

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	60
Programme	BEI, BCT	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Digital Logic (EX 152)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

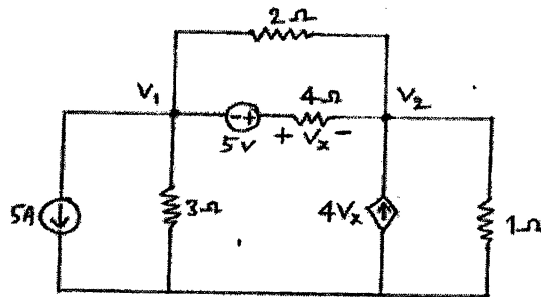
1. Mention merits and demerits of digital signal over analog signal. [2]
2. Perform the following as indicated: [2×1.5]
 - a) $(6E.2C)_{16} = (?)_8$
 - b) $(10110110)_{\text{Gray}} = (?)_2$
3. Design the simplest logic circuit for 'f' segment for the BCD-to-seven segment display decoder. [4]
4. Implement $Y(A, B, C) = \sum_m(0, 2, 3, 5, 7)$ using only a single 1:4 MUX. Design a circuit which can realize both the half-adder and the half-subtractor in a single circuit. [3+7]
5. Design a mod-6 synchronous down counter using JK flip-flops. [7]
6. Explain the operation of 4-bit serial-in parallel-out (SIPO) shift register with necessary circuit and timing diagram for input data of 1011. [3+3]
7. Describe briefly the operation of 3 bit up/down asynchronous counter having negative edge triggering clock system with neat circuit diagram and timing diagram. [4+3]
8. Design a sequential machine that consists of one input, X and one output, Z. The machine is required to give output high ($Y=1$), whenever it detects the serial sequence of 101 from its input data stream X. Implement only SR flip-flops for the designed circuit realization. [10]
9. Draw the circuit diagram of two-input TTL NOR gate and explain its logic operation briefly and list the characteristics of CMOS logic family. [5+2]
10. With the help of functional diagram explain the operation of frequency measurement. [4]

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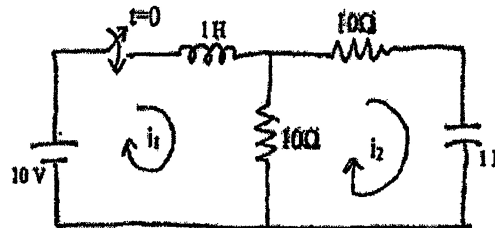
Subject: - Electrical Circuits and Machines (EE 154)

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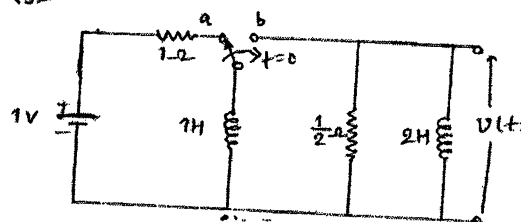
1. Using Nodal analysis and matrix solution method, find V_x and the current in 2 ohm resistance. [6]



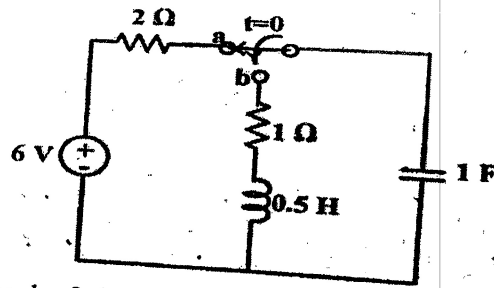
2. Obtain the value of i_1 , i_2 , di_1/dt , di_2/dt at $t = 0^+$, if the switch is closed at $t = 0$ in the circuit shown below. [5]



3. The circuit shown below is in steady state with switch is at position 'a'. The switch is moved to position 'b' at $t = 0$. Find the expression for $V(t)$ and current through 2H inductor $i_L(t)$ for $t > 0$ using classical method. [6]



4. The switch in the figure below has been in position 'a' for a long time. Then, it is moved to 'b' at $t = 0$. Obtain the expression for voltage across capacitor for $t > 0$ using Laplace transform method. [6]



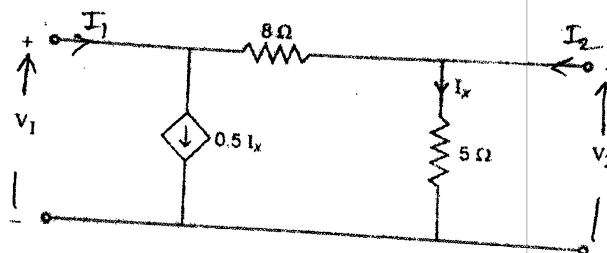
5. Plot asymptotic Bode graph of given transfer function.

$$G(s) = \frac{500(s+2)}{s(s^2+15s+121)}$$

[7]

6. Find the expression of Z parameters in terms of ABCD parameters. For given two port networks, find ABCD parameters.

[2+4]



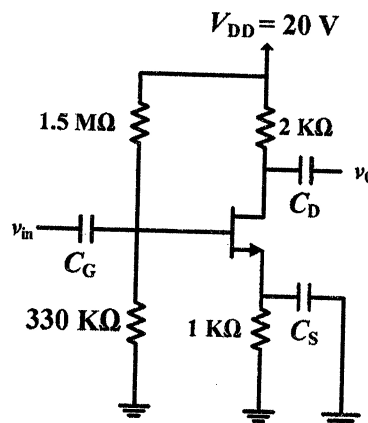
7. Explain operation of transformer at loaded condition and prove that main flux in the core of transformer at any loading condition is constant. [6]
8. A 240 V dc shunt motor has armature winding resistance of 0.4Ω and field winding resistance of 120Ω . It draws a current of 30A at half load and the corresponding speed is 1400 rpm. If a resistance of 1.2Ω is connected in series with the armature winding and load torque is decreased by 20%. Calculate the new speed. [6]
9. Explain the Torque-speed characteristics of three phase induction motor with the help of proper mathematics and graph. [6]
10. Write short notes on (Any Two) [2×3]
- Role of commutator and carbon brush in dc machine
 - Hysteresis and eddy current power losses
 - Stepper motor

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Level	BE	Full Marks	60
Programme	BEI, BCT	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Electronics Device and Circuit (EX 151)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.

1. Design β independent type dc biased common emitter amplifier. Given parameters $V_{CC} = 20\text{ V}$, $I_C = 1.5\text{ mA}$ and $\beta = 110$. Use stiff biasing method. [4]
2. Why is a common collector BJT amplifier also known as an emitter follower? Draw the small signal model of common collector amplifier circuit and derive expressions for input resistance, voltage gain, and current gain. [1+4]
3. Derive trans-conductance of BJT. [4]
4. Describe the construction and working principle of n channel enhancement-type MOSFET with the help of necessary diagrams and its drain characteristic curve. [7]
5. Find I_D and V_{DS} for the following circuit. Given data are $V_P = -5.5\text{ V}$, $I_{DSS} = 10\text{ mA}$. Assume all the capacitors are ideal and check whether the transistor is operating in the Pinch off region or not. [6]



6. State Barkhausen criterion for sinusoidal oscillation. Draw the circuit diagram of Colpitts oscillator and write its frequency of oscillation. [4]
7. Derive frequency of oscillation of 555 timer Astable Multivibrator. [4]
8. Draw a Widlar Current Source. Derive an expression for an output resistance of Widlar Current Source. [5]
9. Calculate the efficiency of a transformer coupled Class A amplifier for a supply of 12 V DC and output of $V_P = 12\text{ V}$ and 6 V . [4]
10. Draw the circuit diagram and the characteristic curve of a transformer coupled class B push-pull amplifier and derive its general efficiency. [5]
11. Draw the circuit diagram of class A tuned amplifier with its frequency response. Derive its 3dB bandwidth. [4]
12. Design variable DC voltage regulator using LM 317 to get (10-20) volts output. [4]
13. Explain the working principle of a series transistor voltage regulator with improved performance and derive an expression for the voltage stability. [2+2]

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Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (SH 153)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. The standard reduction potential of Cd^{++}/Cd and Ni^{++}/Ni electrodes are -0.403 V and -0.25 V respectively. Construct a galvanic cell using these electrodes so the standard emf of the cell becomes positive. For what concentration of Cd the emf of the cell at 25°C becomes zero, if the concentration of Ni is 0.01M. [1+4]

OR

- What is Lithium ion battery? Write the reactions involved during discharging and charging of this battery. Write its advantages and disadvantages. [1+2+2]
2. Taking suitable example, explain how the basic buffer solution resists the change in pH with the addition of small amount of acid or base.
If 0.2 gm of NaOH is added to 1 liter of buffer solution containing 0.1M NH_4OH and 0.2M NH_4Cl , what will be the pH of resulting solution? (pK_b for ammonia = 4.74). [2+3]
 3. How are the catalysts used in the field of pollution control? Explain. Write any two examples of biocatalyst used in degradation of dyes. [4+1]
 4. What is Chromatography? Explain the principle and application of thin layer chromatography. How does it vary from paper chromatography? [1+3+1]

OR

Write the principle of IR spectroscopy. Mention its applications. [3+2]

5. a) What are inner and outer orbital octahedral complexes? On the basis of VBT predict the magnetism and geometry of $[\text{Fe}(\text{CN})_6]^{4-}$ [1+2.5]
b) From the given IUPAC names write the molecular formula of the following complexes. [1.5]
 - i) Potassiumtetraiodomercurate (II)
 - ii) Dichloro-bis- ethylenediaminenickel (IV) sulphate
 - iii) Tetraaquadichlorocobalt (III) chloride
6. What are metallic alloys? Give examples with their uses. Using CFT, explain the color formation and magnetic property of $[\text{Cu}(\text{NH}_3)_6]^{3+}$. [2+3]
7. a) What is the goal of green chemistry? Mention any four principles of green chemistry. [1+4]
b) What is the degree of hardness of water? How are scales formed in boiler? Explain briefly the chemical oxygen demand and its consequences with reference to water pollution. [1+1.5+2.5]
8. What are nanofibers? Mention their applications in health and environment. [2+3]

9. a) Write the preparation and uses of polymethyl methacrylate (PMMA). Explain the mechanism of cationic polymerization reaction taking suitable example. [2+3]
b) Write the preparation and applications of Kevlar and polyurethane. [2.5+2.5]

OR

- i) What are carbon fiber reinforced plastics? Show your acquaintance to collagen. [1+2]
ii) Write the hydration of cement. [2]
10. a) What are the requisites of a good paint? Discuss about the impact of paint on a human health.
b) How can TNG be prepared? Write its uses. [3+2]

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Programme	All(Except BAR)	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Mathematics II (SH 151)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) By using Euler's theorem show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$
where, $u = \tan^{-1}(x^2 + 2y^2)$ [2]
- b) If $u = x^2$ and $v = y^2$, then find $\frac{\partial(u,v)}{\partial(x,y)}$ [2]
2. a) Evaluate $\int_0^1 \int_0^z \int_{x-z}^{x+z} (x + y + z) dy dx dz$ [2]
- b) Evaluate the mass of the solid region bounded by $z = 1 - x^2$ and planes $z = 0$, $y = 1$, $y = -1$ with $\rho(x, y, z) = z(y + 2)$ [2]
3. a) Find the directional derivative of $\Phi(x, y) = 4x^2 + 3y - 4z$ at $(1, 2, 1)$ in the direction of $2\vec{i} + 2\vec{j} + \vec{k}$ [2]
- b) A particle moves along the curve $x = \sqrt{2} \cos t$, $y = \sqrt{2} \sin t$, $z = 4t$, then find the velocity and acceleration at time $t = \frac{\pi}{4}$ [2]
- c) If $\phi = x^3 + y^3 + z^3 - 3xyz$, then find $\text{div}(\text{grad } \phi)$ at the point $(1, -1, 1)$ [2]
4. a) Find the Laplace Transform of the function: $\frac{1-e^t}{t}$ [2]
- b) Find the inverse Laplace transform of $\frac{s}{(s+2)^3}$ [2]
5. a) Find the rank of the following matrix: [2]
$$\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \end{bmatrix}$$
- b) Test whether the vectors $(1, 1, 1)$, $(1, -1, 1)$ and $(2, 0, 3)$ are linearly independent or dependent. [2]
6. Express $2x^2 - 4x + 2$ as the Legendre's polynomials. [2]
7. Find the minimum value using Lagrange multiplier method of $x^2 + xy + y^2 + 3z^2$ subject to the condition $x + 2y + 4z - 60 = 0$. [4]
8. Change the order of integration and evaluate $\int_0^a \int_0^x \frac{\cos y}{\sqrt{(a-x)(a-y)}} dx dy$. [4]
9. Prove that the necessary and sufficient conditions for a vector function \vec{a} of a scalar variable t to have a constant direction is $\vec{a} \times \frac{d\vec{a}}{dt} = 0$ [4]

10. Find the area of asteroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{2/3}$ using Green's theorem. [4]
11. Apply Gauss-Divergence theorem to evaluate $\int_S \vec{F} \cdot \vec{n} ds$ for $\vec{F} = x\vec{i} - y\vec{j} + (z^2 - 1)\vec{k}$ and s is the cylinder formed by the surface $z = 0$, $z = 1$, and $x^2 + y^2 = 4$ [4]
12. Using the Laplace transform technique, solve the initial value problem: [4]
 $y''(t) - y'(t) + 6y(t) = e^{-t}$, $y(0) = 0$, $y'(0) = 0$
13. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & 2 & 2 \\ 1 & 4 & 1 \\ -2 & -4 & -1 \end{bmatrix}$ [4]
14. Reduce the quadratic form $Q(x) = 6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_1x_3$ into canonical form. [4]
15. Solve $y'' - 4xy' + (4x^2 - 2)y = 0$ by power series method. [4]

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Subject: - Object Oriented Programming (CT 151)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. What are the benefits of object-oriented programming? Describe the feature of object-oriented programming. [2+2]
2. Define reference variable and write syntax for defining reference variable. WAP a function which calculates A where $A = P(1 + \frac{r}{100})^n$ for data p, r and n. But for some cases value of r is fix that is 50. Call this function in main. [2+5]
3. Explain friend function and with program code, how friend function can be used to make bridge between two classes? Create a class time, constructor having hour, minutes and second as arguments is used to initialize time objects. The add function that takes two class objects as arguments add them respectively then display the aggregate result. (Apply 60 seconds = 1minute, 60 minutes = 1 hour and 24 hour = 1 day). [2+3+4]
4. How is operator overloading used in case of binary operator? List down the rules of operator overloading. Create a class Length that has two data members meter and centimeter. Write a program to compare the length of two objects of this class by overloading '>' operator. Use constructor to initialize data members. [1+2+4]
5. What is IS-A relation and HAS-A relationship? What do you mean by multipath inheritance? Explain how ambiguity due to multipath inheritance could be resolved. [2+2+3]
6. What do you mean by abstract class? WAP to create two classes employee and student. Now create a class manager which is derived from two base classes employee and student and a class secretary derived from employee. Show the use of virtual destructor. [1+4]
7. Explain different types of file access. Write a program for library to store information of different books (as least 5 items) in a file and display them on console. [3+5]
8. Explain the use of default argument in template class. Write to suitable program to show the concept of function template. Explain in brief about stack in Standard Template Library. [3+3+2]
9. Discuss steps taken during exception handling. Write a program to compute square root of a number. The input value must be tested for validity. If it is negative, an exception must be raised. [2+3]
