

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF MATHEMATICS

MID-SEMESTER EXAMINATION - OCTOBER 2024

COURSE: ENGINEERING MATHEMATICS

TIME: 2 hour

CODE: MA15102

MAXIMUM MARKS: $6 \times 5 = 30$

Answer all questions

1. Use elementary operation to obtain the inverse of the matrix

$$A = \begin{pmatrix} 3 & 1 & 1 \\ 2 & 4 & 2 \\ -1 & -1 & 1 \end{pmatrix}.$$

2. Determine the values of k for which the linear system of equations

$$\begin{aligned} x_1 + x_2 + x_3 &= 1 \\ x_1 + 2x_2 + 4x_3 &= k \\ x_1 + 4x_2 + 10x_3 &= k^2. \end{aligned}$$

has (i) a unique solution; (ii) infinitely many solutions and (iii) no solution.

3. Consider the set $S = \left\{ \begin{pmatrix} a & b \\ b & d \end{pmatrix} \mid a, b, d \in \mathbb{R} \right\}$. Find the basis and dimension of the set S .
4. Determine whether the set $W = \{(a_1, a_2, a_3) \in \mathbb{R}^3 : a_1 - 4a_2 - a_3 = 0\}$ is a subspace of \mathbb{R}^3 under the operations of addition and scalar multiplication defined on \mathbb{R}^3 . Justify your answers. If W is a subspace, then determine the basis and dimension of W .
5. Test that the vectors $u_1 = (2, -3, 1)$, $u_2 = (1, 4, -2)$, $u_3 = (-8, 12, -4)$, $u_4 = (1, 37, -17)$, and $u_5 = (-3, -5, 8)$ generates \mathbb{R}^3 . Find the subset of the set $\{u_1, u_2, u_3, u_4, u_5\}$ that is a basis for \mathbb{R}^3 .
6. Prove that $T : P_2(\mathbb{R}) \rightarrow P_3(\mathbb{R})$ is a linear transformation, where T is defined by

$$T(f(x)) = 2f'(x) + \int_0^x 3f(t)dt.$$

Also find the rank and nullity of the linear transformation.

***** ❖ *****

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

MID SEM EXAM (JULY-DEC 21)

SUB: ENGINEERING CHEMISTRY

CODE: CH15101

TIME = 2 HOURS

FM = 30

BRANCH: B.TECH (GCE-2), B. Tech in Tech Dual Degree in Microelectronics & VLSI.

ANSWER ALL QUESTIONS:

$$3\frac{1}{2} + 4 = 7\frac{1}{2}$$

CO1

1

Q How PERCENTAGE OF MOISTURE, VOLATILE MATTER, ASH AND FIXED CARBON CAN BE DETERMINED BY PROXIMATE ANALYSIS OF COAL?

Q 2.5 g OF AIR DRIED COAL SAMPLE WAS TAKEN IN A SILICA CRUCIBLE, AFTER HEATING IT IN ELECTRIC OVEN AT 110°C FOR 60 MINUTES, THE RESIDUE WAS WEIGHED 2.410 g. THE RESIDUE WAS HEATED IN SILICA CRUCIBLE COVERED WITH VENTED LID AT 950°C FOR EXACTLY SEVEN MINUTES. AFTER COOLING THE RESIDUE WAS FOUND TO BE 1.78 g. THE RESIDUE WAS IGNITED AT 750°C TO A CONSTANT WEIGHT OF 0.246 g. CALCULATE RESULT OF PROXIMATE ANALYSIS.

2

$$3\frac{1}{2} + 4 = 7\frac{1}{2}$$

CO2

Q How PERCENTAGE OF CARBON AND HYDROGEN CAN BE DETERMINED BY ULTIMATE ANALYSIS OF COAL?

Q 0.2 g OF COAL SAMPLE IS ACCURATELY WEIGHED AND IS BURNT IN A COMBUSTION APPARATUS. THE GASEOUS PRODUCTS OF COMBUSTION ARE ABSORBED IN A POTASH BULB AND CALCIUM CHLORIDE TUBES OF KNOWN WEIGHT. THE INCREASE IN WEIGHT OF POTASH BULB AND CaCl_2 TUBES ARE 0.66 g AND 0.08 g RESPECTIVELY. CALCULATE THE PERCENTAGE OF CARBON AND HYDROGEN IN THE COAL SAMPLE.

$$3\frac{1}{2} + 4 = 7\frac{1}{2}$$

CO3

3

Q How HCV AND LCV CAN BE DETERMINED BY BOMB CALORIMETER?

Q A SAMPLE OF COAL CONTAINING 89% C, 8% H, 3% ASH. WHEN THIS COAL WAS TESTED IN LABORATORY FOR ITS CALORIFIC VALUE IN THE BOMB CALORIMETER, THE FOLLOWING DATA WERE OBTAINED:

WEIGHT OF COAL BURNT = 0.85 g

WEIGHT OF WATER TAKEN = 650 g

WATER EQUIVALENT OF BOMB AND CALORIMETER = 2500 g

RISE IN TEMPERATURE = 2.5°C

COOLING CORRECTION = 0.03°C

FUSE WIRE CORRECTION = 10 CALORIE

ACID CORRECTION = 50 CALORIE

ASSUMING THAT THE LATENT HEAT OF COMBUSTION OF STEAM AS 587 CAL/g. CALCULATE THE (i) GROSS AND (ii) NET CALORIFIC VALUE OF COAL IN CALORIE PER GRAM.

$$3\frac{1}{2} + 4 = 7\frac{1}{2}$$

CO4

4

Q How FLUE GAS IS ANALYSED BY ORSAT APPARATUS?

Q CALCULATE THE WEIGHT AND VOLUME OF AIR REQUIRED FOR THE COMBUSTION OF ONE KILOGRAMME OF COAL Carbon

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
MID-SEMESTER EXAMINATION, JULY-DEC 2024

Program: B.Tech. (ECE)
 Department: CSE
 Full Marks: 30

Semester: 1st
 Course Code: CSI501
 Course Name: Introduction to Computing
 Duration of Examination: 2 hours

INSTRUCTIONS

- Answer all the questions. Assume Missing data, if any
(15*2=30M)

| | |
|---|--|
| 1. #include <stdio.h> [CO2][L2] void main() { int a = 5, b = -7, c = 0, d; d = ++a && ++b ++c; printf("\n%d%d%d", a, b, c, d); } | 2. #include <stdio.h> [CO3][L2] void main() { int a = 2, b = 3, c = 4; if(a < b < c) c++; a - -; printf("\n a=%d \t b=%d \t c=%d", a, b, c); } |
| 3. #include <stdio.h> [CO2][L2] void main() { int a = -5; int k = (a++, ++a); printf("%d\n", k); } | 4. #include <stdio.h> [CO2][L2] int main() { float x = 'a'; printf("%f", x); return 0; } |
| 5. #include <stdio.h> [CO2][L2] int main() { int x = 10, y = 20, res; res = x++ + y; printf("X=%d Y=%d res=%d", x, y, res); } | 6. #include <stdio.h> [CO2][L2] void main() { int k = 4; float k = 4; printf("%d", k) } |
| 7. #include <stdio.h> [CO2][L2] void main() { int a = 2, b = 3; printf("\n %d", ++(a-b)); } | 8. #include <stdio.h> [CO2][L2] void main() { int d, a = 10, b = 5, c = 5; d = a == (b + c); printf("%d", d); } |

| | |
|---|---|
| 9. #include <stdio.h> [CO3][L2] void main() { int i, j; for(i=1, j=0; i+j <= 10; i++) printf("%d", i); j += 2; } | 10. #include <stdio.h> [CO3][L2] void main() { int i = 0, j = 0; while (i < 5, j < 10) { i++; j++; } printf("%d, %d\n", i, j); } |
| 11. #include <stdio.h> [CO3][L2] void main() { int a = 0, i = 0, b; for (i = 0; i < 5; i++) { a++; continue; } printf("%d", a); } | 12. #include <stdio.h> [CO3][L2] void main() { int a = 0, i = 0, b; for (i = 0; i < 5; i++) { a++; if (i == 3) break; } printf("%d", a); } |
| 13. #include <stdio.h> [CO3][L2] void main() { int i = 0; char c = '0'; while(i < 10) { printf("%c", c+i); i++; } } | 14. #include <stdio.h> [CO3][L2] void main() { int i = 1; while(i <= 10) { i = 1; printf("%d", i); i++; } } |
| 15. #include <stdio.h> [CO2][L2] void main() { int a = 2, b = 3, c = 4; a = b == c; printf("\n a = %d", a); } | |



Department of Electronics and Communication Engineering, NIT Patna
Mid Semester Examination
Electronics Workshop (EC15103/ EC111103)
B.Tech. Semester -I

Max Marks: 30

Time: 2:00 Hrs.

Note: All questions carry equal marks. Any missing data may be assumed suitably.

- 1 (a) What is the difference Between Active and Passive Components? Give proper justification with examples.
(b) Write brief notes on Zener diode, FET and LDR.
- 2 (a) Calculate the output voltage V_0 and current through diodes D_1 , D_2 , and $0.33\text{k}\Omega$ in Fig. 1.
(b) A LED is fabricated with GaAs material. Find the wave length of radiated light at room temperature if the energy gap at room temperature is 1.47eV .

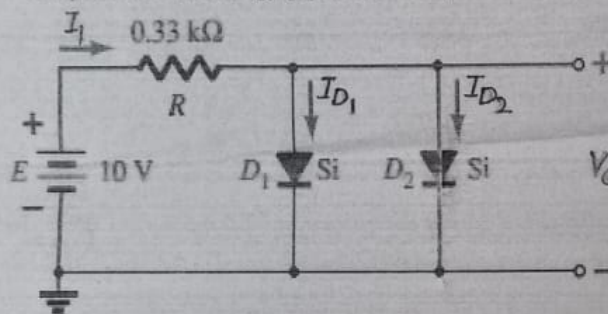


Fig. 1.

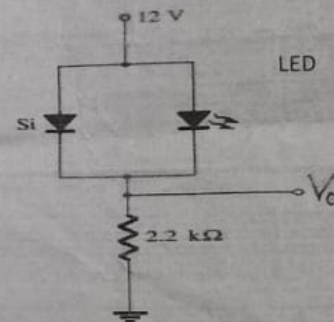


Fig. 2.

- 3 (a) Determine the voltage V_0 of the network shown in Fig. 2, here, LED is made of GaAs material.
(b) What is the major difference between photo diodes and photo transistors? Give the justification with a proper diagram.
- 4 (a) Explain the working principle of a Bipolar Junction transistor for CB configuration.
(b) Write short notes on DC battery Pencil cell: 1.5 V, AAA, AA Type, +9V, rechargeable Cell, Mobile battery.
- 5 (a) Write down the relationship between the current gain coefficient of CB, CE and CC Bipolar Junction transistor.
(b) If the current gain coefficient of CE is 49, find out the value of the remaining two current gain.

B.Tech Ist Sem ECE Mid Sem Exam Oct'2022

Elements of Electronics Engg. (EC15102)

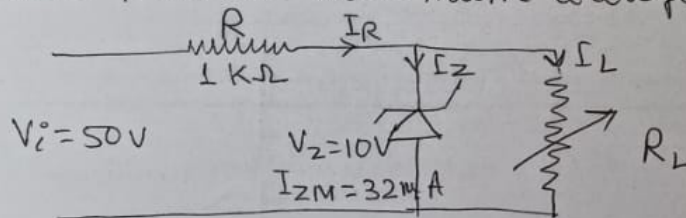
Time - 2 hrs Attempt all the four question F.M - 30

Q1 (a) From diode equation find the dynamic resistance of the diode.

(b) Determine the diode current at 27°C for a silicon diode with reverse saturation current $I_s = 50$ nano amperes and applied forward bias of 0.7 volts. (4+3.5)

Q2. (a) Discuss the two mechanism of break down diode.

(b) Determine the range of R_L and I_L that will result in V_{RL} being maintained at 10 V . Also find the maximum wattage rating of the diode



(2.5+5)

Q3. Draw full wave bridge rectifier circuit.

For a full wave rectifier find

(a) ripple factor (b) Efficiency of rectification
(c) Regulation (d) Transformer utilisation factor

Q4. Explain Series inductor filter (1.5+6)
find the ripple factor in this case (7.5)

———— X ————