



NATIONAL INSTITUTE OF TECHNOLOGY, PATNA
MID-SEMESTER EXAMINATION, JAN - JUN 2024

Program: B.Tech; Semester: 2nd
Course Code: CH27101, CH28101, CH29101
Full Marks: 30

Department: MCT, MSE & CT
Course Name: Engineering Chemistry
Duration of Examination: 2 hours

All questions are compulsory & in accordance to NEP 2020

Q1	Discuss the factors affecting the magnitude of CFSE in coordination complexes of transition metal?	02	CO3
Q2	a) What is the typical reagent for diazotization reaction? Show the formation of effective electrophile. b) How to obtain the 4-iodo-nitrobenzene from 4-nitroaniline? Explain with detailed mechanism. c) Can we obtain iodobenzene from aniline using exactly the same synthetic pathways?	1+2 +1 = 04	CO4
Q3	a) What comprises a typical nitrating mixture? b) Is it different from the nitrating reagent employed for nitration of naphthalene? Which one is a harsher condition? c) What are the possible products formed upon nitration of naphthalene? d) Which one is expected to be formed in overwhelming amount and why? e) Identify and reason out the kinetically (KCP) and thermodynamically controlled products (TCP). f) What is the color of nitronaphthalene and why at all there is a change in the color of naphthalene?	1+1 +1+ 1+1 +1 = 06	CO4
Q4	a) Name the oxidant and indicator employed for estimation of Fe(II) in Mohr's salt in presence of 1M acid solution. What is the color change at the equivalence point? b) Identify the redox couples. Describe the respective half-cell reactions and the overall reactions. c) Write the Nernst expression for each half-cell. Derive the expression for E_{cell} at the equivalence point. d) What are the two purposes of adding H_3PO_4 during this titration? Draw a typical titration curve with EMF vs volume of titrant added.	1+1 +2+ 2 = 06	CO2

Q5	<p>a) What are primary and secondary standard solutions? Name the primary and secondary standard solutions employed for the estimation of Cu(II) in an unknown solution.</p> <p>b) What is the difference between iodometry and iodimetric titrations? Which one has been employed in the above case?</p> <p>c) What is formal potential? The standard reduction potential values of $\text{Cu}^{2+}/\text{Cu}^+$ and I_2/I^- are 0.15 V and 0.54 V. How is it possible to reduce Cu^{2+} to Cu^+ under the prevailing conditions? Explain with Nernst expression.</p>	$2+2$ $+2 =$ 06	CO2
Q6	<p>a) Draw the reagents employed in the complexometric titration of hard metal ions for estimation of hardness of water? Which reagent in particular forms a chelate?</p> <p>b) Draw the geometry for metal chelate complex.</p> <p>c) Why a pH range of 8-10 is ideal for the stability of the hard metal chelate complex? Why lower and higher pH values are detrimental for the stability of this complex?</p> <p>d) Name the chemical species responsible for permanent and temporary hardness? How do you remove temporary hardness?</p>	$1+1$ $+2+$ $2 =$ 06	CO3



National Institute of Technology Patna
Department of Electrical Engineering
Elements of Electrical Engineering (EE27101, EE28101, EE29101)
Mid Term, Date: 14 March, 2024

Timing: 02:00 PM to 04:00 PM

Jan-June 2024

Max mark: 20

1. A battery having an e.m.f. of 105 V and an internal resistance of 1Ω is connected in parallel with a D.C. generator of e.m.f. 110 V and an internal resistance of 0.5Ω to supply a load having a resistance of 8Ω . Calculate

- (a) The currents in the battery, the generator and the load;

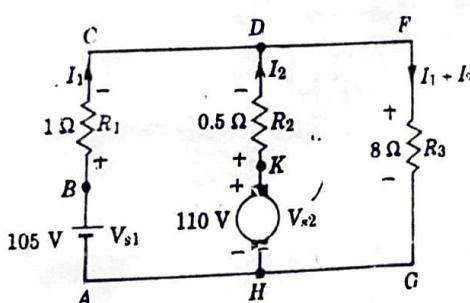


Figure 1: Network for Q1 (a)

- (b) the potential difference across the load.

(5)

2. Four resistance AB, BC, AD and DC are connected together to form a closed square ABCD. The known resistance values are; AD = 12Ω , AB = 35Ω and DC = 12Ω . A D.C. supply of 120 V is connected to A and C so that the current enters the combination at A and leaves at C. A high-resistance voltmeter is connected between B and D, and whilst carrying negligible current, registers a voltage drop of 10 V from B to D.

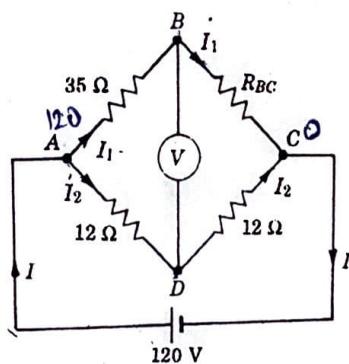


Figure 2: Network for Q2

- (a) Calculate the value of resistance BC, and the total current taken from the supply.

- (b) Calculate the value of BC, such that the potential difference between B and D is in the reverse direction, i.e. from D to B (C& G).

(5)

3. (a) Find the resistance between the terminals a-b of the bridge circuit shown in Figure 3 by using delta-star transformation.

(5)

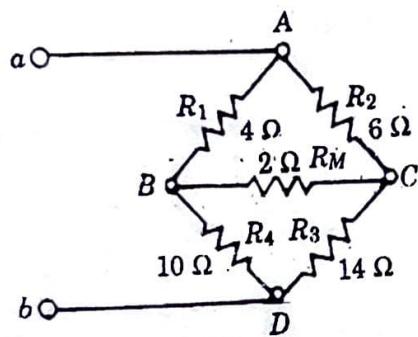


Figure 3: Network for Q3 (a)

- (b) State Superposition Theorem. Determine the current I in the network shown in Figure 4 by the principle of superposition.

(5)

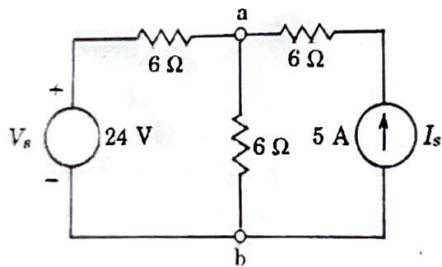


Figure 4: Network for Q3 (b)

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Mid Semester Examination, Department of HSS

B.Tech.- M.Tech.-DD- MA- MCT / DD- PH- MSE/ DD-CH- CT

UG Dual Degree Sem. II, Session Jan- June 2023-2024

Science, Society and Ethical Values (HS27101/ HS28101/29101)

M.M. 30

Note: Attempt all question in maximum 250- 300 words each in one language only. Each question carries equal marks.

- What is the role of this subject (Science, Society and Ethical Values) in your life? Write your understanding about engineering ethics and environmental ethics.
- Establish a relationship between science and spirituality.
- Define Professional and discuss the responsibility of a professional towards the society.

नोट: सभी प्रश्नों को केवल एक भाषा में अधिकतम 250-300 शब्दों में हल करें।
प्रत्येक प्रश्न के अंक समान हैं।

- आपके जीवन में इस विषय (विज्ञान, समाज और नैतिक मूल्य) की क्या भूमिका है? इंजीनियरिंग नैतिकता और पर्यावरण नैतिकता के बारे में अपनी समझ लिखें।
- विज्ञान और अध्यात्म के बीच संबंध स्थापित करें।
- पेशेवर को परिभाषित करें और समाज के प्रति एक पेशेवर की जिम्मेदारी पर चर्चा करें।

National Institute of technology Patna.

Mid sem Examination March,2024

Time 2 hrs

CT+MNC (PARTIAL Differential equation &Complex variable
MA27102) Mark30

Answer the followings questions

Q 1 (a) solve $px(z - 2y^2) = (z - qy)(z - y^2 - 2x^3)$

(b) Using Separation of variable method $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, $0 < x < \pi$, $0 < y < \pi$ which satisfies the condition $u(0, y) = u(\pi, y) = u(x, \pi) = 0$ and $u(x, 0) = \sin^2 x$

Q 2

(a) Form a partial differential equation by eliminating the arbitrary function by $z = f(x \cos \alpha + y \sin \alpha - ct) + g(x \cos \alpha + y \sin \alpha - ct)$

(b) Find the integral surface of

$x^2 p + y^2 q + z^2 = 0$ which passes through the hyperbola $xy = x + y, z = 1$ Q

3 (a) Define analytic function .Prove that polar form condition for $f(z)$ to be analytic.

(b) If $u = e^x(x \cos y - y \sin y)$ is harmonic. Find an analytic function $f(z) = u + iv$ such that $f(1) = e$

Q 4 (a) If $f(z) = u + iv$ is a regular function of z and $u - v = \frac{\cos x + \sin x - e^{-y}}{2 \cos x - 2 \cosh y}$ prove that $f(z) = \frac{1}{2} \left[1 - \cot \frac{z}{2} \right]$ when $f\left(\frac{\pi}{2}\right) = 0$.

(b) Determine p such that the function $f(z) = \frac{1}{2} \log(x^2 + y^2) + i \tan^{-1} \frac{px}{y}$

MID-SEMESTER EXAMINATION MARCH-2024
DEPARTMENT OF MATHEMATICS
NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Course Title: Differential Equation & Linear Algebra (MA27101)

Time: 2 hrs.

Maximum Marks: 30

Branch: MCT (B.Tech 2nd Sem)

Answer any eight questions. All questions are of equal value.

- Find conditions on a, b, c so that $U = (a, b, c)$ in \mathbb{R}^3 belongs to $W = \text{span}\{u_1, u_2, u_3\}$ where $u_1 = (1, 2, 0), u_2 = (-1, 1, 2), u_3 = (3, 0, -4)$.
- If vectors u, v, w are linearly independent. Show that the vectors $u + v, u - v, u - 2v + w$ are also linearly independent.
- Consider the subspaces $U = \{(a, b, c, d) : b - 2c + d = 0\}$ and $W = \{(a, b, c, d) : a = d, b = 2c\}$ of \mathbb{R}^4 . Find a basis and the dimension of the subspaces U, W and $U \cap W$.
- Find a basis and the dimension of the subspace W of V , where V is a vector space of all 2×2 matrices spanned by : $A = \begin{bmatrix} 1 & -5 \\ -4 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ -1 & 5 \end{bmatrix}$, $C = \begin{bmatrix} 2 & -4 \\ -5 & 7 \end{bmatrix}$ and $D = \begin{bmatrix} 1 & -7 \\ -5 & 1 \end{bmatrix}$.
- Find a homogeneous system whose solution set W is spanned by $u_1 = (1, -2, 0, 3), u_2 = (1, -1, -1, 4), u_3 = (1, 0, -2, 5)$.
- Find $T(a, b)$, where linear map $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ is defined by $T(1, 2) = (3, -1)$ and $T(0, 1) = (2, 1)$.
- If $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear operator defined as

$$T(x, y, z) = (x + 2y - 3z, 2x + 5y - 4z, x + 4y + z).$$

Find a basis and the dimension of image and kernel of T .

- If T be a linear operator on \mathbb{R}^2 and $S = \{(1, 3), (2, 5)\}$ be the basis of \mathbb{R}^2 . Find the matrix representation $[T]_S$ of T relative to S . Verify $[T]_S[v]_S = [T(v)]_S$ for the vector $v = (-4, 3) \in \mathbb{R}^2$.

- Diagonalize the matrix $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$.

***** All The Best*****