

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE -
RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: F.Y.B.Tech (Group A/Group B)

Sem.:- I

Subject with Subject Code:- Engineering Mathematics –I (MATH101)

Marks: 20

Date:-03/10/2017

Time:- 1 Hr.

- Instructions: - 1. All questions are compulsory.
2. Use of nonprogrammable calculator is allowed.
3. Figures to the right indicate full marks.

(Marks)

Q.No.1 Attempt the following

(06)

a. The maximum value of the rank of a non-zero matrix $(A)_{4 \times 5}$ is

- i) 0 ii) 1 iii) 4 iv) 5

b. If the rank of matrix A is 2, then the rank of matrix A^T is

- i) 2 ii) 0 iii) 4 iv) 1

c. The eigen values of a triangular matrix are

- i) The elements of its principle diagonal ii) 0, 0, 0
iii) The elements of its non-principle diagonal iv) none

d. The two eigen vectors X_1 and X_2 are said to be orthogonal iff

- i) $X_1 X_2 = I$ ii) $X_1 X_2 = 0$ iii) $X_1 X_2^T = 0$ iv) $X_1^T X_2 = I$

e. If $y = e^{a \sin^{-1} x}$, then the value of $(1 - x^2)y_2 - xy_1 - a^2 y$ is

- i) 1 ii) a iii) 0 iv) none

f. The Maclaurin's series of $\tan^{-1} x$ is

- i) $x + \frac{x^3}{3} + \frac{x^5}{5} + \dots$ ii) $x - \frac{x^3}{3} + \frac{x^5}{5} - \dots$
iii) $1 - x + x^2 - \dots$ iv) $1 + x + x^2 + \dots$

Q.No. 2 Attempt any one of the following:

(06)

- a. Find the eigen values and the corresponding eigenvectors for the Matrix

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

- b. If $y = (\sin^{-1} x)^2$, then prove $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - n^2y_n = 0$, and hence prove that $(\sin^{-1} x)^2 = 2 \frac{x^2}{2!} + 2 \cdot 2^2 \frac{x^4}{4!} + 2 \cdot 2^2 \cdot 4^2 \frac{x^6}{6!} + \dots$

Q.No 3. Attempt any two of the following

(08)

- a. Find for what value of k the set of equations

$$2x - 3y + 6z - 5t = 3, \quad y - 4z + t = 1, \quad 4x - 5y + 8z - 9t = k$$

has (i) no solution (ii) Infinite number of solutions.

- b. If $\cos^{-1} \left(\frac{y}{b} \right) = \log \left(\frac{x}{n} \right)^n$, then show that

$$(x^2)y_{n+2} + (2n + 1)xy_{n+1} + 2n^2y_n = 0.$$

- c. Find the approximate value of $\tan^{-1}(1.003)$ correct upto four decimal places by using Taylor's theorem.

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Mid Semester Examination – October - 2017

Branch: Group A

Sem.:- I

Subject with Subject Code:-Communication Skills (HS102) Marks: 20

Date:-03/10/2017

Time:-1Hr.

Instructions:- All questions are compulsory.

Figures to the right indicates full Marks.

(Marks)

Q.No.1 Attempt the following

(06)

i) The verb communicate has its origin from -----.

a) English b) Greek c) Latin d) Italic

ii) A barrier refers to-----

a) Feedback b) an obstacle c) a pathway d) communication

iii) When a message is expressed using gestures or signs, it is-----

a.) verbal b) non-verbal c) feedback d) Grapevine

iv) Know your-----for effective communication.

a) channel b) self c) speaker d) audience

v) Language barriers are also called ----- barriers

a) Linguistic b) Psychological c) Technical d) Mechanical

vi)----- means technical language.

a) Syntax b) Jargon c) Communicate d) Elocution

Q.No. 2 Attempt any one of the following:

(06)

a) What are the various functions of Communication?

b) Explain the techniques for Group Discussion.

Q.No 3. Attempt any two of the following

(08)

a) To what extent listening skills are helpful in the acquisition of English language? How?

b) Write advantages of Oral Communication.

c) What are the strategies to be followed while participating Group Discussion?

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Mid Semester Examination – October - 2017

Branch: F. Y. B. Tech (Group B)

Sem.:- I

Subject with Subject Code:- Engg. Chemistry (CHM103)

Marks: 20

Date:- 4/10/2017

Time:- 1 Hr.

Instructions:-All questions are compulsory.

(Marks)

Que. No. 1 Multiple Choice Questions.

(06)

- I. For regeneration of Zeolite ----- solution is used.
a. HCl b. NaOH c. KCl d. NaCl
- II. To remove temporary hardness of water ----- is used.
a. $MgCl_2$ b. $CaCl_2$ c. $Ca(OH)_2$ d. $Mg(HCO_3)_2$
- III. If only one Phase is present in one component system then the no of degree of freedom will be -----
a. 0 b. 1 c. 2 d. 3
- IV. Which indicator is used to determine COD -----.
a. Starch b. ferroin c. Methyl orange d. none
- V. In Pb-Ag alloy system ----- is the temperature at Eutectic point.
a. $303^\circ C$ b. $300^\circ C$ c. $325^\circ C$ d. $350^\circ C$
- VI. In water system, the curve which represent equilibrium between ice and water vapour is called -----.
a. Vaporisation curve b. Sublimation curve c. fusion curve d. None

Que. No. 2 Attempt any one of the following:

(06)

- a.) Define softening of water. Explain Zeolite process of softening of water with its advantages and disadvantages.
- b.) Draw Phase diagram of Sulphur system and explain the curves, areas and triple points in it.

Que. No. 3 Attempt any two of the following

(08)

- a.) Write a note on Chemical Oxygen Demand (COD).
- b.) What is Phase rule equation? Explain the term Phase involved in Phase rule equation.
- c.) Explain types of water.

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Mid Semester Examination – October - 2017

Branch: Group B

Sem:- I

Subject with Subject Code:- Basic Electrical Engineering [EE104] Marks: 20

Date: - 4/10/2017

Time: - 1 Hr.

Instructions: -

1. Illustrate your answers with neat sketches, diagrams etc wherever necessary.
2. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

(Marks)

Q.No.1. Attempt the following. (3 x 2 marks)

(06)

- a) Define power and energy write their SI units
- b) State Maximum Power Transfer Theorem?
- c) Find the equivalent resistance across terminal A and B.(figure-1)

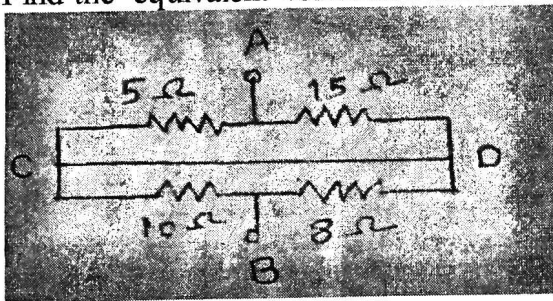


Figure-1

Q. No. 2. Attempt any one of the following: (1x 6 marks)

(06)

- a.) A water immersion heater develops 1800 k Joule heat energy to boil the water 20 °C to 70 °C when connected across 240 Volt supply. The heater has resistance of 50 Ω and heat efficiency is 85 %. Determine
 - i. volume of water.
 - ii. Input energy.
 - iii. Time required to boil the water.Assume specific heat of water 4200 J/kg C.

- b.) Determine current flowing through $5\ \Omega$ register using superposition theorem.(figure-2)

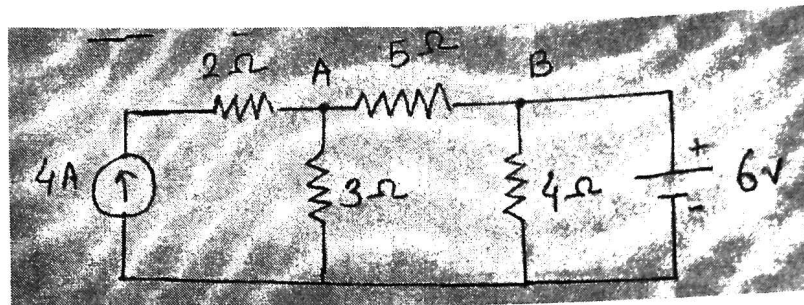


Figure-2

Q. No 3. Attempt any two of the following (2 X 4 marks)

(08)

- a.) Find the current through $10\ \Omega$ resistance using loop analysis (Figure-3)

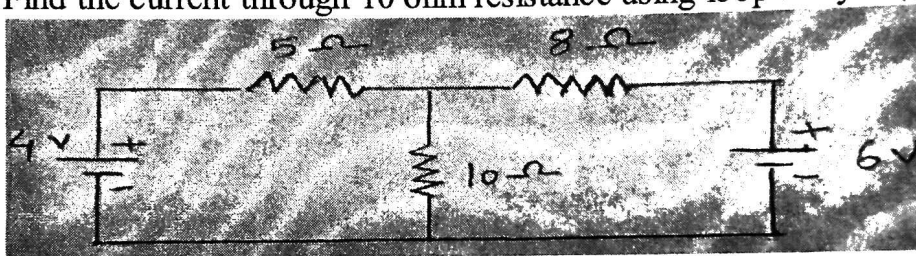


Figure-3

- b.) Define R.T.C. and prove $\alpha_t = \frac{\alpha_0}{1 + \alpha_0 t}$ Where α_0 = tempt. coeff. at 0°C
 α_t = tempt. coeff. at $t^\circ\text{C}$.
- c.) State Thevenin's theorem and explain how it is applied for network problem.

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Mid Semester Examination – October - 2017

Branch: Group A

Sem:- I

Subject with Subject Code: - Basic Civil Engineering (CV105)

Marks: 20

Date: - October 4, 2017

Time:- 1 Hr.

Instructions:-

1. Illustrate your answers with neat sketches, diagrams etc. where ever necessary.
2. Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of the examination.
3. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

(Marks)

Qu. 1 Select appropriate answer for the given multiple choice questions.

(6 x 1 = 6)

i) Black cotton soil is not suitable for foundation because of its.....

- | | |
|----------------------------|--------------------------|
| (a) black colour | (b) low bearing capacity |
| (c) non-cohesive particles | (d) none of these |

ii) Verticality of walls is checked by using.....

- | | |
|---------------|-------------------|
| (a) square | (b) spirit level |
| (c) plumb bob | (d) none of these |

iii) The vertical faces of a door opening which support frame of the door, are.....

- | | |
|-------------|------------|
| (a) jambs | (b) posts |
| (c) reveals | (d) styles |

iv) The commonly used material in the manufacture of cement is.....

- | | |
|----------------|--------------|
| (a) sand stone | (b) slate |
| (c) lime stone | (d) graphite |

v) Seasoning of timber is done.....

- | | |
|------------------------------|------------------------|
| (a) to make it water proof | (b) paints its surface |
| (c) increase its temperature | (d) remove water |

vi) Bulking of sand is caused due to.....

- | | |
|----------------------|-------------------|
| (a) surface moisture | (b) air voids |
| (c) clay contents | (d) none of these |

(1 x 6 = 6)

Qu. 2 Attempt any one of the following:

- (a) Explain in brief the semi-dry process of cement manufacturing.
- (b) Explain different types of shallow foundations and their uses. (with neat sketches).

(2 x 4 = 8)

Qu. 3 Attempt any two of the following:

- (a) What are the important properties of aggregates for making concrete?
- (b) What is the function of staircase in building? Draw neat sketch of dog-legged staircase.
- (c) Write a short note on desirable properties of stones used for construction of buildings.

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
RAIGAD -402 103**

Mid Semester Examination – October - 2017

Branch: F.Y.B.Tech Group A

Sem.:- I

Subject with Subject Code:- Energy & Environmental Engineering (CHE106)
Marks: 20

Date:-5 October 2017

Time:- 1 Hr.

Instructions:- 1. Figures to the right indicate full marks
2. Clearly mention the main question number along with the sub questions.

(Marks)

Q.No.1 1) Define the following: (3 X 2 = 06)

- a) Principle of MHD Generator
- b) Anaerobic digestion of biomass
- c) Fuel cell

Q.No.2 Attempt any one of the following: (6 X 1 = 06)

- a) What is the present status of Nuclear energy in India and what are its future prospects?
- b) Enumerate at least five applications of solar PV cell energy. Discuss in detail any one of them with a neat sketch.

Q.No. 3. Attempt any two of the following (2 X 4 = 08)

- a) Identify the power plants for the following places.
 - i) Bakreshwar in West Bengal ii) Idukki in Kerala iii) Kavaratti in Lakshwdeep iv) Paras in Maharashtra
- b) Compare the relative characteristics of HAWT and VAWT in wind power.
- c) Explain the working principle of Gas turbine power plant with a neat sketch.

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE -

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Mid Semester Examination - October - 2017

Branch: Group B

Sem.:- I

Subject with Subject Code:-Engineering Mechanics ME 102

Marks: 20

Date:- 03/10/2017

Time:- 1 Hr.

Instructions:- Assume the appropriate data if not given

**(Marks)
(06)**

Q. No.1 Fill in the blanks

- a) The Free body diagram of a body we ----- all the supports and ----- them by the reactions which these supports exert on the body. (subtract, remove, add, replace, represent)
- b) Moment of a force about a point is equal to the ----- of the forces and ----- distance of the point from the line of action of the force. (addition, multiplication, product, parallel, perpendicular, equal)
- c) Frame is a structure consisting of -----bars or members pinned together and in which one or more than one of its members is subjected to more than ----- forces. (one, two, several, fix)

Q. No. 2 Attempt any one of the following:

(06)

- a) A uniform wheel 60 cm in diameter rests against a rigid rectangular block 15 cm thick as shown in the figure. Find the least pull force P through the centre of the wheel to just turn the wheel over the corner of the block. All surfaces are smooth. Find also the reaction of the block. The wheel weights 10,000 newtons. (Figure -1)

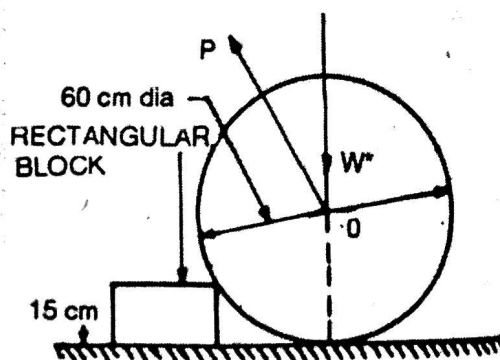


Figure -1

Q.2. b) Explain and elaborate the following

- i) **Parallelogram Law**
- ii) **Varignon's Theorem**
- iii) **Trusses and frames**

Q.No 3. Attempt any two of the following

(08)

- a.) A beam is supported and loaded by hinged support at A and roller support at B as shown in the figure. Find the reactions at A and B (figure -2)

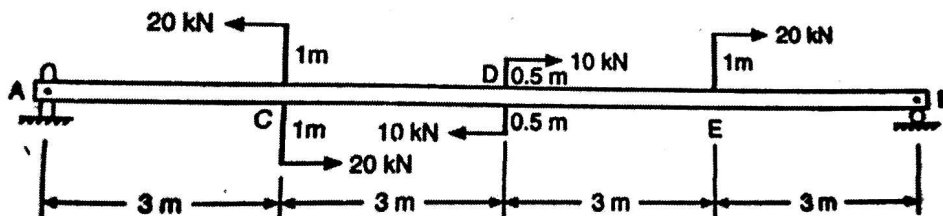


Figure -2

- b) Find the axial force in the member DE of the truss using the method of sections. (figure-3)**

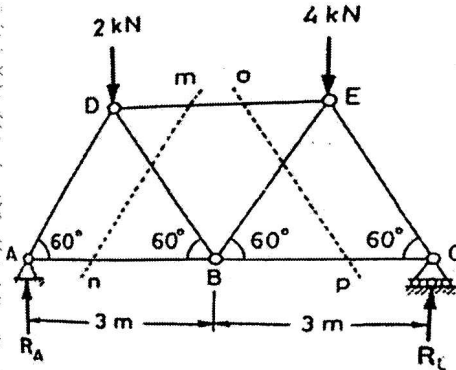


Figure-3

- c) **How will you find out the resultant of two parallel forces acting in the same direction. Explain with neat diagram.**

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**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
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Mid Semester Examination – October - 2017

Branch: Group A

Sem:- I

Subject with Subject Code:- Engineering Physics (PHY 103)

Marks: 20

Date:- 04/10/2017

Time:- 1 Hr.

- Instructions:-**
1. Do not write anything on question paper.
 2. Neat and labeled diagram must be drawn wherever necessary.
 3. Use of non programmable calculator is allowed.
 4. Figures to the right indicate full marks.
 5. Assume suitable data if required.

**(Marks)
(06)**

Q.No.1 Answer the following

- a) Oscillations become damped due to
- | | |
|-----------------------|--------------------|
| i) normal force | ii) friction |
| iii) tangential force | iv) parallel force |
- b) If an object moves back and forth repeatedly around a mean position it is called
- | | |
|----------------|---------------|
| i) oscillating | ii) revolving |
| iii) rotating | iv) motion |
- c) Maximum displacement from equilibrium position is
- | | |
|-----------------|---------------|
| i) frequency | ii) amplitude |
| iii) wavelength | iv) period |
- d) Light waves are transverse in nature, can be demonstrated by observing the phenomenon of
- | | |
|-------------------|------------------|
| i) dispersion | ii) interference |
| iii) polarisation | iv) diffraction |
- e) A system in which population inversion is achieved is called
- | | |
|-----------------------|-------------------|
| i) parallel system | ii) active system |
| iii) metastable state | iv) pumping |

- f) Optical fibre works on the principle of
- i) photo-electric effect
 - ii) laser effect
 - iii) total internal reflection
 - iv) refraction

(06)

Q.No. 2 Attempt any one of the following:

- a) Explain the production of Ultrasonic wave with the help of Magnetostriction generator.
- b) Explain the construction and working of He-Ne Laser with neat diagram

(08)

Q.No 3. Attempt any two of the following

- a) Distinguish between positive and negative crystal.
 - b) Define Ultrasonic Wave. Give its engineering applications.
 - c) The refractive index of core and cladding material of a step index fibre are 1.48 and 1.45 respectively. Calculate:
 - i. Numerical aperture
 - ii. Acceptance angle
-

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY
LONERE — RAIGAD — 402103
MID SEMESTER EXAMINATION — October — 2017

Branch: B. Tech (All branches (GROUP B))
Course: Basic Computer Programming (ICT106)
Date: _____

Semester: First
Marks: 20
Time: 1 Hr.

Q. No. 1 Multiple Choice Questions. (1 x 6 = 6 Marks)

i) What is the output of the following program?

```
void main() {  
    int m = 10, m1, m2;  
    m1 = ++m;  
    m2 = m++, m1--, --m2;  
    m1 -= m2;  
    printf("%d", m1);  
}
```

- a) 1 b) 0 c) 20 d) 11

ii) Which of the following is a valid variable name.

- a) 100K b) case c) good_work! d) DOnut

iii) What is the output of the following program?

```
void main(){  
    int d = 4, m = 8, y = 3608, c = 2, val;  
    val = ( d + m + y + (y/4) + c ) % 7;  
    printf("%d",val);  
}
```

- a) 2 b) 646 c) 1 d) 648

iv) What is the output of the following program?

```
void main() {  
    int x, y, z;  
    x=scanf("%d%d%d", &x,&y,&z);  
    printf("Output=%d", x);  
}
```

- a) input value of x b) Syntax Error c) 3 d) None of these

v) What is the output of the following program?

```
void main(){  
    int flag = 0, flag1 = 0, n;  
    char s;  
    flag = scanf("%d", &n);  
    flag1 = scanf("%d", &s);  
    printf("Value of flag %d and flag1 %d", flag, flag1);  
}
```

- a) 1 0 b) 0 1 c) 0 0 d) None of these

vi) What is the output of the following program?

```
void main() {  
    char ch = 'A';  
    ch = ch + 32;  
    printf("%c", ch);  
}
```

- a) A b) Syntax Error c) a d) 98

Q. No. 2 Attempt any one of the following. (1 x 6 = 6 Marks)

- a) The number on dividing by 2 produces remainder 0 is known as an Even number otherwise it is an Odd number. Write a program in C that find a given number is even or odd without using arithmetic operators and without control flow statements.
- b) A calendar year consists of 365 days (ignore the leap year) and a week consists of 7 days. Write a program in C that takes a number of days as an input and displays a years, weeks and days to user.

Q. No. 3 Attempt any two of the following. (2 x 4 = 8 Marks)

- a) When entering data via the *scanf* function, what relationships must there be between the data items and the corresponding arguments? How are multiple data items separated from one another?
- b) What is the need of precedence and associativity of operators in C? Summarize bitwise operators, logical operators and assignment operators as per precedence and associativity with respect to each other.
- c) If a four-digit number is input through the keyboard, write a program to calculate the sum of its digits without using control flow statements. calculate the amount of memory required to data types while program is executing on machine.

******* End of Paper *******

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE - RAIGAD -402 103
Mid Semester Examination - October - 2017**

Branch: F.Y.B.Tech (Group A)
Subject: -Engineering Graphics ME104
Date: - 05-10-2017

Sem.: - I
Marks: 20
Time: - 1 Hr.

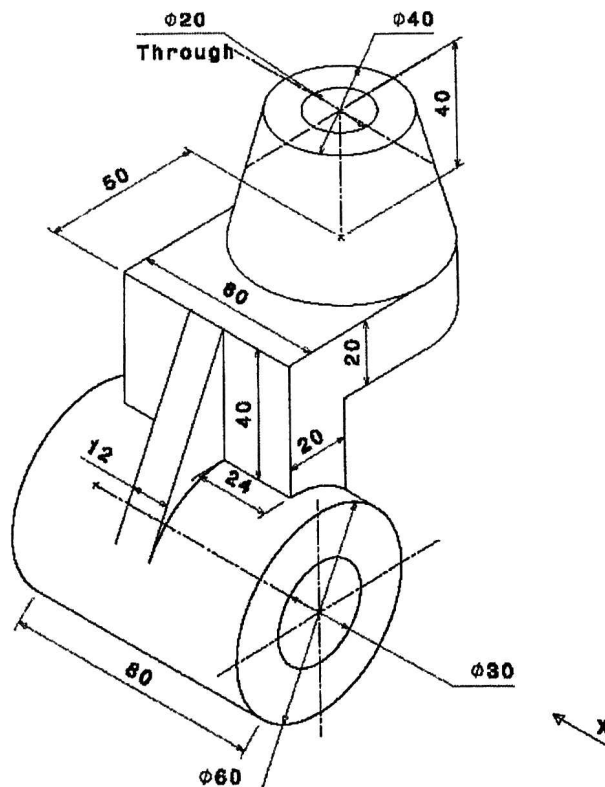
Instructions: -

1. Assume data where ever necessary. (Mention it clearly)
2. Retain all construction lines.

Q. 1 Construct a Pentagon if length of side is 30mm, such that one of the vertex (Point) is on XY (ground) and one of the edge is parallel to ground is away from XY. (use any method) (5)

Q 2. Inscribe a regular octagon about a circle of diameter 80mm. (5)

Q. 3 Draw Front View in the direction of X & Top View
(Use First Angle Projection Method) (10)



DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –

RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: Group B

Sem:- I

Subject with Subject Code:- Basic Electronics Engineering (EXE105) Marks: 20

Date:- October 5, 2017

Time:- 1 Hr.

Instructions:-

- i) All questions are compulsory
- ii) Figures to the right indicates marks
- iii) Assume suitable data whenever necessary

Q. 1. Write the appropriate choice for the following questions

(06)

- I. The diameter of an atom ranges from about
 - a) 1×10^{-10} μm to 5×10^{-10} μm
 - b) 1×10^{-10} cm to 5×10^{-10} cm
 - c) 1×10^{-10} mm to 5×10^{-10} mm
 - d) 1×10^{-10} m to 5×10^{-10} m
- II. Which of the material whose conductivity falls between those of conductors and insulators: a) Gold, b) Germanium, c) Silver, d) Teflon
- III. Which of the trivalent impurity material has 3 valence electrons?
 - a) Arsenic, b) Gallium, c) Antimony, d) Bismuth
- IV. Complete transfer of one or more electrons from one atom to different atom forms
 - a) ionic bonds, b) covalent bonds c) metallic bonding d) co-ordinate bonding
- V. The total energy of revolution of a revolving electron in an atom can
 - a) Have any value above zero, b) never be positive, c) never be negative, d) not be calculated
- VI. Pairs of outer shell electrons not used in bonding are called as
 - a) valence electrons, b)loner electrons, c) electrovalent electrons, d) lone pairs

Q. 2. Attempt any one of the following:

(06)

- a) Explain the ionic bond and covalent bond of the atom.
- b) Discuss the intrinsic and extrinsic semiconductors.

Q. 3. Attempt any two of the following

(08)

- a) Draw and explain the energy band structure of metals, semiconductors and insulators.
- b) Explain the concept of Fermi energy level in p- type semiconductor
- c) Explain the zener breakdown and avalanche breakdown .

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE -

RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: All courses

Sem.:- I

Subject with Subject Code:- Engineering Mathematics –I (MATH101) Marks: 20

Date:-03/10/2017

Time:- 1 Hr.

MODEL SOLUTION

Q.N.	Sub.- Q.N.		Marks
1.	a)	iii) 4	01
	b)	i) 2	01
	c)	i) The elements of its principle diagonal	01
	d)	iv) $X_1^T X_2 = I$	01
	e)	iii) 0	01
	f)	ii) $x - \frac{x^3}{3} + \frac{x^5}{5} - \dots$	01
2.	a)	<p>Step- :To find the eigen values - We know the charaters tics equation of matrix A in is $A - \lambda I = 0$</p> $\lambda^3 - S_1\lambda^2 + S_2\lambda - A = 0$ $\lambda^3 - 8\lambda^2 + 4\lambda + 48 = 0$ <p>solving we get $\lambda = -2, 4, 6$ Step-II: To find corresponding eigen vectors- Case-I: For $\lambda = -2$ the matrix equation $[A - \lambda I]X = 0$ reduces</p> $\begin{bmatrix} 7 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ <p>By R_1 and R_3 we have</p> $7x + 0y + z = 0$ $x + 0y + 7z = 0$ <p>By Crammers rule $\frac{x}{0} = \frac{-y}{48} = \frac{z}{0}$ this gives $X_1 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$</p> <p>Case-II: For $\lambda = 4$ the matrix equation $[A - \lambda I]X = 0$ reduces</p> $\begin{bmatrix} 1 & 0 & 1 \\ 0 & -6 & 0 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ <p>By R_1 and R_2 we have</p> $x + 0y + z = 0 \text{ and } x - 6y + 0z = 0$ <p>By, Crammers rule $\frac{x}{6} = \frac{-y}{0} = \frac{z}{-6}$ this gives $X_2 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$</p> <p>Case-III: For $\lambda = 6$ the matrix equation $[A - \lambda I]X = 0$ reduces</p>	<p align="center">01</p> <p align="center">01</p> <p align="center">01</p>

		$\begin{bmatrix} -1 & 0 & 1 \\ 0 & -8 & 0 \\ 1 & 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ <p>By R_1 and R_2 we have</p> $\begin{aligned} -1x + 0y + z &= 0 \\ 0x - 8y + 0z &= 0 \end{aligned}$ <p>By Crammers rule $\frac{x}{8} = \frac{-y}{0} = \frac{z}{8}$ this gives $X_3 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$</p>	01
	b)	<p>Given $y = (\sin^{-1} x)^2$ -----(i)</p> <p>Differentiating w.r.t x and squaring we get</p> $(1 - x^2)y_1 = 4(\sin^{-1} x)^2 = 4y$ -----(ii) <p>again differentiating w.r.t x and squaring we get</p> $(1 - x^2)y_2 - xy_1 = 2$ -----(iii) <p>Apply Leibnitz's rule for nth differentiation</p> $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - n^2y_n = 0$ -----(iv) <p>Put $x = 0$ in all above four equations, this gives</p> $y(0) = 0, y_1(0) = 0, y_2(0) = 2 \text{ and } y_{n+2}(0) = n^2y_n(0)$ -----(v) <p>Put $n = 1, 2, 3 \dots$ in equation (v) this gives</p> $y_3(0) = 0, y_4(0) = 2^2 \cdot 2, y_5(0) = 0, y_6(0) = 4^2 \cdot 2^2 \cdot 2 \text{ and so on}$ <p>Put all these in Maclaurin's Theorem</p> $y(x) = y(0) + xy_1(0) + \frac{x^2}{2!}y_2(0) + \frac{x^3}{3!}y_3(0) + \dots$ $(\sin^{-1} x)^2 = 2 \frac{x^2}{2!} + 2 \cdot 2^2 \frac{x^4}{4!} + 2 \cdot 2^2 \cdot 4^2 \frac{x^6}{6!} + \dots$	01 01 01 01 01 01
3.	a)	<p>The given system can be written as</p> $\begin{bmatrix} 2 & -3 & 6 & -5 \\ 0 & 1 & -4 & 1 \\ 4 & -5 & 8 & -9 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ t \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \\ k \end{bmatrix}$ $[A:B] = \begin{bmatrix} 2 & -3 & 6 & -5 & 3 \\ 0 & 1 & -4 & 1 & 1 \\ 4 & -5 & 8 & -9 & k \end{bmatrix}$ <p>By applying the row transformations $R_3 - 2R_1, R_3 - R_2$ we get</p> $= \begin{bmatrix} 2 & -3 & 6 & -5 & 3 \\ 0 & 1 & -4 & 1 & 1 \\ 0 & 0 & 0 & 0 & k - 7 \end{bmatrix}$ <p>It is clear that $\rho(A) = 2$</p> <p>(i) For no solution $\rho(A) \neq \rho(A:B)$. This will require $k - 7 \neq 0$ or $k \neq 7$</p> <p>(ii) For infinite no. of solution $\rho(A) = \rho(A:B) < n (= 4)$. This will require $k - 7 = 0$ or $k = 7$</p>	01 01 01 01
	b)	<p>From given equation</p> $y = b \cos[n(n \ln x - n \ln n)]$ -----(i)	01

	<p>Differentiating w.r.t x</p> $xy_1 = -bn \sin[n(n \ln x - n \ln n)] \text{ ----- (ii)}$ <p>Differentiating again w.r.t x</p> $x^2 y_2 + y_1 = -bn^2 \cos[n(n \ln x - n \ln n)] = -n^2 y \text{ ----- (iii)}$ <p>Apply Leibnitz's rule for nth differential and collect the similar terms</p> $x^2 y_{n+2} + (2n+1)xy_{n+1} + 2n^2 y_n = 0 \text{ ----- (iv)}$	<p>01</p> <p>01</p> <p>01</p>
c)	<p>We know Taylor theorem state that</p> $f(x+h) = f(x) + hf'(x) + \frac{h^2}{2!}f''(x) + \frac{h^3}{3!}f'''(x) + \dots \quad (A)$ <p>Here $f(x+h) = \tan^{-1}(x+h)$ and $x = 1$ & $h = 0.003$</p> $f(x) = \tan^{-1}(x)$ <p>Differentiating successively w.r.t x we get</p> $f'(x) = \frac{1}{1+x^2}$ $f''(x) = -\frac{2x}{(1+x^2)^2}$ $f'''(x) = -\frac{2(1-3x^2)}{(1+x^2)^3}$ <p>Put $x = 1$ in all above this gives $f(1) = \frac{\pi}{4}$ $f'(1) = \frac{1}{2}$</p> $f''(1) = -\frac{1}{2}$ $f'''(1) = \frac{1}{2}$ <p>Putting all these values in (A) we get</p> $\tan^{-1}(1.003) = \frac{\pi}{4} + (0.003)\frac{1}{2} + \frac{(0.003)^2}{2!}\left(\frac{-1}{2}\right) + \frac{(0.003)^3}{3!}\left(\frac{1}{2}\right) + \dots$ $= 0.78690$	<p>01</p> <p>01</p> <p>01</p>