JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/ (CE/EE/ ME/ECE)/ BS-M201B/ 2021-22
2022
MATHEMATICS-IIB

Full Marks: 70 Times: 3 Hours

The figures in the margin indicate full marks.
Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. Evaluate $\int_C \vec{A}.d\vec{r}$, where $\vec{A} = (xy)^2\hat{\imath} + y\hat{\jmath}$ and the curve C is $y^2 = 4x$ in the xy-plane from (0,0) to (4,4). 2
2. Change the order of integration of $\int_0^1 dy \int_y^1 e^{x^2} dx$. 2
3. Find an integrating factor of $xydx + (2x^2 + 3y^2 - 20)dy = 0$. 2
4. Show that the function $f(z) = |z|^2$ is not analytic at the point $z = 0$. 2
5. Show that the function $f(z) = \bar{z}$ is continuous at $z = 0$ but not differentiable there. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***five*** questions 12x5 = 60

6. i) Evaluate $\iint \sqrt{\frac{1-x^2-y^2}{1+x^2+y^2}}\,dxdy$ over the positive quadrant of the circle $x^2 + y^2 = 1$. 6
   ii) Find an integrating factor of $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$ and then solve it. 6
7. i) Solve $\frac{dy}{dx} - \frac{tany}{1+x} = (1 + x)e^x secy$. 6
   ii) Solve $p^3x - p^2y - 1 = 0$ 6
8. i) Solve $(D^2 - 4D + 4)y = 12(1 + x)^2e^{2x}$. 6
   ii) If $\frac{d^2v}{dx^2} = \lambda^2 v$ and $v = v_0$ at $x = 0$ and $v = 0$ at $x = l$, then prove that $v = v_0 \frac{sinh\lambda(l-x)}{sinhl}$. 6
9. i) Solve: $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = (logx)^2 - logx^2$. 6
   iii) Solve by method of variation of parameters : $\frac{d^2y}{dx^2} + y = xsinx$. 6
10. i) Find the bilinear transformation which maps the points $z = 1, -2, \infty$ into the points $w = 1 + i, 1 - i, 1$ respectively and find the fixed points of the transformation. 4+2
    ii) Evaluate $\int |z|^2\,dz$ around the triangle with vertices at (0, 0), (1, 0) and (1, 1). 6
11. i) Prove that the function $f(z)$ defined by $f(z) = \begin{cases} \frac{x^3(1+i)-y^3(1-i)}{x^2+y^2}, & z \neq 0 \\ 0, & z = 0 \end{cases}$ is not differentiable at the origin though Cauchy-Riemann equations are satisfied at that point. 3+3
    ii) Show that the function $u(x, y) = 2x - x^3 + 3xy^2$ is harmonic and find its harmonic conjugate $v(x, y)$ such that $f(z) = u + iv$ is analytic. Hence determine $f(z) = u + iv$ as a function of z. 2+2+2
12. i) State Laurent's theorem. Expand the function $f(z) = \frac{1}{z^2+4z+3}$ as a Laurent's series valid in $1 < |z| < 3$. 2+4
    ii) Use Cauchy's integral formula to evaluate $\iint_\Gamma \frac{e^z}{z^2+\pi^2}dz$ where Γ is the positively oriented circle $|z| = 4$. 6
13. i) State Cauchy's residue theorem. Use it to evaluate $\iint_\Gamma \frac{z+1}{z^2(z-1)}dz$ where Γ is the circle $|z| = \frac{1}{2}$. 2+4
    ii) By Contour integration, evaluate $\int_0^\infty \frac{dx}{(1+x^2)^2}$. 6

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/ CE/EE/ME/ BS-CH201/ 2021-22
2022
CHEMISTRY

Full Marks: 70 Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. State true or false: i) Tetrahedral complexes are generally high spin complexes. ii) Sc^{3+} ions white in colour. 2
2. Write the significance of Ψ and Ψ^2. 2
3. What is an ambidentate nucleophile? Give an example. 2
4. How many stereoisomers does this compound (2-Bromo-3-chlorohexane) have? 2
5. What is entropy? 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***four*** questions 4x15=60

6. i) What is ZPE? How we can interpret the concept of ZPE in terms of the energy of an electron confined in 1D box of length "a". 1+3
   ii) For the eigen function of a particle confined in a box, the quantum number cannot be zero though mathematically it is possible- justify the statement. 3
   iii) Stabilization due to resonance or delocalization can be nicely explained from the model, particle in a box- describe it with a suitable example. 4
   iv) A conjugated system, hexatriene having the molecular length 7.3 Å shows an absorption peak at 2507 Å. Determine the electronic transition. 4

7. i) What is the unit of enthalpy? A five-litre container is divided so that 1 L of O_2 gas at 1 atm and 4 L of N_2 gas at 2 atm are on the two sides of the thin membrane. The membrane is then broken, allowing the gas to mix up at 300 K. Calculate the entropy of mixing for this process. 1+4
   ii) Describe the Carnot cycle. In what condition can we get 100 % efficient Carnot heat engine? 4+2
   iii) A power plant generates 5 MW of electricity by extracting 15 MW from burning coal at 400° C and exhausting waste heat at 100° C. What is the actual efficiency of the plant? What is the maximum theoretical efficiency? 2+2

8. i) Define ionisation energy. Calculate the first ionisation energy for fluorine by using the Slater's rule. 1+3
   ii) Explain with reason: both the ionisation and electron affinity processes for the Gr 2, Gr 15 and Gr 18 elements are unfavourable. 3
   iii) Write down the differences of electron affinity and electronegativity. 3
   iv) Calculate the electronegativity of hydrogen in Pauling's and Mulliken's electronegativity scales from the following data: E_{H-H} = 458 kJ mol^{-1}, E_{F-F} = 155 kJ mol^{-1}, E_{H-F} = 565 kJ mol^{-1} and $\chi_P(F) = 4.0$. 3+2

9. i) What happens when AgF and LiI are placed together into solution. Explain the fact on the basis of HSAB theory. 2
   ii) Evaluate the CFSE and spin only magnetic moment for the complex $[Ni(NH_3)_6]Cl_2$ 3
   iii) State the amount that screened by an electron present is '1s' orbital. Calculate the effective nuclear charge for an electron in penultimate shell of copper atom. 1+3
   iv) Draw the structure and mention oxidation state of the central element of the following molecules- XeF_6, SF_4, ClF_3, I^{3-}. 6

10. i) What is the main product of the reaction of (a) RX with KNO_2 and (b) RX with AgCN? Explain your answer. 4

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ii) The treatment of alkyl chloride with aqueous KOH leads to the formation of alcohols; whereas in the presence of alc.KOH, alkenes are formed as the major products. Explain 3

iii) Haloalkanes undergo nucleophilic substitution; whereas haloarenes undergo electrophilic substitutions. Account for it. 4

iv) Among *cis*-2-Butene and *trans*-2-Butene on bromination, one gives meso product while other one gives an enantiomer. Write down the proper mechanism. 4

11. i) Why CH_3-O-CH_2^+ is more stable than CH_3-CH_2-CH_2^+ though both are primary carbocations? 2

ii) State Markovnikov's rule. HBr addition for F_3C-CH=CH_2 gives anti-Markovnikov's product-explain. 3

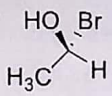
iii) Write down the types of isomerism in the following pairs of compounds. 2

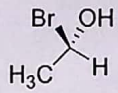
a) CH_2=$CHCH_2CH$=CH_2 and CH_2=$CHCH$=$CHCH_3$

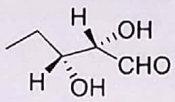
b) $CH_3COCH_2CH_2CH_3$ and $CH_3CH_2COCH_2CH_3$

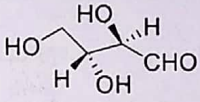
iv) When 0.30 g of natural cholesterol is dissolved in 15 ml of chloroform and placed in a 10 cm polarimeter tube, the observed rotation at 20°C (using the D-line of sodium) is -0.630°. Calculate the specific rotation of cholesterol. 4

v) Designate the chiral center as a (*R*) or (*S*) of the following and also identify the relationship (enantiomer, diastereomer or identical) 4

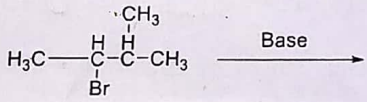
1. a) 

b) 

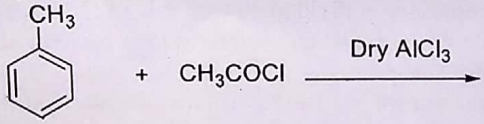
2. a) 

b) 

12. i) What is Saytzeff rule? Predict the major and minor products in the following reaction on the basis of this rule: 3



ii) Complete the following equations and write the name of reagents where require:

(a) 

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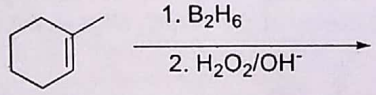
(b) 

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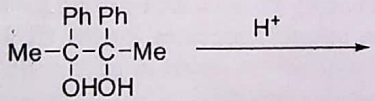
(c) 

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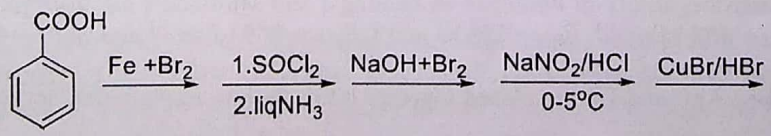
(d) 

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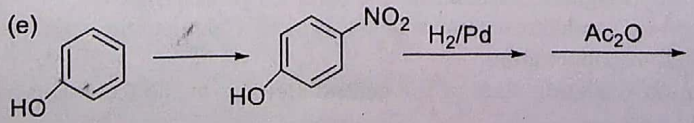
(e) 

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PART OF TRADITION

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
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JGEC/B.TECH/CE/EE/ME/CSE/ECE/IT/HM-HU201/2022-23
2022
ENGLISH

Full Marks: 70 **Time Allotted: 3 Hours**

The figures in the margin full marks. Candidates are required to give their answer in their own wards as per as practicable.

Group – A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions: **5x2=10**

Explain the meaning of the expressions highlighted below:

1. She is thought to be **a chip of the old block.**
2. He's been **in the doldrums** ever since his wife deserted him.
3. I'm safe; I hope Sam is **out of woods** too.
4. When you called him a coward, you **hit the nail on the head.**
5. I advised her not to **live in an ivory tower.**

Group – B
[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions: **4x15=60**

6. a) Write an essay on the factors affecting the preference of engineering course among students. (200 words) **10**

b) Fill in the blanks with appropriate prepositions: **5**
i) You can look _____ words in the dictionary.
ii) Our plane took _____ thirty minutes late.
iii) Will the old man live _____ the day?
iv) I'm sorry he disobeyed instructions I'll take him _____ when he gets back.
v) Someone's been rifling _____ my drawers, some important papers are missing.

7. a) You are a recent post graduate in science and interested in research, apply for the post of Junior Research Associate in the R&D division. You should hold a post-graduate degree in Mathematics, Physics, Chemistry or Biology. Apply within 15 days to Manager Research, R&D Division, Wipro Industries, Bangalore-560012. **10**

b) Give one word expressions for the following: **5**
i) Important printed government communication/news:
ii) One who runs own business:
iii) Study of human skin:

iv) One who behaves differently from others with his own opinions:
v) Scientific study of mind:

8. a) As the Purchase Officer of a Company, write a complaint letter to Uniflex Limited, New Delhi, pointing out the damage which was discovered after checking a consignment containing Compact Discs sent to you by the supplier. Invent necessary details. **10**

b) Fill in the blanks with appropriate antonym of the word given in the bracket: **5**
i) His _____ (legal) business is _____ (sinking).
ii) The _____(last) thing that struck me when I met him was his _____ (artificial) sorrow.
iii) By the time we _____(began) our work, it was already_____(evening).
iv) He was an intellectual _____(dwarf) with a_____(strong) constitution.
v) _____(surely) I rose and responded. My speech was followed by a thunderous _____(criticism).

9. a) Write a memo to the accounting department asking them to attend training to learn about the new software the company has adopted. Invent necessary details. **10**

b) Form sentences to point out the difference in meaning between words of each set: **5**
i) groan/grown, ii)descent/dissent, iii)dense/dents, iv)ceiling/sealing, v)feat/fit

10. a) Write an email to a colleague congratulating him on his success in a grand project. **10**

b) Do as directed: **5**
i) The teacher scolded him for coming late. (Begin: He…)
ii) It was so hot that the PT period could not be held. (Begin It was too…)
iii) Our school sent up the best exhibit to the Town Hall. (Rewrite using 'better')
iv)They were asked to combine all their ideas into one document. (Rewrite using 'combination')
v) As soon as the bell rang, the children ran out. (Begin: No sooner…)

11. a) Write an essay on the topic 'peer pressure'. (250 words) **10**

b) Fill in the blanks with the appropriate form of the verb given in the bracket: **5**
I ___(i)__ (pull) up into the driveway ___(ii)__ (observe) the way they had __(iii)___ (build) up the balcony. I __(iv)___ (forget) that the bricks of the house ___(v)__ (be) chocolate brown.

_____

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
COE/B. Tech/CE/EE/ME/ES EE 201/2021-22
2022
Basic Electrical Engineering

Full Marks: 70 Times: 3 Hours

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Candidates are instructed to write the answers in their own words as far as practicable.

GROUP- A
[OBJECTIVE TYPE QUESTIONS]

Answer **ALL** questions 5x2=10

1 Mention features of an ideal independent voltage source. 2
2 Write any two differences between 'series and 'parallel' resonance of RLC circuits. 2
3 Classify losses in a transformer. 2
4 On which factors does the speed of an induction motor depend – justify your answer. 2
5 Why 'power factor correction' is required in power system? 2

GROUP- B
[LONG ANSWER TYPE QUESTIONS]

Answer any **FOUR** questions 4x15=60

6

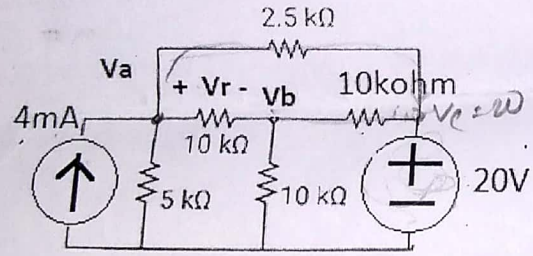

Figure 1

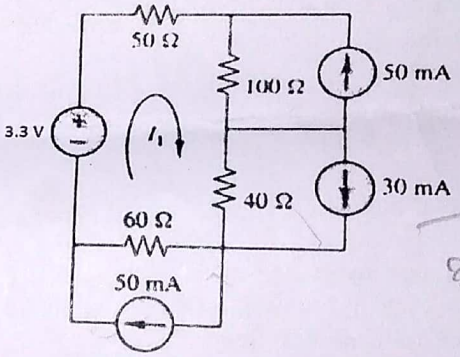

Figure 2

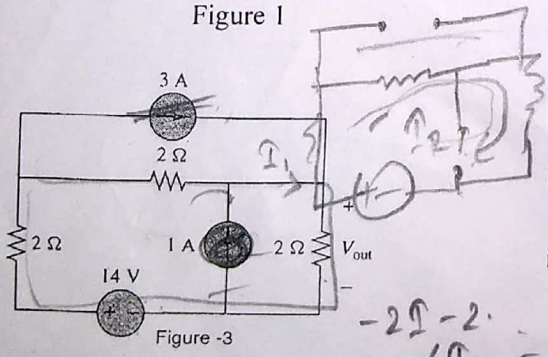

Figure -3

i) Apply Kirchhoff's Current Law to the circuit in Figure-1 and calculate voltages V_a and V_b. 6

ii) Apply Kirchhoff's Voltage Law to the circuit in Figure-2 and calculate current I_1. 3

iii) Use Superposition theorem and calculate Vout in the circuit in Figure-3. 6

7 i) Find the, a) r.m.s value, b) frequency (f), and c) phasor form - of a sinusoidal voltage specified as, $v(t) = 155\ sin(377t)$ 1+1+1

ii) A coil has a resistance of 12ohm and draws a current of 10 A, when connected across a 230 V, 50 Hz source. Determine the following: 2+2
a) power factor of the circuit, b) inductance of the coil.

iii)

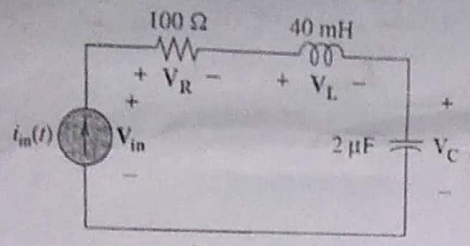

Figure - 4

In the circuit of Figure-4, it is given that, $i_{in}(t) = 100\ sin\ (2500t)$ mA.
Find out the following:
a) Instantaneous value of the voltage, $v_{in}(t)$, 4+
b) Reactive power supplied by the source, 2+
c) Reactive power supplied by the source, 2

8 i) What is an 'ideal transformer'? 2

ii) What is 'regulation' of a transformer? How it can be obtained from equivalent circuit parameters (considering lagging load)? 2+

iii) The secondary of a single -phase transformer, feeds a load of 50 kW at a power factor of 0.8 lagging. The voltage at the load terminal is 415 V. Following are the ohmic values of the circuit parameters of the transformer: 5
Primary side: R1 = 0.25 ohm, X1 = 1.2 ohm; Secondary side: R2 = 0.02 ohm, X2 = 0.04 ohm
Determine the following:
a) the supply voltage, if the turns ratio (N1/N2) of the transformer is 5. 4+
b) the regulation of the transformer for the given load. 2

9 i) A three-phase induction motor is self-starting- explain why? 5

ii) What is 'slip'? Deduce a relationship between the slip and rotor induced e.m.f in a three-phase induction motor. 1+3

iii) Three impedances, each of resistance 10 Ω in series with inductive reactance of 5 Ω, are connected in (a) star, (b) in delta, across a three phase 400 V supply. Find the power factor and the line currents in each case (a & b). 2+4

10 i) What is a dc chopper? Explain the working of a dc buck converter with appropriate diagram. 2+6

ii) a) What is an inverter? 2+
b) Enlist a few industrial applications of inverters. 3+
c) Give classification of inverters 2

11 Write short notes on any **THREE**
i) Thevenin's theorem 5
ii) Auto-transformer 5
iii) DC motor and its applications 5
iv) Miniature Circuit Breaker (MCB) 5
v) Earthing- its importance and methods 5