For the circuit shown in fig.2 determine $A_v$, $R_i$ and $R_o$.



Fig.2

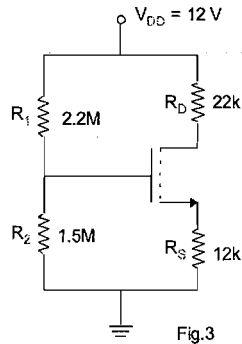## UNIT – IV                                                      16

4.  a) With neat diagram and output characteristics explain n-channel depletion MOSFET in detail.

b) For the circuit shown in fig.3 calculate $V_{gsq}, I_{Dq}$ and $V_{Dsq}$.

$K = 250 \times 10^{-6}$ A|$V^2$, $V_T = 1V$ (Use eq$^n$ $-I_D = K(V_{gs} - V_T)^2 \cdot$) VDD= 12V
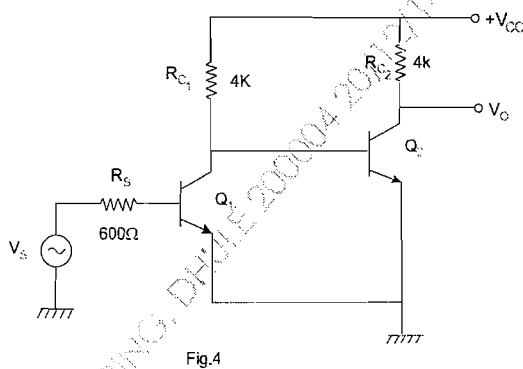


Fig.3

c) With neat diagram and o/p characteristics, explain p-channel enhancement MOSFET in detail.

## UNIT – V

16

5. a) For N-stage cascade amplifier, derive the expression for the overall upper cut –off frequency and lower cut –off frequency.

b) Write notes on –
1) Effect of coupling and bypass capacitor on frequency response of BJT
2) Effect of junction capacitances on frequency response of BJT

c) For the two stage, amplifier shown in fig. 4 determine $A_i$, $R_i$, $A_v$ and $R_o$ using exact analysis.
The h-parameters are-
$h_{ie} = 1600$ $\Omega$, $h_{fe} = 60$, $h_{re} = 5 \times 10^{-4}$, $h_{oe} = 25 \times 10^{-6}$ A/V



Fig.4

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Seat Number

*1739*

# Electrical Circuits and Machines
## (143102/183102/233102)

**P. Pages : 4**

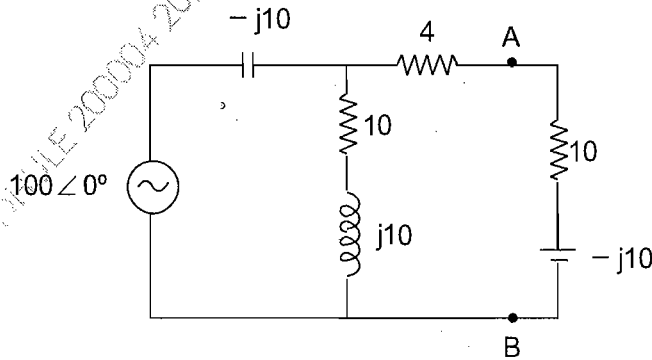**Time : Three Hours**                                         **Max. Marks : 80**

_____

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub-questions from each unit.
5. Assume suitable data wherever necessary and state the assumption made
6. Diagrams / sketches should be given wherever necessary.
7. Use of Logarithmic table, drawing instruments & non-programmable Calculators is permitted.
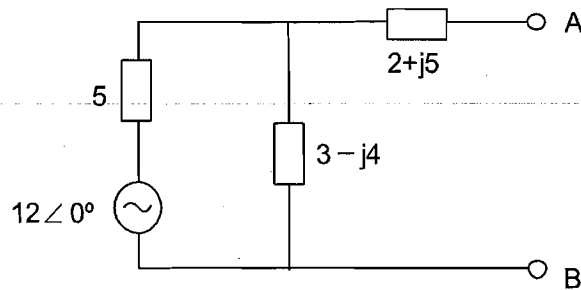8. Figures to the right indicate full marks.

## UNIT - I

1. a) i) Using Thevenins Theorem Calculate current flowing through the Load across terminals A & B & also Calculate power delivered to the load.    4

ii) Find the Nortons equivalent Network of terminals A and B of the circuit as shown below. **4**



b) i) Derive the relationship between line voltage and phase voltage for star connected 3 phase Balanced load. **4**

ii) A star Connected balanced load Take 7 Ampere of 0.8 Lagging power factor from 400 V power supply. Calculate loading of wattmeter $W_1$. If current coil is connected in R line and Voltage coil is connected in between R and Y line. For $W_2$ if current coil is in R line and Voltage coil is connected in between B & Y line. Phase sequence is R-Y-B and also draw net phasor diagram. **4**

c) To derive and expression for total power Consumed by three phase balanced Delta connected inductive load using two wattmeter. Draw net circuit & phasor diagram. **8**

## UNIT - II

2. a) Explain why starter is necessary for DC motor? Explain with neat diagram the working of 4 -point starter? **8**

b) i) Derive the speed equation of DC motor. **4**

ii) Draw and explain following characteristics of DC series motor. **4**

a) Ta-Ia

b) N-Ia

c) N-Ta

c) i) A shunt generator delivers 200 A of a terminal voltage of     **4**
220 volt the armature and shunt field resistance are 0.03 $\Omega$
and 55 $\Omega$. The iron and friction losses is 800 W. Find

    i) EMF generated.

    ii) Copper Losses.

    iii) B.H.P of the prime more.

    iv) Electrical, Mechanical and Commertial efficiency.

ii) The armature winding of a 4 - pole, 250 V DC shunt motor is     **4**
lap connected these are 120 slots each slots containing 8
conductors. The flux per pole is 20 mwb and current taken by
motor is 25 A. The resistance of armature and field circuit are
0.1$\Omega$ and 125 $\Omega$ respectively. If the rotational Losses amount
to 810W find.

    i) Gross Torque.

    ii) Useful torque.

    iii) Efficiency.

## UNIT - III

3. a) Draw open circuit and short circuit Test of single phase     **8**
transformer and explain the steps to find out efficiency and voltage
regulation from observation.

  b) i) Explain the working principal of transformer.     **4**

    ii) Draw the phasor Diagram for transformer on load of Lagging     **4**
and Leading power factor with winding resistance?

  c) Write a short notes on.     **8**

    i) Potential transformer.     ii) Current transformer.

## UNIT - IV

4. a) Derive and expression of emf equation of an alternator and     **8**
calculation of $K_c$ and $K_d$.

b) i) Explain the principle of operation of an alternator. 4

ii) What are the different methods of starting synchronous motor and explain any one in detail? 4

c) Explain with vector diagram for synchronous motor with different excitations for various power factors. 8

## UNIT - V

5. a) Explain working principle of 3φ Induction motor and concept of rotating Magnetic field. 8

b) i) Draw and explain the torque-slip characteristics of 3φ Induction motor? 4

ii) Write a short note on – Star – Delta starter. 4

c) i) With the help of neat sketch explain the working and applications of stepper motor. 4

ii) With the help of neat sketch explain the working and applications of Servo motor. 4

\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Seat Number

# Analog Communication
## (1110)

P. Pages : 2

Time : Three Hours                                          Max. Marks : 100

_____

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve all questions.
5. Assume suitable data if required.
6. Figures to the right indicate full marks.
7. From each question attempt **any two** subquestions.

## UNIT – I

1. a) Explain the internal noise in detail.                     10

   b) Explain communication system.                            10

   c) Explain & derive noise voltage for thermai noise.         10

## UNIT – II

2. p) Derive equation for total power of AM signal.             10

   q) Explain phase shift method for SSB generation.            10

   r) Explain SSB generation by filter system.                  10

## UNIT – III

3. a) Derive equation for FM signal.                            10

   b) Explain pre – emphasis and de – emphasis.                 10

   c) Compare PM with FM and AM with FM.                        10

## UNIT – IV

4.  p) Explain diode detector circuit in detail. **10**

    q) Explain balanced slope detector with characteristics. **10**

    r) Explain FM receiver. **10**

## UNIT – V

5.  a) Explain TDM in detail. **10**

    b) Explain space wave & sky wave propagation. **10**

    c) Describe different tones used in an auto exchange. **10**

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Seat Number

*1883*

# Management Science
## (1070)

P. Pages : 2

Time : Three Hours                                    Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions carry equal marks.
5. Solve **any two** from each unit.

## UNIT – I

1.  a)  State and describe the Fayol's principle of management.                    10

    b)  Describe the Neo-classical theory of management. How does it differ from scientific management.                    10

    c)  Describe co-ordination as a function of management state the various types of co-ordination in business organisation.                    10

## UNIT – II

2.  a)  Name the various types of organisation structure and explain any one of them with its merits and demerits.                    10

    b)  Differentiate between private limited company and public limited company.                    10

    c)  Define co-operative organisation ? State the characteristics of co-operative organisation ? Name the various types of co-operative societies with their advantages and limitations.                    10

## UNIT – III

3.  a)  Working capital is known as "revolving" or "circulating capital" justify.     **10**

    b)  Describe the following sources of finance –     **10**
        i)   Debentures
        ii)  Equity shares

    c)  Describe the role of foreign capital for the developing countries.     **10**

## UNIT – IV

4.  a)  What is manpower planning ? State its objectives and describe the various steps involved in manpower planning.     **10**

    b)  Explain the importance of training in business / industrial organisation.     **10**

    c)  Explain sales promotion. How does it differ from advertising.     **10**

## UNIT – V

5.  a)  State the causes of industrial accident and suggest practical measures to minimize them.     **10**

    b)  Explain in detail trademarks and copy right.     **10**

    c)  Describe Total Quality Management (TQM) in details.     **10**

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Seat Number

# Networks and Lines
## (1100)

**P. Pages : 3**

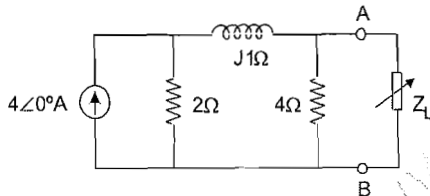**Time : Three Hours**                                         **Max. Marks : 100**
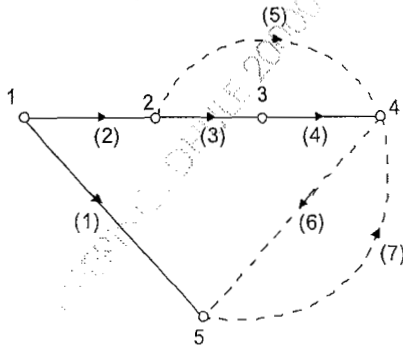
Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** from each unit.
5. Use of non programmable calculators is allowed.
6. Assume suitable data if necessary.

### UNIT – I

1.  a)  Determine the load required to be connected in the network shown       **10**
        below for maximum power transfer. Determine the maximum power
        drawn.



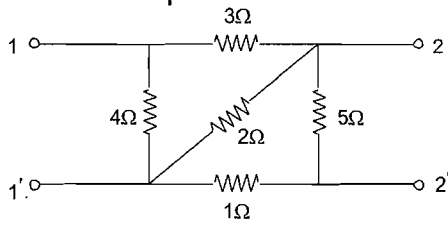    b)  For the graph shown write the incidence matrix tieset matrix and f-     **10**
        cutset matrix.

c) What is duality ? List five dual pairs of elements give the step by step procedure for obtaining the dual network of a given network. **10**

## UNIT – II

2. a) A series resonant circuit has impedance of 500 Ω at resonant frequency. Cut off frequencies are 10 kHz and 100 Hz. Determine : **10**
   i) resonant frequency
   ii) value of R, L & C and
   iii) Quality factor at resonant frequency.

b) A given generator of 1v, 0.7 MHz has internal resistance of 1kΩ. Design reactance L section to couple with a load of 10kΩ for impedance matching. **10**

c) i) State the significance of quality factor.

   ii) Define mutual inductance and coefficient of coupling. **10**

## UNIT – III

3. a) Find the equivalent T network for the circuit shown below. **10**



b) Distinguish between symmetrical network and asymmetrical network. What is identical network show that for symmetrical network $z_0 = \sqrt{z_{oc}z_{sc}}$ . **10**

c) Calculate the characteristic impedance, the attenuation constant and phase constant of a transmission line if $z_{oc} = 550\angle-60^\circ\,\Omega$, $z_{sc} = 500\angle-14^\circ\,\Omega$. **10**
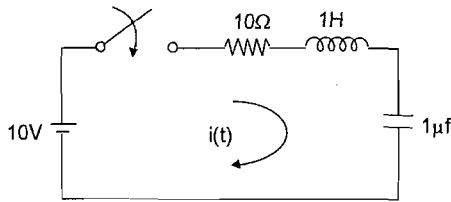
## UNIT – IV

4. a) Design m derived T type low pass filter to work into a load of 500Ω and cutoff frequency at 4 kHz and peak attenuation of 4.5 kHz. **10**
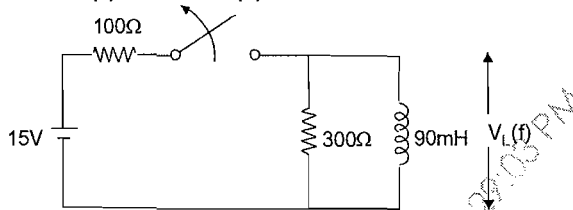
b) What are attenuators ? Classify attenuators. Explain in brief units of attenuation and obtain the relation between the two units. **10**

c) Design a constant k band pass filter to be terminated in 600Ω resistance having cut off frequencies of 2 kHz and 5 kHz. **10**

## UNIT – V

5. a) In the following network the switch is closed at t = 0. Assuming all initial conditions as zero find $i(0^+)$, $\dfrac{di(0^+)}{dt}$, $\dfrac{di(0^+)}{dt^2}$ **10**



b) What is the significance of initial conditions ? Write a note on initial conditions in basic circuit elements. **10**

c) For the network shown below, steady state is reached with the switch closed. The switch is opened at t = 0 obtain the expressions for $L_L(t)$ and $V_L(t)$. **10**



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Seat Number

*1887*

# Engineering Mathematics - III
## (1090)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt all the questions.
5. Figures to the right indicate full marks.
6. Use of non-programmable calculator is allowed.
7. In each question solve as per direction.

**1.** Solve **any four** 20

a) $\left(D^3 + 1\right)y = \sin 3x - \cos^2 \dfrac{x}{2}$

b) $\left(D^2 + D + 1\right)y = x^3 - 3x^2 + 1$

c) $\left(D^2 - 2D\right)y = e^x \sin x$ by the method of variation of parameter.

d) $x^3 \dfrac{d^3 y}{dx^3} - 4x^2 \dfrac{d^2 y}{dx^2} + 6x \dfrac{dy}{dx} = 4x$

e) $(1 + x)^2 \dfrac{d^2 y}{dx^2} + (1 + x) \dfrac{dy}{dx} + y = 2 \sin(\log (1 + x))$

f) A condenser of capacity 'C' is discharged through the inductance 'L' and a resistance 'R' in series. The charge 'Q' at any time t satisfy differential equation.

$$L \dfrac{d^2 Q}{dt^2} + R \dfrac{dQ}{dt} + \dfrac{Q}{C} = 0$$

Given L = 0.25 henry, R= 250 ohms; C = $2 \times 10^{-6}$ farads, and Q = 0.02, i = 0 at t = 0. Find Q in terms of t.

2. **Solve any four.** 20

a) Find the bilinear transformation which maps the points Z = 0, −i, −1 into the points W = i, 1, 0.

b) Find the analytic function f (z) = u + iv,
Where $v = \log(x^2 + y^2) + x - 2y$

c) Find the image of $|Z - 3i| = 2$ under the transformation $W = \dfrac{1}{Z}$.

d) Evaluate $\displaystyle\oint_C \dfrac{3Z^2 + Z}{Z^2 - 1}\, dZ$, where C is the contour $|Z - 1| = 1$

e) Evaluate $\displaystyle\oint_C \dfrac{\sin 5Z}{Z - \frac{\pi}{2}}\, dZ$, where C is the contour $|Z| = 3$.

f) Evaluate $\displaystyle\int_0^{2\pi} \dfrac{d\theta}{2 + \cos\theta}$

3. A) **Solve any two.** 14

a) Find the Fourier transform of
$$f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$$

and hence evaluate $\displaystyle\int_{-\infty}^{\infty} \dfrac{x\cos x - \sin x}{x^3} \cos \dfrac{x}{2}\, dx$

b) Find the Fourier sine transform of $\dfrac{e^{-ax}}{x}$

c) Find Z {f (k)} where

   i) $f(k) = \dfrac{2^k}{k!}, k \ge 0$

   ii) $f(k) = e^{-ak}, k \ge 0$

B) Solve **any one**    6

d) Using Fourier integral representation, show that

$$\int_0^\infty \frac{1-\cos\pi\lambda}{\lambda}\sin\lambda x\,d\lambda = \begin{cases} \pi/2 & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

e) Find $Z^{-1}\dfrac{Z}{(Z-1)(Z-2)}$ , if $|Z| \geq 2$

**4.** Solve **any four**    20

a) Find $L\{f(t)\}$, where $f(t) = \cosh at \sin at + e^{4t}\cosh 5t$

b) Obtain $L\{f(t)\}$, where $f(t) = \dfrac{t\sin at}{2a} + \dfrac{\sin^2 t}{t}$

c) Evaluate $\displaystyle\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\,dt$ by L·T

d) Find $L^{-1}\left\{\dfrac{s}{(s^2+a^2)^2}\right\}$

e) Using convolution theorem find $L^{-1}\left\{\dfrac{1}{(s+1)(s^2+1)}\right\}$

f) Solve the differential equation
$y'' + 3y' + 2y = t\,\delta(t-1)$ given that $y(0) = y'(0) = 0$

**5.** Attempt **any two**

a) i) If $\dfrac{\partial^2 y}{\partial t^2} = c^2\dfrac{\partial^2 y}{\partial x^2}$ represents the vibration of a string of length    7

$\ell$ fixed at both ends, find the solution with boundary conditions

$y(0,t) = 0; y(\ell,t) = 0$ ; and initial conditions $\left(\dfrac{\partial y}{\partial t}\right)_{t=0} = 0$

$y(x,0) = k(\ell x - x^2),\ 0 \leq x \leq \ell$.

ii) Evaluate $\int \bar{F}\cdot d\bar{\pi}$ for $\bar{F} = x^2 i + y\hat{j} + Z\hat{k}$    3

along the curve $x = t^2$, $y = 0$, $z = 1$ from $t = 0$ to 1

b) i) Evaluate $\iint_S \bar{F} \cdot \hat{n} \, ds$ over the surface of the tetrahedron bounded    **7**

by the coordinates planes and the plane $2x + y + 2z = 6$ using the divergence theorem if

$$\bar{F} = (x + y^2)\hat{i} - 2x\hat{j} + (2yz)\hat{k}$$

ii) For any closed surface enclosing a volume V, show that    **3**

$$\iint_S \text{curl} \, \bar{F} \cdot \hat{n} \, ds = 0$$

c) i) Evaluate $\oint_C (x^2 - y^2)dx + (2y - x)dy$ where C consists of the    **6**

boundary of the region in the first quadrant that is bounded by the curves $y = x^2$ and $y = x^3$

ii) Two of Maxwell's equations are    **4**

$$\nabla \cdot \bar{B} = 0, \quad \nabla \times \bar{E} = \frac{-\partial \bar{B}}{\partial t}$$

given $\bar{B} = \text{curl} \, \bar{A}$, then deduce that

$$\bar{E} + \frac{\partial \bar{A}}{\partial t} - \text{grad} \, V$$

Where V is a scalar point function.

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चपळ - 025

# Electronic Circuits & Applications
## (1080)

**P. Pages : 3**

**Time : Three Hours**                                    **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and attempt **any two** from each question.
5. Assume suitable data if necessary.
6. Use of non-programmable calculator is allowed.
7. Figures to the right indicate full marks.

## UNIT I

1.  a) Explain methods to improve CMRR in differential amplifier. Determine the output voltage of a differential amplifier if the input voltages are 250 $\mu V$ and 150 $\mu v$. The differential gain is 5000 and CMRR is 100.    **10**

    b) Explain a Schmitt trigger circuit using transistor. Draw input and output waveforms and state the applications.    **10**

    c) Determine output voltage $V_o$ for the given circuit in fig. (1) and draw input and output wave forms considering.    **10**
       a) Ideal diode.
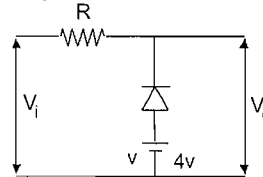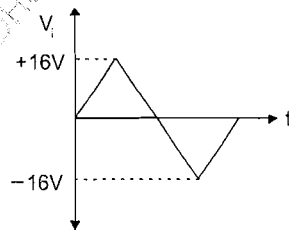       b) considering a silicon diode with drop of 0.7 v.



Fig.1

## UNIT – II

2.  a)  What is necessity of a different transistor model at high frequency **10** which model is used for transistor at high frequency. Draw the model and discuss each component in brief.

    b)  Explain effect of cascading tuned amplifier. What is remedy to **10** increase bandwidth? Explain frequency response characteristics of such amplifiers.

    c)  Derive an expression for $f_\beta$ for CE amplifiers. Explain significance **10** of $f_\alpha$ and gain bandwidth product.

## UNIT III

3.  a)  Derive an expression for efficiency of class A transformer coupled **10** amplifier.
    Calculate efficiency in above amplifier if $V_{CE(max)}$=15 v and $V_{CE}$ (min)=1 v.

    b)  Justify the statement with mathematical expressions - "A push pull **10** arrangement gives less distortion for a given power output."

    c)  Draw circuit diagrams for class B push pull with transformer **10** coupling and complementary symmetry configuration. Distinguish between these two configurations.

## UNIT IV

4.  a)  Calculate $A_{vf}$ and $R_{if}$ for the amplifier circuit shown in fig. (2). **10** Assume $R_s$=0, $h_{fe}$=50, $h_{ie}$=1.1 K$\Omega$, $h_{re}$ = $h_{oe}$= 0. The transistors are identical and all capacitors are short circuit at operating frequency.
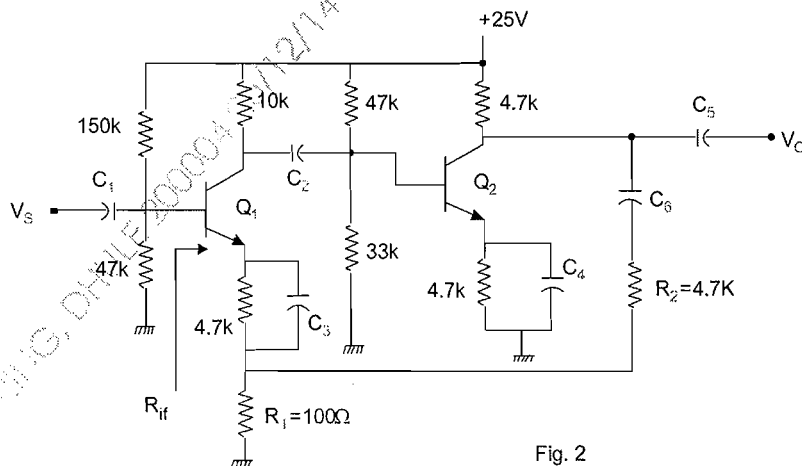


Fig. 2

b) Draw block diagram of a single loop feedback connection around the basic amplifier. Explain fundamental assumptions for analysis of feedback network. State effect of negative feedback on types of amplifier characteristics. **10**

c) Explain Colpitts oscillator in detail. State expression for frequency of oscillation and condition for maintenance of oscillation. **10**

## UNIT V

5. a) What will be value of $V_o$ in the following circuit fig. (3) if appropriate value of $C_i$, $C_o$ and $V_i$ are connected. What is function of $C_i$ and $C_o$ and values in the circuit. Draw a circuit using three terminal regulators to generate fixed output of ±15v. **10**
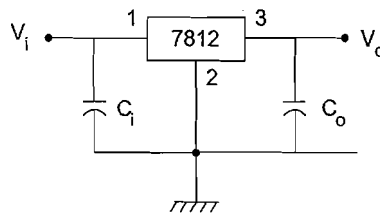


Fig. 3

b) Explain switch mode power supply. What are advantages of SMPS over linear power supply. **10**

c) Explain overload and short circuit protection circuits in regulators. **10**

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Seat Number

*1891*

# Electronics Instrumentation
## (1020)

**P. Pages : 3**

**Time : Three Hours**                                  **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal 20 marks.
5. Solve **any two** sub questions from each questions.
6. Use of non-programmable calculator is allowed.
7. Assume any additional suitable data, if required.
8. Illustrate your answer with neat sketches.

## UNIT – I

**1.**  a)  i)   What is difference between accuracy and precision ?        3

ii)  Explain arithmetic mean and deviation from mean.         3

iii) A voltmeter having sensitivity of 1000 $\Omega$/V, reads 100 V on its 150V scale when connected across an unknown resistor in series with a milli ammeter. When the milli ammeter reads 10mA calculate the apparent value of unknown resistance, the actual resistance of unknown resistor and the error due to loading effect.        4

b)  i)   Write short note on – CGS electro static system.         4

ii)  Explain in brief fundamental and derived units.         4

iii) A flux density is 129 lines / in$^2$, find out its value in CGS system.        2

c)  Write short notes on :                              10

i)   Resistance standard.

ii) Primary and secondary calibration.

## UNIT – II

2. a) i) A basic D'Arsonval movement with internal resistance $R_m=100\Omega$ **5** and full scale current $I_{fsd}=1mA$ is to be converted into a multirange dc voltmeter having 10V, 100V and 1000V ranges. Suggest suitable circuit arrangement with component values.

ii) Draw the functional circuit diagram of Watt Hour meter and explain it in brief. **5**

b) i) What do you mean by temperature compensation ? Is it necessary for PMMC basic movement ? If yes, explain in brief. **5**

ii) A series type ohm meter uses a 50 $\Omega$ basic movement with full **5** scale current of 1 mA. The internal battery voltage is 3V. The desired scale marking for half scale deflection is 2 k$\Omega$. Calculate component values of referred ohm-meter and draw the circuit diagram. Also determine, the maximum value of resistance connected across meter to compensate 10% drop in battery voltage.

c) i) Write short note on – Power Factor Meter. **5**

ii) Interpret the circuit shown in fig.1. It uses a 10 mA basic **5** D'Arsonval movement with an internal resistance of 5$\Omega$. It is desired to modify the circuit by adding an appropriate shunt resistor $R_{SH}$ across movement, so that the instrument will indicate 0.5 $\Omega$ at the mid point on its scale. Calculate the value of $R_{SH}$ and $R_1$.
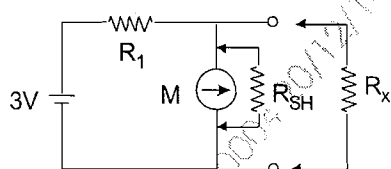

Fig.1

## UNIT – III

3. a) Draw the circuit diagram of wheat stone bridge and explain it in brief. **10** If battery of 5V and zero internal resistance is used in this circuit with 3 resistance of 1k each and one unkown resistor. The galvanometer used has current sensitivity of 10 mm/$\mu$A and an internal resistance of 100 $\Omega$, it shows deflection of 30 mm. Calculate the value of unknown resistor.

b) Suggest suitable a.c. bridge with justification for the measurement of high 'Q' coils. Draw the circuit diagram and derive the expression for unknown inductance. **10**

c) What is stray capacitance ? What is the effect of stray capacitance in a.c. bridges ? Explain the technique used to eliminate the effect of stray capacitance. **10**

## UNIT – IV

4. a) Draw block diagram of true rms responding voltmeter and explain in brief. How it differs from ac voltmeters using rectifiers. **10**

b) Draw block diagram of ramp type DVM and explain it in brief. State its advantages and disadvantages. **10**

c) i) Explain different parameters which influence the selection analog voltmeter. **5**

ii) Write short note on – Servo Potentiometer. **5**

## UNIT – V

5. a) Discuss temperature measurement using thermocouple. **10**

b) i) Name four types of electrical pressure transducer and describe one application of any two types. **6**

ii) Define 'gage factor" wrt strain gage. A resistance strain gage with gage factor 2 is fastened to a steel member subjected to a stress of 1050 kg/cm$^2$. Calculate the change in resistance ($\Delta$R) of strain gage due to applied stress, assume modulus of elasticity of steel = $2.1 \times 10^6$ kg/cm$^2$. **4**

c) Write short notes on :

i) Pyrometer. **6**

ii) Transducer selection. **4**

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# Semiconductor Devices and Circuits
## (1050)

**P. Pages : 4**

**Time : Three Hours**                                          **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory & carries equal marks.
5. Assume suitable data if required.
6. Use of non-programmable calculator is allowed.
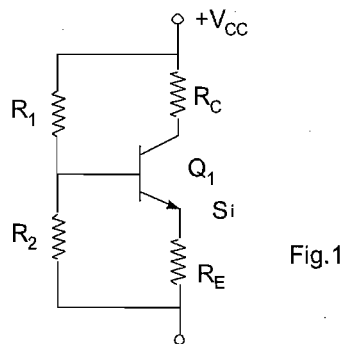
## UNIT – I

1.      Solve **any two.**

a)   A specimen of pure germanium at 300°K has a density of charge     **10**
     carries $2.5 \times 10^{19}/m^3$. It is doped with donor impurity atoms at the
     rate of one impurity atom every $10^6$ atoms of Ge. The density of
     Ge atom is $4.2 \times 10^{28}$ atoms/$m^3$. Calculate the resistivity of doped
     germanium if electron mobility is $0.38 m^2/V - s$.
     If the Ge bar is $5 \times 10^{-3}$ m long & has a cross-sectional area of
     $[5 \times 10^{-6}]^2 m^2$, determine its resistance & the voltage drop across
     the semiconductor bar for a current of $1\mu A$ flowing through it.

b)   Calculate the current flowing through silicon diodes $D_1$ & $D_2$     **10**
     voltage drop across diode & voltage drop across resistance. If
     i)   Both diodes are connected in forward bias.
     ii)  Both diodes are connected in Reverse Bias.
     iii) Both diodes are connected back to back.
     A 10V battery along with 100Ω resistance is used in series with
     diode.

c) For a FWR with capacitor filter, derive the mathematical **10** expression of ripple factor & also draw its output waveform.
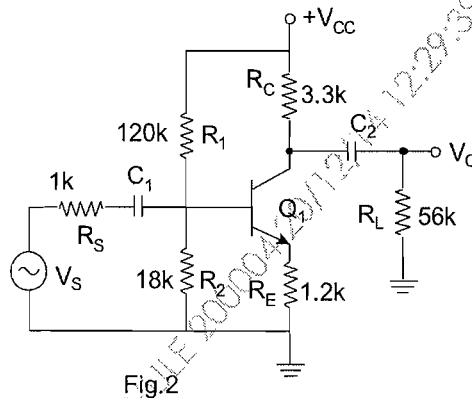
## UNIT – II

2. Solve any two.

a) For the circuit shown in fig. 1 with **10**
$V_{CC} = 12V$, $R_1 = 8k\Omega$, $R_2 = 4k\Omega$, $R_C = 1k\Omega$, $R_E = 1k\Omega$ & $R_L = 1.5k\Omega$.
   i) Draw the d.c. load line.
   ii) Determine operating point.
   iii) Draw the a.c. load line.



Fig.1

b) For a single stage amplifier shown calculate $A_v, R_i, A_I$ & $R_O$. **10**
Also draw its A.C. equivalent h-parameter model.

Assume $h_{ie} = 1.1k\Omega$, $h_{fe} = 50$, $h_{re} = 2.5 \times 10^{-4}$ & $h_{oe} = 25 \times 10^{-6}$ A/v.



Fig.2

c) Compare performance of CE, CB & CC configuration, Also **10** explain the need of multistage amplifier.

## UNIT – III

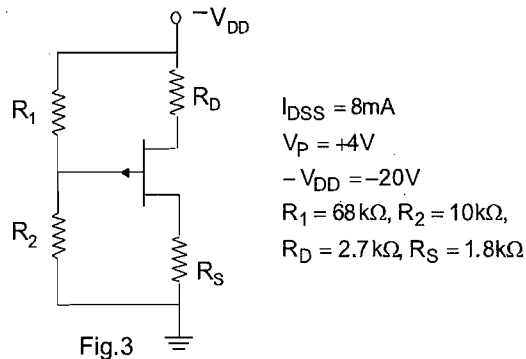3.  Solve **any two.**

a)  Write short notes on :  **10**

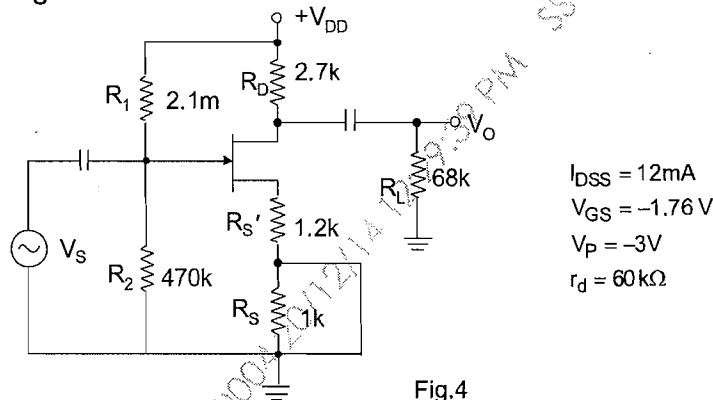i)  Drain & Transfer characteristics of JFET.

ii)  MESFET.

b)  For the circuit shown in fig. 3 determine Q-point, $V_{GS}$ & $g_m$.  **10**



$I_{DSS} = 8mA$
$V_P = +4V$
$-V_{DD} = -20V$
$R_1 = 68 k\Omega, R_2 = 10 k\Omega,$
$R_D = 2.7 k\Omega, R_S = 1.8 k\Omega$

Fig.3

c)  For the circuit shown in fig. 4 determine $A_V, R_i, R_O, A_{VS}$ &  **10**
magnitude of output voltage. Also draw A.C. equivalent small-signal model.



$I_{DSS} = 12mA$
$V_{GS} = -1.76 V$
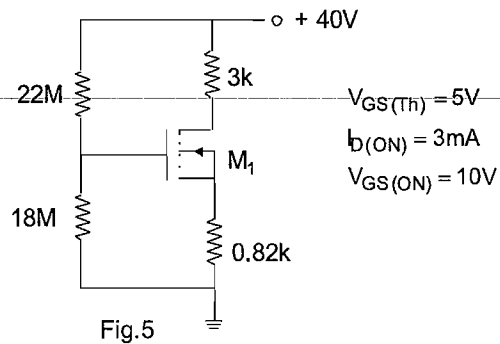$V_P = -3V$
$r_d = 60 k\Omega$

Fig.4

## UNIT – IV

4.  Solve **any two.**

a)  With the help of constructional diagram & output (Orian)  **10**
characteristics, explain the operation of n-channel Depletion MOSFET.

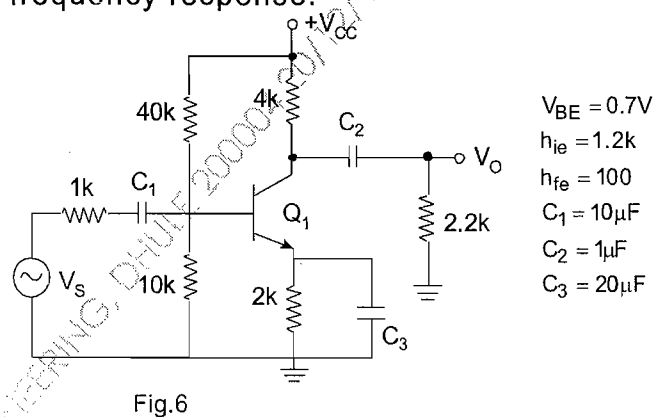b) Determine $I_{DQ}$, $V_{GSQ}$ & $V_{DS}$ for the circuit shown in fig. 5 using graphical approach. **10**



$V_{GS(Th)} = 5V$

$I_{D(ON)} = 3mA$

$V_{GS(ON)} = 10V$

Fig.5

c) Write notes on : **10**

i) Body effect.

ii) CMOS Inverter.

## UNIT – V

5. Solve **any two.**

a) Explain square wave testing & its advantages. Derive the equation of $F_L$ & $F_H$ for an amplifier using square-wave testing method. **10**

b) Explain : **10**

i) Frequency response of multistage amplifier.

ii) Reasons for higher cut off frequency in amplifier.

c) For the given circuit in fig. 6. Determine $F_L$, $A_{vmid}$ & sketch the frequency response. **10**



$V_{BE} = 0.7V$

$h_{ie} = 1.2k$

$h_{fe} = 100$

$C_1 = 10\mu F$

$C_2 = 1\mu F$

$C_3 = 20\mu F$

Fig.6

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*1 8 9 5 *

# Electrical Circuits and Machines
## (1040)

**P. Pages : 3**

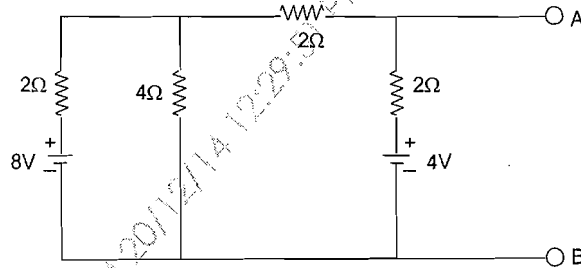**Time : Three Hours**                     **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Figures to the right indicate full marks.
5. Use of non – programmable calculator is allowed.
6. Assume suitable additional data if necessary.
7. Neat diagrams must be drawn wherever necessary.

**1.** Attempt **any two.**

a) i) Prove that sum of two wattmeter readings gives total power consumed in three phase star connected load.    **6**

   ii) Find thevenin's equivalent for the circuit shown in fig. below.    **4**



b) i) A star connected balanced load is supplied from a 3 phase balanced supply with a line voltage of 416v at a frequency of 50Hz. Each phase of the load consists of a resistance and capacitor joined in series and the readings on the two wattmeters connected to measure the total power supplied are 782 watts and 1980 watts, both positive. Calculate p.f. of the circuit, line current and capacitance of each capacitor.    **6**

   ii) State and explain maximum power transfer theorem.    **4**

c) i) Show that how reactive power can be measured by using one wattmeter method.　　5

ii) Derive the relationship between line current and phase current & line voltage and phase voltage for delta connected load.　　5

2. Attempt **any two.**

a) i) An 8 pole de stunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of 12.5$\Omega$ resistance at terminal voltage of 250V. If Ra = 0.24$\Omega$ and the field resistance is 250$\Omega$. Find emf induced and flux per pole.　　6

ii) Explain why starter is necessary for starting de motor and draw the figure of three point starter.　　4

b) i) Explain Torque = Armature current characteristics and speed – armature current characteristics of de series motor.　　5

ii) A 200V de series motor takes 40A when running at 700 rpm. Calculate the speed at which the motor wile run if the field is shunted by resistance equal to the field resistance and the load torque is increased by 50%. Assume Ra = 0.15$\Omega$ and field resistance = 0.1$\Omega$ and the flux per pole is proportional to the field.　　5

c) i) A 220V, 15kw, 850 rpm shunt motor draws 72.2A when operating at rated condition. The resistance of the armature and shunt field are 0.25$\Omega$ and 100$\Omega$ respectively. Determine the percentage reduction in field flux in order to obtain a speed of 1650 rpm when armature current drawn is 40A.　　6

ii) Explain the function and material used in yoke, commutator in de machine.　　4

3. Attempt **any two.**

a) i) What do mean by efficiency and regulation of transformer and determine the condition for maximum efficiency.　　6

ii) Write a short note on current transformer.　　4

b) i) Derive the emf equation for transformer.　　5

ii) Explain the operation & advantages of auto – transformer.　　5

c) i) A 10KVA, 450/120V, 150Hz transformer gave the following readings:
O. C test : 120V, 4.2A, 80W (L.V. Side)
S. C test : 9.65V, 22.2A, 120 W (L.V side shorted)
Calculate efficiency and regulation at half load and 0.8 lagging pf load.　　6

ii) Explain star – star and star – delta connections of three phase transformer.　　4

4. Attempt **any two.**

   a) i) Compare salient pole type and smooth cylindrical type rotor    **5**
   of alternator.

   ii) Explain the phenomenon of hunting in synchronous motor.    **5**

   b) i) Explain synchronous impedance method of calculating    **6**
   regulation of alternator.

   ii) Explain the advantages of rotating field over rotating armature    **4**
   type construction of altimeter.

   c) i) Find the number of armature conductors in series per phase    **6**
   required for the armature of a 3 phase 10 pole 50Hz
   synchronous generator with 90 slots. The winding is to be star
   connected so as to have the line voltage of 11kV and the flux
   per pole is 0.16 cub.

   ii) Write a short note on V – curves.    **4**

5. Attempt **any two.**

   a) i) Derive the torque equation of Induction motor and hence    **5**
   derive the condition for maximum torque.

   ii) Explain the construction and operation of a stepper motor.    **5**

   b) i) Write a short note on universal motor.    **5**

   ii) A 3 phase induction motor having 6 pole, star connected stator    **5**
   winding runs on 240V, 50 Hz supply. The rotor resistance and
   stand still reactance are 0.12Ω and 0.85Ω per phase. The ratio of
   stator to rotor turns is 1.8 and full load slip is 4%. Calculate torque at
   full load and maximum torque and speed at maximum torque.

   c) i) Explain Torque - slip characteristics of 3 phase induction    **5**
   motor.

   ii) The power input to rotor of a 400V, 50Hz 6 pole, three phase    **5**
   induction motor is 75kw. The rotor emf is observed to make
   100 complete alterations per minute. Calculate slip, rotor
   speed and rotor cu loss per phase and mechanical power
   developed.

**\*\*\*\*\*\*\*\*\***

Seat Number

[ ][ ][ ][ ][ ][ ]

*1897*

# Digital Circuits and Logic Design
## (1030)

**P. Pages : 2**

**Time : Three Hours**                                      **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** questions from each unit.
5. Draw neat diagram wherever necessary.
6. Figures to the right indicate full marks.

## UNIT – I

1.  a) Explain the following terms with reference to digital IC's.          **10**
       i)   Speed of operation
       ii)  Fan in
       iii) Fan out
       iv)  Power dissipation
       v)   Noise immunity.

    b) State merits and demerits of CMOS logic family. Explain with          **10**
       diagram two input CMOS NAND gate and NOR gate.

    c) Explain basic ECL OR/NOR gate with neat diagram, why ECL          **10**
       family has lowest propagation delay of all logic families?

## UNIT – II

2.  a) Design Binary to Gray Code Convertor.          **10**

    b) i)  Write a note on Minterms and Maxterms.          **5**

       ii) Minimize the given function using K-map.          **5**

       $f(A,B,C,D) = \Sigma m(0, 1, 2, 3, 6, 7, 13, 15)$

c) Give the classification of codes, explain hamming code and ASCII code with the help of example.    **10**

## UNIT – III

3. a) Design BCD adder by using 7483 and logic gates.    **10**

   b) i) Write a short note on ALU (Arithmetic Logic Unit)    **5**

      ii) Write a short note on carry look ahead generator.    **5**

   c) Design a full adder by suitable multiplexer and decoder.    **10**

## UNIT – IV

4. a) What is a shift register? Explain its use as a ring counter and twisted ring counter.    **10**

   b) i) Explain combinational and sequential logic circuits.    **5**

      ii) Explain J – K flip flop.    **5**

   c) Design Mod – 8 Asynchronous counter by using J – K flip – flop.    **10**

## UNIT – V

5. a) Design Mod – 10 synchronous counter by D flip flop.    **10**

   b) Explain Mealy circuit with suitable example and compare it with Moore circuits.    **10**

   c) i) Write a short note on sequence generator.    **5**

      ii) Define counter and Differentiate between synchronous and asynchronous counter.    **5**

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